

The Effect of “Caregiver Care for Tuberculosis Program” on Improving Knowledge, Attitudes, and Skills in Caring for Children with Tuberculosis

Astuti Yuni Nursasi^{1,*}, Sartika Sartika²

¹Department of Community Nursing, Faculty of Nursing, Universitas Indonesia, Depok, Indonesia

²Faculty of Sports and Health, Gorontalo State University, Gorontalo, Indonesia.

*corresponding author: ayunin@ui.ac.id

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Abstract

Aims: This study aimed to evaluate the effect of the Caregiver Care for TB Program on improving the knowledge, attitudes, and caregiving skills of mothers as primary caregivers of children diagnosed with tuberculosis in Depok, Indonesia.

Methods: A quasi-experimental study was conducted with 80 mothers divided equally into intervention and control groups. The program included four structured educational sessions delivered in small support groups at a health center over four consecutive weeks. Data were collected at three points: before the intervention (pre-test), immediately after the completion of the sessions (post-test 1), and 10 days after the intervention (post-test 2). Knowledge, attitudes, and skills were measured using the Knowledge, Attitude, and Practice (KAP) questionnaire for Tuberculosis care.

Results: Significant improvements were observed in the intervention group compared to the control group in knowledge ($p=0.000$) and attitudes ($p=0.000$) and skills ($p=0.000$), as well as improvements in knowledge, attitude, and skills 10 days later ($p < 0.000$).

Conclusion: The Caregiver Care for TB Program effectively enhanced caregivers' knowledge, attitudes, and caregiving skills in preventing TB transmission among children. This program should be implemented as part of TB control strategies in high-burden areas

Keywords: attitude, knowledge, pediatric tuberculosis, skills.

Introduction

Tuberculosis (TB) remains a major global health challenge, with an estimated 8.2 million new cases reported worldwide in 2023. The WHO South-East Asia Region, which includes Indonesia, contributes approximately 45% of the global TB burden and over half of the global TB deaths. Indonesia is the second-highest contributor to global TB cases, accounting for approximately 10% of all cases, with an estimated incidence rate of 394 per 100,000 population in 2023. The country also faces significant challenges with drug-resistant TB, contributing to approximately 7.4% of global cases of multidrug-resistant TB (MDR-TB) and rifampicin-resistant TB (RR-TB). Despite some progress in detection and treatment, TB mortality remains high, with approximately 134,000 deaths annually in Indonesia. Regional and global efforts continue to focus on improving detection, treatment success, and prevention as part of the commitment to ending TB by 2030 (WHO 2024; Kemenkes RI 2025). Tuberculosis (TB) is the leading cause of infectious disease-related morbidity and mortality worldwide, with an estimated 1.6 million deaths in 2021 (WHO, 2022).

Indonesia ranks second globally in TB cases, with 969.000 cases reported in 2023, including 100.726 (11%) in children (WHO, 2022; Dinkes Jawa Barat, 2022). Childhood TB poses significant challenges owing to nonspecific symptoms and difficulties in diagnosis and management (Narasimhan et al., 2013).

Most of the estimated increase in deaths from TB globally is contributed by countries in Asia, one of which is Indonesia, which has the second highest TB case record in the world. In 2023, the country recorded 969.000 cases of pulmonary tuberculosis or 354 cases per 100.000 population, and among the new tuberculosis cases, 11% were in children (100.726) (WHO, 2022). There are approximately 85.681 new tuberculosis cases with 6.549 cases found in Depok City, West Java, of which 1.502 are children aged 0-14 years (Dinkes Jawa Barat, 2022). The impact of high rates of tuberculosis cases, particularly in children, poses a global health challenge. Uncontrolled tuberculosis causes the disease to spread more widely, especially in the context of the current global pandemic. Therefore, greater and coordinated efforts need to be made in the prevention, early detection, and treatment of tuberculosis, especially in areas with a high number of cases, such as West Java.

World Health Organization (WHO) global prevention efforts by 2023 will include updated guidelines that include new recommendations based on current evidence to improve prevention and care of TB in vulnerable children (Kharchenko et al., 2017). Government efforts to control TB globally have been launched by the WHO such as preventive TB treatment, prevention and control of TB infection, vaccination of children with Bacillus Calmette-Guérin (BCG) vaccine which can provide protection, especially from severe forms of TB in children (WHO, 2022). In addition, the WHO has launched the 'STOP TB' movement as part of the Millennium Development Goals, with DOTS (Direct-Observed Treatment, Short-course) being one of its key pillars (Christanto, 2018).

Preventing TB transmission in children largely depends on household caregivers, particularly mothers, because household contact is the primary risk factor (Batra et al., 2012; Rutherford et al., 2012). Low awareness, inadequate caregiving practices, and insufficient family involvement can lead to malnutrition, treatment nonadherence, drug resistance, and even death (Auld et al., 2014; Justine et al., 2018). The World emphasizes family engagement through initiatives such as DOTS, in which drug-taking supervisors are critical (Kemenkes RI, 2020).

Therefore, the National Pulmonary Tuberculosis Control Program stipulates that every patient with tuberculosis must have a companion as a drug swallowing supervisor in Indonesia, called the Pengawas Menelan Obat (PMO). Family involvement in treatment and care is an important aspect of DOTS strategy. Strong family support can help improve patient adherence to treatment, achieve optimal recovery, and prevent the spread of the disease to others, especially children (Kementerian Kesehatan RI, 2020). The main cause of TB in Children is household contact (Narasimhan et al. 2013). This is generally caused by interactions between parents (Batra et al., 2012; Rutherford et al., 2012). Tuberculosis is a severe problem if families and patients have unhealthy behaviors and lifestyles (Addo et al., 2022; Meyerson et al., 2020). Childhood TB can lead to malnutrition and death (Auld et al. 2014; Justine et al. 2018). However, this can be prevented and controlled through the role of family (Li et al., 2017; Samal, 2017). The spread of TB in children remains unnoticed by parents because the diagnosis of TB in children is different from that in adult TB, where symptoms are not typical and similar to other diseases. Moreover, children are unable to express their symptoms. In addition, in the process of treating TB in children, parents often do not pay attention to the condition and progress of the treatment, especially the side effects felt by the child and the fulfillment of balanced nutrition that supports the treatment. Low awareness and knowledge of

parents can be an obstacle in the prevention, identification, and treatment of TB in children, if not addressed properly and appropriately.

Various studies have analyzed the effectiveness of families as caregivers of children in overseeing the treatment and prevention of tuberculosis transmission (Bergene et al., 2017; Rakhmawati et al., 2019; Rouse et al., 2016). The results of a previous study showed that the primary outcome analysis described peer support that had been implemented as more effective in improving treatment outcomes in patients with tuberculosis, such as treatment completion and adherence (Potty et al., 2021; Ricks et al., 2015). In addition, support groups can encourage the management of TB risk factors and play a role in patient care, such as controlling a healthy diet and taking TB medication and improving nutrition (Potty et al., 2023). Improving understanding and beliefs about TB can be achieved through social support from people around the patient (Dean and Fenton, 2013).

Previous studies have demonstrated that peer and group support interventions can improve adherence and treatment outcomes in TB patients (Potty et al., 2021, 2023). However, most interventions target patients rather than mothers of children patients, leaving a gap in strategies aimed at empowering maternal caregivers to manage childcare and effectively prevent transmission. Unlike previous research focused on patients or general community awareness, this study evaluates a structured, group-based support program for mothers as primary caregivers of children with TB in Indonesia, a population rarely addressed in TB control programs. This approach is expected to improve maternal caregivers' knowledge, attitudes, and practical skills, which are essential for successful treatment and infection prevention. This is the novelty and significance of the present study.

An approach that involves the family in the care process by centering on sick family members has a higher chance of success in improving knowledge and completion of tuberculosis treatment (Tolossa et al., 2014). Empowering communities, doctors, medical staff, and policymakers contributes to adherence (Chen et al., 2020). Many studies on other diseases have shown that it is possible to empower and engage groups to protect families from disease risk factors (Wolff et al., 2023) and improve treatment outcomes (Agbornkwai et al., 2022). Similar support for tuberculosis patients has been attempted in many countries with varying degrees of success (Potty et al. 2021, 2023). Group support strategies and patient involvement in Indonesia have not been applied to the caregivers of children with tuberculosis. Therefore, this study aimed to determine the effect of the Caregiver Care for TB Program on improving the knowledge, attitude, and skills of mothers caring for children with tuberculosis.

Methods

Research design

This quantitative study used a quasi-experimental design, conducted at a health center in the city of Depok, West Java, Indonesia, between May and July 2023 (Dinkes Kota Depok, 2022). This study was conducted with the parents or caregivers of children with TB.

Setting and samples

The initial steps to find research respondents began by searching for information on tuberculosis cases from the Tapos Community Health Center and then focusing on the data on children with tuberculosis. Next, the researchers visited the families' homes to meet the caregivers, explained the purpose and objectives of the study, and asked for their willingness to sample as respondents in this study. The sample size was calculated based on data from a pilot study, with a minimum sample size of 80.

Samples ranging in size from 10 to 40 per group were evaluated for their adequacy in providing estimates sufficiently precise to meet a variety of possible aims (Hertzog, 2008). Based on a 10% attrition probability, the sampling was stopped when the sample size reached 88. The sample was then divided equally into the experimental and control groups using simple randomization. The researchers separated the time and place of implementation as a strategy to prevent interaction between respondents and ensure that respondents did not know whether they were in the intervention or control group. Specifically, for the control group, the intervention will be conducted on July 18-22, 2023, after the intervention group completed the intervention. The sample recruitment results showed that three potential respondents in the experimental group were unwilling to continue participating in the study due to busy work, no one to take care of their children, and lack of willingness. Meanwhile, five potential respondents in the control group did not return to the health center because of the distance of their residence from the health center and busy work. Thus, in approximately one month, when the sample was purposely selected, 80 samples were obtained. There were 40 caregivers in the experimental group and 40 caregivers in the control group. The inclusion criteria were registration as a drug swallowing supervisor/caregiver of a child with tuberculosis, at least elementary school education, and ability to communicate in Indonesian.

Intervention

Pre-test data were collected from the intervention and control groups on June 5, 2023. A TB caregiver program consisting of structured educational interventions on TB, nutritional management, correct OAT use, effective coughing, cough etiquette, and correct sputum disposal was provided. The intervention was conducted for 1 month from June 5 to July 8, 2023, and consisted of four sessions, with each session lasting $\pm$ 60 min. The training began on June 5 with an initial meeting and introductory session. The first intervention was held on June 17, 2024, discussing education and discussion on tuberculosis. The second session was held on June 24, 2023, and included material on nutritional management education. The third session was held on July 1, 2023, with material on education regarding the proper and effective use of OAT, and the final session was held on July 8, 2023.

Posttest-1 was conducted after the intervention, followed by internalization for 10 days. Subsequently, on July 17, 2023, post-test-2 was conducted on the intervention and control groups. The control group received the intervention on July 18-22, 2023. The training materials and sessions received by the control group were the same as those of the intervention group. The only difference was that the training period was shorter and workbooks were not used for monitoring and evaluation purposes. During the study period, the control group received routine treatment activities that included OAT administration every two weeks and health status assessment by the person in charge of TB at the health center. The experimental group received routine intervention (Table 1).

Measurement and data collection

The research instruments included knowledge, attitude, and skills questionnaires that had been tested for validity ($r > 0.316$), indicating construct validity based on Pearson's correlation and reliable results (Cronbach's $\alpha = 0.879$). In addition, demographic information such as sex, education, income, history of TB disease, exposure to information, and experience in caring for TB patients were included. The knowledge questionnaire on tuberculosis in the questionnaire was modified from the knowledge questionnaire on tuberculosis used by Supriatun (2017). This questionnaire consisted of 15 questions with a dichotomous question form, namely true or false. The scale used in this section is the Guttman scale with a score of 0 if

the answer is “wrong” and a score of 1 if the answer is “right.” The overall score in this study was the lowest score of 0 and the highest score of 15; the higher the score obtained, the higher the family's knowledge about the care and prevention of TB transmission.

Table 1: Implementation of the intervention in the treatment group

Activities	Topic	Methods
Session 1	Education and discussion on Tuberculosis.	Lecture and discussion.
Session 2	Education on nutritional management.	Food model demonstration and discussion.
Session 3	Education on proper OAT use Effective.	Lecture and discussion.
Session 4	Coughing and cough etiquette.	Watch videos, demonstrations, and discussion.

The attitude questionnaire on the care and prevention of childhood tuberculosis was modified and completed by Astuti (Astuti & Nursasi, 2019), which consists of 15 questions using a Likert scale. For positive statements, respondents' attitudes are scored 4 for “strongly agree” and 1 for “strongly disagree.” Conversely, for negative statements, a score of 4 is given for “strongly disagree” and 1 for “strongly agree.” The maximum and minimum scores are 60 and 15, respectively. Validity and reliability tests were conducted. The results of the validity and reliability tests indicated that this technique is valid and reliable as a tool for measuring tuberculosis prevention behavior, with 12 questions on the knowledge variable (content validity with experts), 12 questions on the attitude variable ($R_{table} > 0.361$; Cronbach's $\alpha = 0.831$), and 12 questions on the skill variable ($R_{table} > 0.361$; Cronbach's $\alpha = 0.829$).

The skills questionnaire on preventing tuberculosis transmission in children consisted of questions accompanied by pictures, four questions related to cough etiquette, six questions related to effective coughing skills, and correct sputum discharge, using a Likert scale. This questionnaire was adapted from the knowledge, attitude, and skills questionnaire on tuberculosis prevention developed by Fradianto (Fradianto et al., 2022). Answer: Never with a score of 1, rarely: 2, often: 3, and always: 4. The maximum score is 40 and the lowest is 10. The higher the score, the higher the respondent's skill in preventing tuberculosis transmission.

The Caregiver Care for TB Program was developed using a group support approach based on the Nursing Intervention and Classification (NIC). Group support is defined as an activity that uses groups with similar health problems to provide emotional support and health information to all members. The Indonesian Nursing Intervention Standards (SIKI) also mention that group support interventions are activities carried out by facilitating increased problem-solving abilities and feelings of support by groups of individuals with similar experiences and problems so as to better understand each other's situations. From the two definitions that have been explained, it is concluded that the group support process is an intervention involving people in similar situations and problems to carry out various activities aimed at learning from each other and supporting and strengthening each other against the problems they suffer with the help and supervision of one or more nurses.

Data analysis

Data analysis was performed using SPSS version 24.00 software. Descriptive statistics were used to describe respondents' characteristics. The overall knowledge, attitude, and skills scores before, immediately after, and 10 days after the intervention in each group were compared separately by repeated measures analysis of variance. The reason for conducting this test separately in each group was to compare caregiver knowledge, attitudes, and skills between the two groups before and after the intervention using an independent t-test and repeated measures ANOVA.

Ethical Considerations

This study was approved by the Ethics Committee of the Faculty of Nursing, University of Indonesia (letter number: KET-125/UN2).F12.D1.2.1/PPM.00.02/2023. Before the study, all the prospective respondents completed an informed consent form. The researcher provided an explanation of the objectives, benefits, and procedures of the study. In addition, the researcher assured potential respondents that their information would be kept confidential and would only be used for research purposes. Potential respondents were free to withdraw from the study at any time, with no impact on their children's treatment.

Results

Eighty potential respondents agreed to participate in the study. All respondents were female (100%), education was predominantly secondary school (60%), family income was below the minimum wage (82.5%), participants had experience treating TB patients (51.3%), and had received information about TB (56.3%) (Table 2).

Table 2: Participant characteristics (n = 80)

Characteristics	f	%
Gender		
Male	0	0
Female	80	100
Education		
Elementary	23	28.7
Secondary	48	60
Higher education	9	11.3
Family Income		
<UMR Rp.4.694.493,-	66	82.5
>UMR Rp.4.694.493,-	14	17.5
Experience caring for TB patients		
Have experience	41	51.3
No Experience	39	48.7
History of exposure to TB		
Ever	45	56.3
Never	35	43.7
TB History		
Yes	39	48.8
No	41	51.2

TB: Tuberculosis, UMR: Minimum Wage

Table 3 shows the changes in knowledge, attitudes, and skills through the group support intervention in the experimental and control groups. The results showed a significant increase in the mean scores of knowledge, attitudes, and skills of child caregivers in the care and treatment of children with TB in the experimental group immediately and 10 days after the intervention ($P < 0.000$). The findings showed that there was no significant difference between the mean skill scores of the two groups before ($P < 0.315$) and immediately after the intervention ($P < 0.979$). However, the

mean scores of knowledge and attitude showed a significant difference ($P < 0.038$) (Table 3). Ten days after the intervention, the mean scores of all variables in both groups were significantly different ($P < 0.000$). In the experimental group, the mean scores of caregiver knowledge, attitude, and skills were higher than those in the control group after the intervention (Table 3).

Table 3: Comparison of mean scores of caregiver knowledge, attitudes, and skills pre-test, post test-1 and post test-2 within and between the experimental and control groups.

Time		Pre Test	Post Test 1	Post Test 2	P value** (Within group)
Statistics					
	Group	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	
Knowledge	Experiment	10.20 $\pm$ 1.772	12.20 $\pm$ 1.772	14.20 $\pm$ 0.723	0.000**
	Control	9.35 $\pm$ 1.833	11.35 $\pm$ 1.833	9.85 $\pm$ 1.875	
P value*(Between group)		0.038*	0.038*	0.000*	
Attitude	Experiment	41.00 $\pm$ 4.878	42.98 $\pm$ 4.875	52.17 $\pm$ 4.344	0.000**
	Control	47.13 $\pm$ 5.792	48.13 $\pm$ 5.792	47.13 $\pm$ 5.792	
P value*(Between group)		0.000*	0.000*	0.000*	
Skill	Experiment	24.35 $\pm$ 4.318	27.33 $\pm$ 4.293	32.17 $\pm$ 2.459	0.000**
	Control	25.30 $\pm$ 4.084	27.30 $\pm$ 4.084	25.30 $\pm$ 4.084	
P value*(Between group)		0.315*	0.979*	0.000*	

*Independent t-test, ** Repeated measurement ANOVA

Discussion

The results showed that there was a statistically significant difference in the average value of knowledge, attitudes, and skills of caregivers of children with tuberculosis after 10 days of intervention between the experimental and control groups. The implementation of group support interventions has improved the knowledge, attitude, and skills of parents as caregivers. All respondents actively participated in group discussions and engaged in multiple learning modalities: visual, auditory, and kinesthetic. Peer support builds motivation and trust, which are essential for attitude change and behavior adoption. Respondents then received feedback and reinforcement from other respondents that helped correct misconceptions and improve their skill performance. The learning process in the support group activities was contextualized and relevant, which increased retention and transfer to real-life situations.

Parents who understand how to manage tuberculosis risk factors correctly will prevent the transmission of tuberculosis to others (Rakhmawati et al., 2019). Information received by parents is communicated to their children, which has a major impact on the completeness of taking medication (Rakhmawati et al., 2022). Some studies have also illustrated that group support can be described as an interaction that improves the performance of the parental role in caring for their child. The positive impact of group support on child medication adherence (Samal, 2017). Positive group support has also been found to have a positive effect on the quality of parental care for their children (Koller & Nicholas, 2006; Somma et al., 2008). Parents play an important role and are primary caregivers. Therefore, parents need to pay close attention when caring for and overseeing a child's treatment.

In addition, awareness of a healthy diet for children should be emphasized, as malnutrition is the root cause of tuberculosis development (Casha & Scarci, 2017).

Maintaining the nutritional status of children with tuberculosis is important for effective recovery (Vonasek et al., 2023). Parents and family members are considered to be the main source of knowledge about childcare and child health, which has a long-term influence on achieving excellent health (Reitman & Asseff, 2010). The child's caregiver is considered a key figure in achieving the child's recovery from tuberculosis and ensuring the termination of transmission.

The results of this study also showed that there were statistically significant changes in the mean values of knowledge, attitudes, and skills of child caregivers after the application of group support in the intervention group ($p < 0.05$). The role of caregivers is necessary in caring for, motivating, and reminding children so that they can undergo tuberculosis treatment to completion. In addition, caregivers play a significant role in preventing poor nutritional status, drug resistance, and child death. Improvement in the nutritional status of children with tuberculosis due to the supervision of a healthy diet by parents is better than that of those who are not supervised by parents in terms of food intake (Samal, 2017).

The finding that the intervention did not have a statistically significant positive effect on caregiver skills in the care and prevention of childhood tuberculosis at baseline and immediately after the intervention changed significantly after a 10-day internalization period. This is because caregivers need time to apply the skills taught, especially cough etiquette skills, thus affecting test results. These results are in line with those of other studies that reported that cough etiquette skills can be practiced at home along with droplet control to prevent tuberculosis transmission (Jin & Kim, 2015). Agree with the view that a person's knowledge through the learning process changes and influences human behavior in increasing awareness and confidence so that they are aware and willing to change their behavior to be healthy (Nuwa & Kiik, 2021).

Implication and limitations

We expected more score changes and statistically significant values for the caregiver skills. Therefore, it is recommended that in future research, the intervention should be conducted over a longer period and with a higher frequency of training to enable testing of the long-term impact of the intervention on skill improvement. One limitation of this study is the lack of a more in-depth analysis to determine other factors that influence the results of the study. Moderating variables or mechanisms linking support groups to positive changes in caregiver roles have not been fully identified; therefore, further research is needed to better understand the effects of implementing support groups on caregivers of children with tuberculosis and the complex dynamics that arise between caregivers, support groups, and children with tuberculosis. Another limitation was that all participants in this program were 100% female, thus not representing different sexes. Furthermore, this program can be replicated in other regional contexts or locations with different cultures by considering parenting patterns for children with tuberculosis that are strongly influenced by local culture.

Contribution to Global nursing practice

This study's intervention integrated structured activities, participatory learning methods in the support group process, and behavior-change strategies. Such evidence-based interventions provide a replicable model for culturally sensitive family centered education and support, enabling nurses worldwide to enhance the quality of tuberculosis in children's care in both high- and low-resource settings. This showed that nurses can empower caregivers to find the best way to maintain children's adherence to treatment protocols, implement effective infection prevention measures, and provide psychosocial support for affected children. This not only

strengthens the continuum of tuberculosis care but also aligns with the global health priorities set by the World Health Organization in ending tuberculosis, ultimately reducing morbidity, preventing transmission, and improving child health outcomes across diverse healthcare contexts.

Conclusion

Significant improvements in the average scores of caregivers' knowledge, attitudes, and skills were found after the implementation of caregiver care for the TB Program. Implementing support group activities effectively may increase caregivers' motivation to provide optimal care for children with tuberculosis. This program is suggested to be implemented as part of TB control strategies in high-burden areas

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Author contribution

Conceptualization, methodology, funding acquisition, writing-review and editing and final approval of the manuscript (AYN). Writing-original draft, data collection, analysis, and validation (SS).

Conflict of interest

No conflict of interest.

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