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JOURNAL OF COMMUNITY SERVICE FOR HEALTH

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Family-Based Tuberculosis Prevention Through Self-Management Education (SME) for Community Health Workers in Rural East Indonesia

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Article Information

History Article:
Received, 19/09/2025
Accepted, 20/10/2026
Published, 09/11/2026

Keywords:
Tuberculosis, Self-Management Education, Health Cadres, Family-Based Health Education, Community Empowerment

Abstract

Pulmonary Tuberculosis (TB) remains a significant public health concern in Indonesia, especially in East Nusa Tenggara Province. This community service program aimed to strengthen the knowledge and skills of community health workers (cadres) in delivering family-based TB prevention through a Self-Management Education (SME) approach. A pre–post descriptive design was implemented involving 35 active Integrated Service Post (ISP) health cadres in Manusak Village, Kupang Regency. The intervention included cadres training, developing and distributing educational materials (modules, posters, and leaflets), conducting structured home visits, and implementing monitoring tools. Cadres' knowledge and skills were measured using a structured 15-item questionnaire and a skills observational checklist before and after the intervention. The results showed an increase in average knowledge scores from 57% before the intervention to 94% after the intervention. Cadres' skills also improved markedly, with the proportion of cadres categorized as having good skills increasing from 6% at baseline to 94% after the intervention. This program demonstrates that SME is a feasible and effective approach to empowering community health cadres to deliver family-based TB prevention in rural settings. Each family affected by TB received four home visits over an eight-week period. Post-intervention observations indicated that 80% of families practiced proper cough etiquette, 72% maintained adequate household ventilation and 64% consistently wore masks when interacting with TB patients. These results reflect an improvement in household-level TB preventive behaviors. Longitudinal follow-up is recommended to assess whether cadres continue to apply SME principles consistently, and whether preventive behaviors among families are maintained over time.

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E-ISSN: 2746-5195
DOI: https://doi.org/10.26699/jcsh.v7i2.ART.p050-057

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INTRODUCTION

Tuberculosis (TB) is a chronic infectious disease caused by Mycobacterium tuberculosis spreading through droplet from infected individuals to those around them. This disease remains a major global health issue especially in the low and middle income countries (Yang et al., 2024). Since the COVID-19 pandemic, global TB incidence has increased from 10.1 million cases in 2019 to 10.8 million cases in 2023, equivalent to an incidence rate of 134 per 100,000 population. The sharpest increase occurred between 2021 and 2022 due to disruptions in health care services, while in 2023 the rise slowed, although the trend remained consistently high. Almost all TB cases were concentrated in 30 high-burden countries in 2023, with five nations contributing the majority: India (26%), Indonesia (10%), China (6.8%), the Philippines (6.8%), and Pakistan (6.3%). Globally, 55% of people who developed TB in 2023 were men, 33% were women, and 12% were children and young adolescents. The risk of developing TB is highest among populations with low socioeconomic status, poor nutrition, overcrowded living conditions, and those living with HIV/AIDS. (WHO, 2024).

The prevalence of tuberculosis (TB) in Indonesia remains high. Based on the Basic Health Research (Riskesdas) (2018), the estimated TB incidence was 316 per 100,000 population, equivalent to approximately 845,000 cases, with around 93,000 deaths. More recent findings from the Indonesian Health Survey (SKI) (2023) reported a national TB prevalence of 0.30%, corresponding to about 821,000 cases, with variations in distribution across provinces. Furthermore, the TB Inventory Study 2023–2024 estimated the actual incidence to be as high as 388 per 100,000 population (approximately 1.08 million cases) after adjusting for under-reporting (15.6%) and undiagnosed cases (14%) (Kemenkes, 2024). These data emphasize that, despite improvements in early detection and case reporting, TB continues to pose a major public health challenge in Indonesia, requiring comprehensive and sustained interventions.

According to the Health Statistics of East Nusa Tenggara Province (BPS, 2025), the number of tuberculosis (TB) cases was 9,535 in 2023, and it decreased to 6,161 in 2024. A similar trend was observed in Kupang District, where TB cases declined from 440 in 2023 to 337 in 2024(BPS Kesehatan propinsi NTT, 2025). At the level of primary health care, data from Naibonat Public Health Center, which covers Manusak Village, the site of this community service, showed that TB cases increased from 17 in 2023 to 25 cases by April 2025 (Rekam Medik Puskesmas Naibonat, 2025).

Initial observations revealed that residents of Manusak Village, particularly TB patients and their families, still had limited knowledge regarding TB transmission and its prevention. Several environmental and behavioral risk factors, such as poor household ventilation, coughing without covering the mouth, and the inadequate use of face masks within families, further exacerbated the spread of the disease. Moreover, family members living with TB patients tended to interact normally without adopting household transmission prevention measures. This condition has the potential to increase TB prevalence at the family level.

Active health cadres working in Integrated Service Posts (ISPs) play a crucial role in the management and prevention of tuberculosis (TB) through primary health services. As frontline health workers in rural communities, they maintain strong social ties with local people and play an active role in the activities of health posts. However, despite their experience and community engagement, their capacity to deliver family-based TB health promotion remains limited. An evaluation conducted during community health nursing practice in July 2024 found that 85% of cadres lacked adequate knowledge and skills related to TB prevention education (Mahasiswa Program Profesi Ners STIKes Maranatha Kupang, 2024). Although the cadres were involved in maternal and child health services, they had not received specific TB-related training, lacked standardized educational materials and appropriate media, and had no structured guidelines for home visits. Consequently, TB education activities remained general and did not focus on family-based prevention.

The increasing number of TB cases at the primary health care level in Manusak Village highlights the urgent need for targeted, community-based interventions. One intervention that have had a proof in empowering health Cadres is self-management education (SME). Self-management refers to an individual's capacity to regulate symptoms, adhere to treatment, and adapt to the physical, psychosocial, and lifestyle adjustments

required when living with a chronic illness (Li et al., 2021). SME is a set of methods, counseling, and behavioral strategies designed to improve knowledge, self-efficacy, and the capacity of individuals and families to manage pulmonary tuberculosis. Self-management involves the ability to set priorities, develop plans, and maintain focus on essential matters (Setiyowati et al., 2020 & Nuwa and Kiik, 2021). Thus, self-management among TB patients (SMTP) plays a crucial role and may enhance treatment outcomes when adequate knowledge and skills are fostered (Li et al., 2021).

Previous studies have demonstrated that self-management education (SME) facilitated by Community Health Workers (CHW) is effective in improving patients' knowledge, self-care practices, and family involvement in the management of chronic diseases, including tuberculosis intervention (Porterfield et al., 2024 & Adhikari et al.,2025). Therefore, The aim of this community service was to improve the knowledge and skills of community health workers in delivering family-based tuberculosis (TB) prevention using a self-management education (SME) approach in rural communities.

METHODS

This community empowerment program was carried out in Manusak Village, Kupang Regency, East Nusa Tenggara Province, from April to July 2025. The intervention adopted a participatory approach using Self-Management Education (SME) to empower health Cadres in delivering family-based tuberculosis (TB) prevention. The program involved 35 active ISP health cadres, all of whom were regularly engaged in maternal and child health services in the village. Prior to the program, most of the health cadres had not received any specific training related to TB prevention or family-based health education.

The program was implemented in three main phases. In the preparation stage (Figure 1), the team coordinated with the Naibonat Public Health Center and village authorities, developed training modules and educational materials (leaflets, posters, and structured home-visit guidelines), and conducted a baseline knowledge assessment among Cadres. The implementation stage consisted of structured Cadre's training sessions on TB prevention and self-management principles (Figure 2), distribution of printed educational materials (Figure 3), and home visits (Figure 4). Each Cadres was assigned to visit at least four households to provide counseling on cough etiquette, household ventilation, and the use of face masks. Finally, in the monitoring and evaluation stage (Figure 5), the community service team together with health center staff supervised Cadres activities, conducted post-training assessments, and collected documentation of household visits and TB preventive practices.



Figure 1. Coordination meeting to strengthen activities with Village Officials and Manusak Village Cadres



Figure 2. SME TB training was conducted through lectures, discussions, simulations, and direct practice.





Figure 3. Distribution of technological innovations to Cadres



Figure 4. Implementation of SME and home visits by Cadres



Figure 5. Monitoring and evaluation

The knowledge of the community health cadres was assessed using a structured pre-post questionnaire consisting of 15 multiple-choice questions covering tuberculosis transmission, symptoms, prevention, the DOTS strategy, the roles of community health cadres, the principles of Self-Management Education (SME), family support, and documentation and reporting. Each correct answer was scored as 1, while incorrect answers were scored as 0. Total scores were then converted into percentages. Knowledge levels were categorized as good (≥76%), moderate (56–75%) or poor (≤55%). The questionnaire was developed based on national TB guidelines and SME concepts, and was reviewed by public health and nursing experts to ensure content validity.

Cadres' skills were assessed using a structured observational checklist consisting of eight domains: preparation; mastery of TB material; communication; educational methods; family engagement; practical demonstration of TB prevention behaviors; session closure; and documentation. Each item was scored on a 4-point Likert scale (1–4), with higher scores indicating better performance. Observations were conducted during simulations and household visits, and overall skill levels were categorized as good, moderate, or poor based on mean scores and standard deviations (SD) of groups.

Family-level preventive practices were assessed using structured observation checklists that had been developed for this community service program. These checklists were completed by trained staff during each home visit and were designed to capture changes in household tuberculosis prevention behaviors over time. Key indicators evaluated included proper cough etiquette, adequate household ventilation and consistent mask use when interacting with TB patients. Responses were recorded in a dichotomous format (yes/no) to indicate whether each preventive practice was observed at household level.

The data were analyzed descriptively using frequencies, percentages and mean scores. Improvements in knowledge and skills were evaluated by comparing the results before and after the intervention. The outcomes of household visits were summarized quantitatively.

Ethical considerations

Permission to conduct the program was obtained from the Naibonat Public Health Centre and the Manusak Village Government. Written informed consent was obtained from all participating cadres. Participation was voluntary, and the confidentiality of all data was ensured.

RESULTS

The community service program was implemented in two stages: Cadres training and field practice. The Cadres training on Self-Management Education (SME) for family-based TB prevention was held on June 28, 2025, at the Manusak Village Hall and attended by 35 active ISP health Cadres. Training consisted of lectures on TB transmission and prevention, introduction to SME

principles, and simulation sessions to strengthen Cadres counseling skills. The field practice took place during ISP activities on July 5, 2025, where Cadres applied SME methods in delivering family-based TB education under the supervision of the research team. Preparatory coordination with village officials and Cadres was carried out beforehand to ensure smooth implementation.

Table 1. Knowledge Improvement and Skill Enhancement before and after SME training

Categories	Pre test of Knowledge		Post test Knowledge	
	f	%	f	%
KNOWLEDGE IMPROVEMENT				
Poor	25	72	0	0
Moderate	5	14	4	11
Good	5	14	31	89
SKILL ENHANCEMENT				
Poor	20	57	0	0
Moderate	13	37	2	6
Good	2	6	33	94

The pre- and post-test assessments revealed a substantial improvement in Cadres' knowledge of TB prevention. Before the intervention, only 5 Cadres (14%) had good knowledge, 5 Cadres (14%) had moderate knowledge, and the majority, 25 Cadres (72%), demonstrated poor knowledge. After receiving SME training, 31 Cadres (89%) achieved good knowledge, while 4 Cadres (11%) had moderate knowledge, and none remained in the poor category. This indicates that the training effectively addressed knowledge gaps among Cadres.

Cadres skills in applying SME also showed marked improvement. Prior to training, only 2 Cadres (6%) demonstrated good skills, 13 Cadres (37%) had moderate skills, and 20 Cadres (57%) were classified as poor. Post-intervention, 33 Cadres (94%) demonstrated good skills and 2 Cadres (6%) had moderate skills, with no Cadres remaining in the poor category. These findings highlight the effectiveness of SME in equipping Cadres with practical competencies for TB education.

Community Practice

Table 2. Changes in Household Preventive Practices Before and After Home Visits (n = 25)

Indicator (Household Level)	Pre Compliant n (%)	Pre Not Compliant n (%)	Post Compliant n (%)	Post Not Compliant n (%)
Understanding of airborne TB transmission	11 (44)	14 (56.0)	21 (84.0)	4 (16.0)
Proper cough etiquette practiced	9 (36)	16 (64.0)	20 (80.0)	5 (20.0)
Adequate household ventilation	8 (32)	17 (68.0)	18 (72.0)	7 (28.0)
Consistent mask use within household	7 (28.0)	18 (72.0)	16 (64.0)	9 (36.0)
Family support for TB treatment adherence	13 (52.0)	12 (48.0)	22 (88.0)	3 (12.0)

Table 2 shows clear improvements in household-level TB preventive practices following four home visits conducted over an eight-week period, with visits scheduled once in every two weeks. The most notable changes were observed in cough etiquette and household ventilation. Cough etiquette increased from 36.0% at baseline to 80.0% post-intervention, while household ventilation improved from 32.0% to 72.0%. There was also an increase in consistent mask use, rising from 28.0% to 64.0%, and an increase in family support for treatment adherence, rising from 52.0% to 88.0%.

Overall, the table highlights a substantial reduction in non-compliant behaviors following the implementation of the SME-based home visit intervention.

DISCUSSION

The implementation of Self-Management Education (SME) for family-based TB prevention in Manusak Village significantly improved both the knowledge and skills of health Cadres. The results demonstrated that prior to the intervention, the majority of Cadres had poor levels of knowledge (72%) and skills (57%). Following the training, however, nearly all Cadres achieved good knowledge (89%) and skills (94%). These findings confirm that structured SME interventions are effective in equipping community health workers with the capacity to deliver targeted health promotion. Beyond improvements at cadre level, this program demonstrated meaningful changes at household level through repeated home visits. During these visits, cadres applied SME principles, enabling them to reinforce key messages and provide contextualized counselling. Post-intervention observations showed that 80% of families practiced proper cough etiquette, 72% maintained adequate household ventilation and 64% consistently wore masks when interacting with TB patients. These results suggest that improvements in the competencies of the cadres translated into better TB preventive practices at the family level, thereby supporting the effectiveness of SME in facilitating real-world behavior change.

The marked improvement in knowledge aligns with previous studies demonstrating the effectiveness of SME in strengthening community health worker–led diabetes self-management education programs, which enhanced both individual and family capacity to manage chronic disease (Wijayanti, 2024). SME emphasizes self-regulation, planning, and adherence to preventive practices, which are highly relevant in the context of TB control. Training that combines didactic sessions with simulation, as conducted in this program, has also been shown to improve both cognitive understanding and practical competencies (Li et al., 2021).

The enhancement of Cadres skills highlights the value of experiential learning and supervised practice, as they were not only trained but also applied SME methods during ISP activities and home visits. This resonates with findings from (Adhikari et al., 2025), who reported that CHW-led self-management programs in rural areas improved health-related quality of life, optimized healthcare utilization, reduced out-of-pocket expenses, and lowered exacerbation rates among patients with COPD. Similarly, CHWs have been shown to reduce HbA1c levels in patients with diabetes through SME interventions (Porterfield et al., 2024). In Manusak, Cadres demonstrated comparable competencies by counseling families on ventilation, cough etiquette, and mask use, which led to improved household awareness and adoption of preventive measures. Evidence from South Africa further supports this, where self-management training empowered CHWs with skills such as goal setting and action planning, thereby strengthening their confidence and ability to influence community health behaviors (Majee et al., 2019). Likewise, (Collinsworth et al., 2013) demonstrated that CHW-led DSME programs not only resulted in significant clinical improvements but also reinforced the pivotal role of CHWs in bridging patients and providers through education, support, and care coordination.

This study also illustrates the importance of leveraging existing community health structures. In Manusak Village, Cadres are already trusted by local residents and actively involved in maternal and child health programs. By enhancing their knowledge and skills in TB prevention, the program strengthened their role as frontline educators. This reflects broader evidence that empowering community health workers is a cost-effective strategy to extend the reach of health systems in resource-limited rural areas.

Despite its success, this intervention had several challenges. Limited resources constrained the scale of training materials, and continued supervision will be needed to ensure sustainability. Moreover, while short-term improvements were evident, long-term follow-up is necessary to determine whether Cadres consistently apply SME and whether household practices are sustained. Future programs should integrate continuous training, monitoring, and support from local health authorities to maximize impact.

Overall, the findings of this program demonstrate that SME is a feasible and effective approach for strengthening community-based TB prevention in rural Indonesia. By building Cadres

capacity, this model has the potential to be replicated in other high-burden settings, contributing to national and global TB control efforts.

CONCLUSION

Implementing a Self-Management Education (SME) program for family-based TB prevention in Manusak Village significantly strengthened the capacity of ISP health cadres. As well as demonstrating increased knowledge and skills, the health cadres showed greater confidence and competence in delivering structured TB education, conducting home visits and applying SME techniques in real-world community settings. This capacity building established the cadres as more effective frontline educators and facilitators of behavioral change at the household level. At the family level, the program resulted in measurable improvements in TB preventive practices, as reflected in the increased adoption of proper cough etiquette, improved household ventilation, consistent mask use and stronger family support for treatment adherence. These changes suggest that cadre-led SME interventions can translate training outcomes into practical, context-appropriate preventive behaviors within TB-affected households.

From a program perspective, the findings suggest that SME-based interventions are feasible and sustainable when integrated into existing community health structures. To ensure long-term impact, continued supervision, periodic refresher training and alignment with primary healthcare services are recommended. Institutionalizing SME-guided home visits within routine ISP activities could support sustained cadre performance and reinforce household-level TB prevention practices over time. Overall, this model offers a practical and scalable approach to strengthening community-based TB prevention in rural areas with limited resources.

SUGGESTION

Although this program demonstrated short-term improvements in the capacity of cadres and preventive behaviors within households, future studies should explore the long-term sustainability of these outcomes. Longitudinal follow-up is recommended to assess whether cadres continue to apply SME principles consistently, and whether preventive behaviors among families are maintained over time. Additionally, future research could employ comparative or mixed-methods designs to better understand the mechanisms through which SME influences behavioral change at cadre and household levels. Expanding the scope of the research to include larger sample sizes and diverse rural settings would strengthen the evidence base and inform the scalability of SME-based interventions for tuberculosis and other priority health conditions.

ACKNOWLEDGMENTS

This community service program was funded by the Program Pengabdian kepada Masyarakat (PMP), Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia, under contract number 123/LLDIKTI/PM/2025. The authors also acknowledge the support of the Naibonat Public Health Center, the Village Government of Manusak, and the *ISP* Cadres who actively participated in the implementation of this program.

FUNDING

This community service program and the preparation of this article were financially supported by the Program Pengabdian kepada Masyarakat (PMP), Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia, under contract number 123/LLDIKTI/PM/2025. The funding body had no involvement in the design of the program, data collection, data analysis, interpretation of results, or writing of the manuscript.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest related to the financial, consultant, institutional, or other relationships that might influence the results or interpretation of this manuscript.

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