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THE EFFECT OF MATERNAL EMPOWERMENT ON KNOWLEDGE, ATTITUDES, AND ACTIONS IN PREVENTING CHILDHOOD TUBERCULOSIS IN PAREPARE CITY

Destriani[1], Henni Kumaladewi Hengky[2], Fitriani Umar[3], Haniarti[4], Usman[5]*

[125]*Faculty of Health Sciences, University Muhammadiyah Parepare*
[34]*Study Program of Nutrition Science, University Muhammadiyah Parepare*

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CORRESPONDENCE

E-mail: destrianirusdianty012@gmail.com[1]
hennikaysa14@gmail.com[2*]

No. Tlp : +6281342341599

A B S T R A C T

This study aimed to examine the effect of empowering mothers through the "Mom's TBChild Care" application on enhancing their knowledge, attitudes, and practices in preventing TB in children in Parepare City. A quasi-experimental method with a pretest-posttest control group design was used, involving a treatment group that received the health application and a control group that did not. The sample consisted of mothers with children aged 0–14 years in Parepare City. Data were collected using questionnaires and analyzed with the Wilcoxon and Mann-Whitney tests, which showed significant improvements and differences in knowledge, attitudes, and practices between the treatment and control groups. The study concludes that empowering mothers has a significant effect on their knowledge, attitudes, and practices in preventing childhood TB ($p<0,05$). It is recommended that mothers utilize the application as an educational tool to improve TB prevention efforts for their children.

INTRODUCTION

Based on data from the World Health Organization WHO in 2022, currently tuberculosis (TB) is still one of the biggest health problems in the world due to the high morbidity (10 million sufferers) and mortality (1.5 million sufferers), especially in developing countries such as Indonesia (1)(2). It is estimated that nearly a quarter of the world's population has been infected with this bacteria. As many as 89% of TB patients are adults (56.5% men and 32.5% women), while the remaining 11% are children. Indonesia ranks second in the number of global TB cases, with the proportion of new cases reaching 10% of the total TB cases in the world. By 2022, there are estimated to be 10.6 million TB patients globally. Given that 40% to 50% of the population in developing countries consists of children, pediatric TB is one of the most important diseases to study (1).

Based on data from the Global Tuberculosis Report (2023), in 2022 the estimated TB incidence rate in Indonesia was 385 per 100,000 population, an increase compared to the TB incidence rate in 2021 of 354 per 100,000 population. Meanwhile, the TB mortality rate in 2022 was 49 per 100,000 population. In 2023 the number of all TB cases found was 821,200 cases, a considerable increase compared to all TB cases found in 2022, which amounted to 677,464 cases (3).

According to the South Sulawesi Provincial Health Office, TB cases in South Sulawesi in 2023 were 23,058 cases and the number of TB cases in children 0-14 years was 1,605 cases. In Makassar, the number of TB cases was 6,861 cases in 2023, and the number of TB cases in children was 659 cases (4). In Parepare City, TB cases in 2020 were recorded at 1,305 cases, while in 2021 suspected cases were 1,455 cases, then in 2022 it increased to 2,810 cases, and in 2023 it was higher at 3,096 cases (5).

The increase in pediatric TB cases in Indonesia is due to the fact that children <15 years old have a developing immune system that is not yet fully effective in fighting infection. In addition, children with poor nutritional status have lower immunity, making them more susceptible to TB infection. Research conducted by Wijaya et al in 2021(6) shows that children with poor nutrition have a higher risk of developing TB.

Maternal knowledge plays a very important role in the prevention of TB in children because mothers are the primary caregivers responsible for the health and well-being of their children. Mothers who have a good understanding of TB will be more aware of the early symptoms of the disease, such as prolonged cough, weight loss, fever, and night sweats. With adequate knowledge, mothers can immediately bring their children to health facilities for proper examination and treatment, thus preventing further complications.

Understanding how TB is transmitted is important so that mothers can take preventive measures, such as keeping their homes clean, ensuring good air ventilation, and avoiding direct contact with people with active TB. Mothers who know the importance of BCG immunization are also more likely to give their children the vaccine on schedule, which plays a role in protecting children from severe forms of TB

(7). According to research by Noviansyah et al in 2021(8) explained that poor maternal knowledge is one of the factors causing TB in children due to delays in bringing children to health facilities when TB symptoms appear. Ignorance of the symptoms of TB and the importance of early treatment causes children's health conditions to deteriorate before getting the necessary treatment.

Presidential Regulation of the Republic of Indonesia Number 67 of 2021 Article 4 states that the target of TB elimination in 2030 is to reduce the incidence rate of TB to 65 per 100,000 population and reduce the death rate from TB to 6 per 100,000 population (9). Therefore, one of the national strategies for TB control in Indonesia is community empowerment (10).

Community empowerment is a process that aims to increase the knowledge capacity, skills, and independence of individuals and groups in a community so that they are able to overcome the problems they face and improve their quality of life. There are various empowerment models, namely health cadre-based empowerment, family empowerment, social media-based community empowerment, empowerment through a behavioral theory approach, and digital media-based empowerment models (11).

The increase in TB cases in children requires the role of the community, especially mothers, in preventing TB in children because mothers have a very important role in the family. Mothers are responsible for ensuring that children receive adequate nutrition to keep their immune systems strong, as well as ensuring the cleanliness of the living environment so that it does not become a breeding ground for TB bacteria. Therefore, it is necessary to empower mothers, considering that they are the primary caregivers and decision-makers regarding family health. The success of the program to eradicate TB in children is inseparable from the role of mothers in efforts to improve their knowledge, attitudes and actions related to preventing TB in children (12).

Along with the rapid development of technology and information, it has brought significant changes in various sectors, including the health sector. The utilization of digital media in health communication and education allows the delivery of information to be faster, wider and more effective. Various digital media that can be accessed to obtain health information such as health apps, social media, webinars, and online discussions. Health applications are more effective than other digital media as a medium for empowerment because in addition to providing education about health to increase understanding for mothers, health applications also provide various features such as monitoring children's health, symptoms and early signs of illness, reminders of health schedules, reporting disease symptoms, and community features in the application also allow mothers to interact with health workers and fellow mothers, so that they can share experiences and gain support in implementing healthy behaviors. Based on research conducted by Ninda Anisa Erika Safura et al in 2022 (13), the results showed that the use of health applications through smartphones as a medium for health promotion is considered effective in improving knowledge, attitudes, and actions because the application can be accessed anytime, and where people can get health information quickly and precisely.

Currently, in Indonesia, there are various health applications that support TB management such as the Sobat TB application, TOMO (Tuberculosis Monitoring), TB Counter, E-Tibi and Empati. These applications have not specifically targeted efforts to prevent TB in children, indicating a gap in the development of family-based digital health applications, especially those designed to empower mothers to play a preventive role against TB in children (14).

Most of these applications only focus on TB treatment and monitoring in adults. So, the application is less effective to be used as a medium for empowering mothers in preventing TB in children because the application still lacks a special approach for mothers, even though mothers are the main key in prevention/early detection so that mothers need more relevant and focused information on preventing TB in children. However, there is an application that will be developed by Andi Maria Ulfa's research, namely the "Mom's TBhild Care" application which focuses on preventing TB in children such as helping mothers detect TB symptoms and understand the right prevention steps. So that the android-based application "Mom's TBChild Care" is more effectively used as an effort to empower mothers in increasing their knowledge for the prevention of TB in children.

According to data from the Parepare City Health Office in 2020, the number of pediatric TB patients was 34 people, decreased in 2021 by around 5 people, increased again in 2022 by 16 people and in 2023 by 20 people (5). Based on this data, the number of pediatric TB cases in Parepare decreased in 2021 but increased again in 2022 and 2023.

RESEARCH METHODS

This research method uses the Quasi Experiment method with a nonequivalent control group design, where there are two groups that get different treatments. The two groups will be compared based on pretest and posttest results to assess the effect of maternal empowerment on knowledge, attitudes, and actions in preventing TB in children. This research has been conducted in Parepare City, consisting of two sub-districts namely Bacukiki precisely in Watang Bacukiki Village and Soreang Sub-district precisely in Watang Soreang Village which started on May 25-June 25, 2025. The population in this study were all mothers who had children aged 0-14 years in two sub-districts in Parepare City, namely Bacukiki District and Soreang District. Based on the sample size calculation, the maximum sample size used in this study was 34 mothers in 2 (two) sub-districts of Parepare City, namely Bacukiki Sub-district located in Watang Bacukiki Village and Soreang Sub-district located in Watang Soreang Village. In this study consisted of 34 treatment group samples and 34 control group samples so that the total number of research subjects was 68 samples. Data Collection Techniques in this research, namely Secondary Data, namely data obtained from the South Sulawesi Health Profile 2023 regarding the number of TB cases in children, Parepare experienced an increase in TB cases in children of 34 cases and Primary Data Data obtained directly through questionnaires in the form of knowledge, attitudes, and actions of mothers before and

after empowerment. Then In this research, Data Analysis was used, namely Univariate Test Analysis and Bivariate Test Analysis.

RESEARCH RESULTS

This research was conducted in two urban villages in Parepare City, South Sulawesi: Kelurahan Watang Soreang (Soreang sub-district) and Kelurahan Watang Bacukiki (Bacukiki sub-district). The city of Parepare covers an area of 99.33 km² with a population of ±160,309 people and is divided into four sub-districts, of which Soreang and Bacukiki are the focus areas.

Watang Soreang has an area of 0.65 km² and is inhabited by ±7,391 people; this area is directly adjacent to the sea so that fishing activities and the presence of Puskesmas and posyandu become the center of community services. This location is also a center for maternal and child health education, and has family attractions such as Anjungan and Sumur Jodoh.

Watang Bacukiki, one of four villages in Bacukiki Sub-district, has been recognized nationally as an exemplary KB Village and a pioneer of the "Women-Friendly and Child-Caring Village" program. The Kelurahan Office on Jl. Bacukiki Raya serves as the administrative and service center for local residents.

Table 1. Differences between Treatment Group and Control Group Before Intervention

Variable	Treatment	Control	p
Mother's Age (mean)	31,99	37,01	0,293*
Mother's Education	n (%)	n (%)	
Low	17 (50,0)	17 (50,0)	
High	17 (50,0)	17 (50,0)	1,000**
Pre-Test	Mean±SD	Mean±SD	
Knowledge	8,44±3,332	8,26±3,414	0,609*
Attitude	27,71±3,353	28,50±2,799	0,387*
Action	34,50±8,132	25,03±9,453	0,918*

Table 1 shows that based on maternal age, maternal education level, and pre-test in both groups before being given the intervention shows that all statistical test results obtained p>0.05, which means there is no statistically significant difference between the two groups. This means that both groups were in the same condition before the intervention.

Table 2. Differences in Knowledge, Attitudes, and Actions of Respondents in the treatment group after being given application media and the control group without being given media (Post-test 1)

Variable	*Pre Test*		*Post Test 1*				
	Mean±SD	Min-Max	Mean ±SD	Min-Max	p (Pre-Post)	Δ	p
Knowledge							
Treatment	8,44 ±3,332	3-15	14,94 ±0,239	14-15	0,000*	↑6,50	0,000
Control	8,26 ±3,414	0-13	9,44 ±2,688	3-14	0,007*	↑1,18	

Attitude							
Treatment	27,71 ±3,353	18-34	32,38 ±2,174	29-38	0,000*	↑4,67	0,000
Control	28,50 ±2,799	23-40	27,74 ±3,405	21-38	0,251*	↓0,76	
Action							
Treatment	34,50 ±8,132	21-49	42,26 ±3,484	34-49	0,000*	↑7,76	0,000
Control	25,03 ±9,453	10-46	28,12 ±6,285	19-43	0,005**	↑2,89	

Table 2 shows that knowledge in the treatment group increased by 6.50. Meanwhile, the control group experienced a smaller score increase of 1.18. Wilcoxon test results showed that there was a significant increase in knowledge (p=0.000) in the treatment group and (p=0.007) in the control group, but a higher increase occurred in the treatment group. Based on the Mann Withney test, the post-test comparison between the treatment and control groups was also significant (p=0.000), indicating that the treatment group given the application media had a higher increase in knowledge than the control group who were not given the media.

In the treatment group, the score increased by 4.67, while the control group decreased by 0.76. Based on the Wilcoxon test, the treatment group showed a significant change in attitude after the intervention (p=0.000), while the control group did not experience a significant change in attitude (p=0.251). The results of the Mann Withney test analysis of the post-test comparison between the treatment and control groups were also significant (p=0.000), indicating that the group given the application media had an increase in maternal attitudes compared to those not given the media.

The average action score in the treatment group increased by 7.76, while the control group experienced a much smaller increase of 2.87. After the Wilcoxon test in the treatment group showed a significant increase in action after the intervention (p=0.000), while in the control group with the results of the Paired-Samples T test was also significant (p=0.005) but with a much smaller increase. The Mann Withney test results p=0.000 which means there is a difference between the treatment group and the control group.

Table 3. Differences in Knowledge, Attitudes, and Actions of Respondents in the treatment group after being given application media and the control group without being given media (Post-test 2)

Variable	***Pre Test***		***Post Test 2***				
	Mean±SD	**Min-Max**	**Mean±SD**	**Min-Max**	**p (Pre-Post)**	**Δ**	**p**
Knowledge							
Treatment	8,44 ±3,332	3-15	14,97±0,171	14-15	0,000*	↑6,53	0,000
Control	8,26 ±3,414	0-13	8,91 ±2,875	3-14	0,061*	↓0,65	
Attitude							
Treatment	27,71 ±3,353	18-34	33,15 ±2,017	29-38	0,000*	↑5,44	0,000
Control	28,50 ±2,799	23-40	27,53 ±3,323	22-39	0,109*	↓0,97	

Action							
Treatment	34,50 ±8,132	21-49	42,79 ±3,282	34-49	0,000*	↑8,29	0,000
Control	25,03 ±9,453	10-46	25,85 ±4,142	21-46	0,560**	↓0,82	

Table 3 shows the results of the analysis of differences in knowledge, attitudes, and actions between the treatment and control groups after the intervention (post-test 2). The results showed that there was an increase in the three variables in the treatment group, namely knowledge, attitudes, and actions of mothers in preventing TB in children. In the knowledge variable, there was an increase in the score of 6.53 while the control group experienced a decrease of 0.65. Based on the Wilcoxon test in the treatment group before and after the intervention, the value (p=0.000) means there is a difference before and after the intervention, while in the control group there is no difference before and after the intervention (p=0.061). Based on the Mann Withney test, the value of p=0.000 means that there is a difference in knowledge between the treatment and control groups after the intervention.

In the attitude section, the treatment group also increased their score by 5.44. Meanwhile, the control group experienced a decrease of 0.97. Based on the Wilcoxon test in the treatment group there was a difference in attitude before and after the intervention (p=0.000) while in the control group there was no difference in the attitude of respondents before and after the intervention (p=0.109). Then the Mann Withney test was conducted, the results showed that there was a difference between the treatment group and the control group after being given the intervention (p=0.000).

Meanwhile, on the action variable, the treatment group showed an increase in the score of 8.29, while the control group experienced a decrease of 0.82. After the Wilcoxon test, there was a difference in action before and after the intervention (p=0.000) in the treatment group, while in the control group there was no difference in behavior before and after the intervention (p=0.560). The Mann Withney test results showed that there was a difference between the treatment group and the control group (p=0.000).

DISCUSSION

The selection of mothers aged 25 to 45 years in this study was based on the classification of productive age according to the World Health Organization (WHO). In this age range, women are generally in a mature psychological and cognitive condition, so they have a good ability to understand health information and make decisions related to child care. In addition, mothers aged 25-45 years tend to be familiar with the use of technology such as smartphones and digital applications, so they are more ready to receive health application-based interventions. They are also more actively involved in social activities and have primary responsibility for childcare, making them strategic targets for health empowerment programs (15).

Mothers with children aged 0-14 years were selected because this age group is highly vulnerable to TB infection. Based on WHO data, children in this age range account for approximately 10-12% of total

global TB cases, with a higher risk occurring in children who have immature immunity, and poor nutritional status. Another factor that increases children's susceptibility to TB is close contact with untreated adult TB patients, especially when it occurs in a house with poor ventilation. A study by Siregar et al. (2020) stated that children who live in the same house with a TB patient have up to 4 times greater chances of contracting the disease, especially if the child has not received BCG immunization. In addition, environmental conditions such as densely populated houses, exposure to cigarette smoke, and poor sanitation exacerbate the risk of transmission (16).

The age of 0-14 years is also an important period of growth and development, so prevention of infectious diseases such as TB should be prioritized. In this age range, mothers play a major role in regulating nutritional intake, maintaining environmental hygiene, ensuring children follow the immunization schedule, and bringing children to health services if symptoms appear. Therefore, empowering mothers with children aged 0-14 years is important to increase awareness and early preventive measures to reduce the risk of TB in children.

Tuberculosis (TB) is an infectious disease that not only affects adults, but is also very vulnerable to children. Children have an immature immune system, so if they live in a house with an active TB patient, the risk of transmission is very high. In this context, the role of mothers as the primary caregivers of children is very important, as they play a direct role in monitoring children's health and implementing preventive measures at home. Therefore, it is necessary to empower mothers about preventing TB in children using health application media, where the results of the study showed a significant difference in the average pre-test and post-test results, meaning that there was an effect of maternal empowerment on maternal knowledge in preventing TB in children.

The results obtained before the intervention were 70.6% of respondents stated that TB only attacks the lungs and cannot attack other organs, after being given the intervention 100% of respondents answered that TB disease does not only attack the lungs but other organs can also be attacked. Likewise, the statement that TB can heal itself without treatment if the child's immune system is strong, 52.9% of respondents answered correctly, and after being given the intervention 100% of respondents answered incorrectly.

The majority of respondents still knew that TB only attacks the lungs and does not attack other organs, and also the majority of respondents knew that TB in children can heal itself without treatment if the child's immune system is strong. After being given the intervention, there was an increase in knowledge, so that mothers can protect their children from contracting TB disease. These results are in line with research by Noviansyah et al (2021) (8) which states that mothers who have good knowledge of TB symptoms are quicker to recognize the early signs of the disease and immediately take their children to health facilities, thus preventing further complications.

Empowerment through digital applications allows mothers to obtain information in a more flexible, fast and interactive way. The Mom's TBhild Care application, provides information features on childhood TB symptoms, causes, prevention methods, and various information presented in an attractive form, thus helping mothers to understand and apply this knowledge in their daily lives. This is reinforced by the findings of the Safura et al study 2022 (15) which states that the use of Android-based health applications significantly increases respondents' knowledge because it can be accessed anytime and anywhere. The same thing was also revealed by Mirza Ludita et al 2024 (17) that digital media-based empowerment effectively increases maternal knowledge in the context of infectious diseases, including tuberculosis in children

The results showed that the respondents' attitudes had increased in the treatment group, while the control group did not experience an increase. These results indicate that empowering mothers using health application media is effective in changing respondents' attitudes.

Before the intervention, 57.9% of respondents agreed, and 30.2% of respondents strongly agreed that home hygiene does not affect the risk of TB in children, but after the intervention 73.5% disagreed, and 26.5 strongly disagreed. Likewise, exposure to cigarette smoke from active smokers and poor sanitation affect the risk of TB in children as much as 50% who answered strongly disagree, and 20% answered disagree, after the intervention 100% of respondents answered strongly agree. This is because respondents accessed the health application well and understood the material in the application.

Maternal attitude is very important in TB prevention because it shows the extent to which the mother is ready to accept and carry out health actions for her child. According to Notoatmodjo (2012), attitude consists of three parts, namely beliefs (cognitive), feelings (affective), and tendency to act (conative). If the mother's knowledge increases and is accompanied by empowerment, a positive attitude towards prevention efforts will be formed, such as BCG immunization, maintaining environmental hygiene, recognizing the early symptoms of TB, and avoiding contact with people with active TB (18).

These results are in line with research by Dewi Nur Aisyah et al (2020) who found that mothers' positive attitudes emerged along with increased understanding or knowledge about the risks of TB in children. They also mentioned that personal experiences and educational information can foster mothers' concern and sense of responsibility for their children's health (19). Empowerment through the Mom's TBhild Care app gives mothers the opportunity to continue to access the information they need, increasing their confidence in making health decisions. The interactive features also make mothers more emotionally engaged, which encourages positive attitudes and a sense of responsibility in preventing TB in children.

In the process of empowering mothers by using the health application media "Moms TBhild Care" it takes one month to see changes in maternal behavior related to preventing TB in children. The results of the study obtained a significant difference in the average value of the pre-test and post-test

results, this means that there is an effect of maternal empowerment on maternal actions in preventing TB transmission in children.

One of the factors causing many TB patients in children is due to direct contact with people with active TB. Before the intervention, 80% of respondents said they never told their children to avoid direct contact with someone who is sick, including people with TB. After the intervention, 100% of respondents said they always told their children to avoid direct contact with people with active TB. Likewise with maintaining cleanliness, 73% of respondents answered that they rarely teach their children about the importance of cleanliness, such as always washing their hands after playing and before eating, after the intervention 100% of respondents answered that they always teach their children about the importance of cleanliness.

TB prevention measures taken by mothers include keeping the house clean, avoiding children from contact with TB patients, and detecting TB symptoms early. This increase shows that the knowledge and positive attitudes obtained by mothers after using the application are actually applied in their daily lives. This is in line with Lawrence Green's (1980) theory in the PRECEDE-PROCEED model which states that behavior is influenced by knowledge, availability of facilities or information, and support from the surrounding environment (20).

These results are also supported by research by Safira et al (2022), which states that digital media such as Android applications can help improve healthy living habits because they present information that is easy to understand, and interactive features. In this case, mothers feel more confident and helped when making decisions for children's health (15). Research by Rahman et al. 2021 also found that health apps can encourage behavior change in families, such as adherence to immunization, nutrition, and early detection of disease (21).

The features in the "Mom's TBhild Care" app such as education with pictures, information on TB symptoms and prevention, really help mothers to turn knowledge into action. Mothers not only know the importance of TB prevention, but also actually take concrete steps, such as maintaining good home ventilation and avoiding places with a high risk of TB transmission.

CONCLUSION

Pediatric tuberculosis is a serious public health problem in Indonesia because children have an immature immune system, making them more susceptible to infection. Mothers as primary caregivers play an important role in TB prevention efforts, so empowering mothers is one of the effective strategies to reduce the number of TB cases in children. This study shows that empowering mothers through the "Mom's TBhild Care" application has a significant effect on increasing mothers' knowledge, attitudes, and actions in preventing TB in children in Parepare City. Using the quasy-experiment method and involving two groups (treatment and control), the results of Wilcoxon and Mann-Whitney statistical analysis showed a significant increase in scores in the treatment group compared to the control group p-value = 0.000 ($p<0.05$), both in aspects of knowledge, attitudes, and actions. Mothers who were empowered through the application showed a better understanding of the symptoms and ways of transmission of TB, had a more positive attitude towards prevention efforts, and were more proactive in taking preventive actions, such as taking children to health facilities, maintaining home hygiene, and providing appropriate immunizations. Based on these results, it is recommended that the "Mom's TBhild Care" application can be widely utilized as a digital educational medium that supports the empowerment of mothers in preventing TB in children. In addition, local governments and health workers are advised to integrate the use of this application into public health education programs to strengthen the capacity of mothers in maintaining children's health independently and sustainably.

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