Proceedings Academic Universitas Jambi
Volume 2, Issue 1, January 2026.

Strengthening Tuberculosis Preventive Treatment Through Management Functions in Primary Health Centers; Evidence From Jambi, Indonesia

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Abstract

Background: Tuberculosis (TB) remains a major primary health concern in Indonesia. Preventive treatment (TPT) is a key strategy to reduce the risk of TB disease among high risk populations. Effective program management at Primary Health Centers (Puskesmas) is essential to ensure optimal implementation of TPT. However, limited evidence is available on how management functions are applied at the frontline level in supporting TPT delivery. **Objective**: To assess the implementation of management functions such as planning, organizing, actuating, and controlling in TPT programs at Primary Health Centers in Jambi, Indonesia. **Methods**: A quantitative cross sectional study was conducted involving 60 TB program officers across 20 Primary Health Centers in Jambi. Data were collected using a structured questionnaire covering four management functions. Descriptive and bivariate analyses were performed to identify strengths and weaknesses in management implementation. **Results**: The study revealed that planning and organizing functions were relatively strong across most health centers, particularly in the identification of eligible TPT targets and allocation of resources. In contrast, actuating and controlling functions were less consistently implemented, leading to challenges in ensuring adherence, follow up, and monitoring of TPT completion. Key obstacles included limited human resources, insufficient supervision, and workload distribution issues. **Conclusion**: Management functions play a crucial role in strengthening TPT implementation at the primary care level. Interventions to improve actuating and controlling functions, including enhanced supervision, monitoring, and capacity building, are needed to optimize TPT program performance in Jambi and potentially in other similar high burden settings.

Keywords: Tuberculosis, TPT, Preventive treatment, Management functions, Primary Health Centers.

Cite This Article

Rumita Ena Sari., Helmi Suryani Nasution., Arnild Augina Meckarische., Ismi Nurwaqiah Ibnu. (2026). Strengthening Tuberculosis Preventive Treatment Through Management Functions in Primary Health Centers; Evidence From Jambi, Indonesia. Proceedings Academic Universitas Jambi, 2 (1): e51176. DOI:

Editor

Dr. I Wayan Sumandya, S.Pd., M.Pd.

Article info

Received: November 25, 2025. Revised: December 08, 2025. Accepted: January 12, 2026.

INTRODUCTION

In 2023, an estimated 10.8 million people fell ill with TB worldwide.(1) The TB incidence rate globally in 2023 was about 134 cases per 100 000 population (95% UI: 125–145).[1] Tuberculosis (TB) continues to be a leading infectious disease in Indonesia, ranked second globally in TB burden after India[1]. Preventive strategies, particularly Tuberculosis Preventive Treatment (TPT), are crucial to prevent latent infections from developing into active disease[2]. Primary Health Centers play a frontline role in implementing TPT. However, the success of this program largely depends on effective management functions at the operational level[3].

In 2022, 1,277 active TB cases were found in Jambi City, with 62 deaths[4]. In 2024, the Jambi City Health Office reported 448 active TB cases[5]. Cases of TB in children and vulnerable groups (people living with HIV) also showed an increase, indicating serious challenges in TB control, including latent TB[6]. Although not contagious, latent TB has a high potential to develop into active TB, especially in individuals with weak immune systems. Therefore, latent TB treatment is an integral part of the global TB elimination strategy[7].

Based on interviews with TB officials at the Health Office, several issues can be identified as contributing to the low success rate of latent TB treatment in Jambi City. First, patient compliance with latent TB treatment is low, with treatment often discontinued due to a lack of education or side effects from the medication. Second, the detection of latent TB cases is limited, with community health centres focusing more on active TB. Third, there is low contact tracing and risk identification, given the stigma attached to TB in the community. Fourth, there is a lack of education and home visits for patients and their families, so they do not understand the importance of treatment adherence[8]. In addition, the increase in TB cases among children and vulnerable groups, as well as the inability to manage the side effects of medication, further exacerbates the situation. Finally, limited human resources at health centres also pose an obstacle to monitoring and managing treatment. All these circumstances indicate major challenges in improving the success of latent TB treatment in Jambi City.

Although latent TB treatment programmes have been implemented in various community health centres, their success has not been optimal. One of the main challenges lies in the implementation of management functions (POAC): planning, organising, executing, and supervising. Many community health centres still prioritise active TB, while latent TB has not yet become the focus of intervention, even though it is important in breaking the chain of transmission. The POAC framework Planning, Organizing, Actuating, and Controlling serves as a foundation for understanding how managerial activities affect program outcomes. Despite national guidelines, limited evidence exists regarding how these management functions are applied at the frontline, particularly in resource constrained settings such as Jambi Municipality. This study aims to assess the implementation of management functions such as planning, organizing, actuating, and controlling in TPT programs at Primary Health Centers in Jambi, Indonesia.

METHODS

Study design and setting

This study employed a quantitative cross sectional design aimed at assessing the implementation of management functions such as planning, organizing, actuating, and controlling (POAC) in the Tuberculosis Preventive Therapy (TPT) program at Primary Health Centers (PHCs) in Jambi, Indonesia. The cross sectional design was selected to capture a comprehensive overview of management function performance among TB program officers at a single point in time. Data collection was carried out from August to September 2025 across 20 Primary Health Centers implementing the TPT program in Jambi Municipality.

Population, samples and sampling

The target population in this study was all tuberculosis (TB) programme officers working at community health centres implementing tuberculosis preventive therapy (TPT) in Jambi Municipality. This population was selected because these officers have direct

responsibility for planning, implementing and supervising TPT activities at the primary health care level, and are therefore considered to have the best understanding of the implementation of management functions in the programme.

The research sample consisted of 60 TB programme officers from 20 Puskesmas in the Jambi Municipality. The sample was selected using a total sampling approach, which involved all officers who met the inclusion criteria at the selected Puskesmas, with the aim of obtaining a comprehensive picture of the application of management functions in the implementation of TPT.

The inclusion criteria in this study were TB programme officers who had worked for at least one year in the implementation of the TPT programme and were actively working during the data collection period. Meanwhile, the exclusion criteria included officers who were on extended leave or absent during the data collection process, as well as questionnaires that were not completed in full (more than 20% of the main questions were not answered) and therefore did not meet the requirements for further analysis.

Instruments and criteria

The instrument used in this study was a structured questionnaire based on George R. Terry's management theory, covering the four main functions of management: planning, organizing, actuating, and controlling. The questionnaire consisted of four main sections, namely, respondent identity, covering demographic data and work characteristics of TB programme officers, programme success indicators, containing questions related to the implementation and achievements of the latent TB programme at the primary health center, program performance coverage, containing quantitative indicators such as therapy completion rates and patient compliance, and management functions (POAC), consisting of a number of statements measured using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree) to assess the extent to which management functions are applied in the implementation of latent TB programmes. This instrument has undergone content validity testing by health management and TB programme experts, as well as internal reliability testing with a Cronbach's alpha result of 0.87, indicating good internal consistency. The questionnaire is self administered by respondents and takes approximately 20–30 minutes to complete.

Procedure and data collection

Data collection was conducted from August to September 2025 across 20 Primary Health Centers (PHCs) in Jambi Municipality implementing the Tuberculosis Preventive Therapy (TPT) program. Prior to data collection, ethical approval and official permissions were obtained from the relevant health authorities and PHC management. Respondents were TB program officers who met the inclusion criteria and agreed to participate voluntarily after receiving an explanation of the study objectives and procedures. Each respondent provided written informed consent before completing the questionnaire. Data were collected using a structured self-administered questionnaire distributed directly to respondents. The researcher provided brief guidance on how to complete the form and remained available for clarification when needed. The questionnaire required approximately 20–30 minutes to complete. All returned questionnaires were checked for completeness and consistency. Data were then coded, entered, and verified before analysis. Confidentiality of respondent identities and all collected information was strictly maintained throughout the research process.

Statistical analysis

Data were analyzed using SPSS version 31. Univariate analysis was conducted to describe the characteristics of respondents and the implementation level of each management function such as planning, organizing, actuating, and controlling. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the data. The results are presented in tables to illustrate the distribution and average scores of each management function in the TPT program implementation at Primary Health Centers. Table 1. Characteristic Respondents

Ethical Clearance

This study obtained ethical approval from the Health Research Ethics Committee of Universitas Jambi, under approval number 2553/UN21.8/PT.01.04/2025. The ethical review ensured that all research procedures complied with the principles of the Declaration of Helsinki and applicable national ethical standards for research involving human participants. Prior to data collection, written informed consent was obtained from all respondents after providing a full explanation of the study's objectives, procedures, potential benefits, and risks. Participation was entirely voluntary, and respondents were assured of their right to withdraw at any time without any consequence. To maintain confidentiality, all data were anonymized, and no personal identifiers were recorded or disclosed in any report or primaryation. The collected information was used solely for research purposes to support improvements in the Tuberculosis Preventive Therapy (TPT) program management at the Primary Health Centers in Jambi Municipality.

RESULTS

Based on univariate analysis, the results obtained are as follows as table 1 :

Table 1. Characteristic Respondents

Variable	Category	n	%
Age (years)	Mean ± SD = 42.1 ± 8.5		
Length of service (years)	Mean ± SD = 12.8 ± 6.7		
Education level	Diploma (D3)	21	35.0
	Bachelor's degree (S1)	36	60.0
	Master's degree (S2)	3	5.0
Role in TB program	Program holder	20	33.3
	TB officer	20	33.3
	TB examining doctor	20	33.3
Having TPT program	Yes	41	68.3
	No	19	31.7
Duration involved in TPT	1 year	8	13.3
	1–3 years	33	55.0
	≥ 3 years	19	31.7
Average number of TPT patients/year	< 10 patients	15	25.0
	10–30 patients	24	40.0
	≥ 30 patients	21	35.0
Specific TPT budget	Yes	21	35.0
	No	39	65.0
Routine TPT training	Every year	29	48.3
	Occasionally	18	30.0
	Never	13	21.7
Availability of SOP	Yes	42	70.0
	No	18	30.0

Institutional support	Yes	48	80.0
	No	12	20.0
Readiness to implement TPT	Very ready	12	20.0
	Quite ready	24	40.0
	Less ready	15	25.0
	Not ready	9	15.0

A total of 60 TB program officers from 20 Primary Health Centers (PHCs) in Jambi Municipaity participated in this study. The respondents mean age was 42.1 years, ranging from 25 to 54 years. The average length of work was 12.8 years, indicating that most respondents had considerable experience in TB program implementation.

Regarding educational background, the majority held a Bachelor's degree (S1) (60%), followed by Diploma (D3) (35%) and Master's degree (S2) (5%). Based on their roles in the TB program, 33.3% were program holders, 33.3% were TB officers, and 33.3% were TB examining doctors, reflecting a balanced distribution of key personnel involved in the TPT program. More than half of the respondents (68%) reported that their PHC had a TB preventive therapy (TPT) program, while 32% stated otherwise.

Most respondents (55%) had been involved in the TPT program for 1–3 years, and 40% reported managing 10–30 patients per year.Only one-third (35%) of respondents indicated that there was a specific budget allocated for TPT activities, whereas the majority (65%) stated there was no or unclear budget allocation. In terms of capacity building, nearly half (48%) had attended TPT related training regularly each year, 30% attended occasionally, and 22% reported never receiving any training. The availability of standard operating procedures (SOPs) was reported by 70% of respondents, showing relatively good structural support for TPT implementation.

Regarding institutional support, 80% of respondents mentioned receiving support — either technical (40%), financial (25%), or other forms (15%) — while 20% reported insufficient support. Finally, when assessing readiness to implement TPT, 40% of respondents were categorized as "quite ready", 20% as "very ready", 25% as "less ready", and 15% as "not ready." This suggests that although most officers demonstrated moderate readiness, there remains a need to strengthen resources and management support to enhance TPT implementation effectiveness.

Table 2. Summarizes the mean scores of each management function assessed among TB officers at Primary Health Centers in Jambi.

Management Function	Mean Score	Category
Planning	4.2	Good
Organizing	4.0	Good
Actuating	3.4	Fair
Controlling	3.2	Fair

The assessment of management functions revealed that the actuating and controlling dimensions were relatively weaker compared to planning and organizing. Mean scores for actuating and controlling were 3.4 and 3.2, respectively, indicating a "fair" level of implementation. In the actuating domain, several operational components showed suboptimal implementation. While most Primary Health Centers consistently performed contact tracing and patient education, deficiencies were observed in home visit activities, psychosocial support, and sustained patient follow-up.

Only 55% of officers reported conducting routine home visits for latent TB patients, and 48% indicated that psychosocial support was provided when needed. Furthermore, community participation through health cadres was limited in most centers (42%), and

continuity of drug supply for TPT was not always guaranteed (only 60% reported consistent availability). Documentation of daily TPT implementation was performed by 70% of respondents, but only half (52%) reported that data were systematically analyzed for decision making.

For the controlling function, weaknesses were more pronounced. Although routine evaluation of program achievements was reported by 65% of respondents, only 50% indicated that feedback from these evaluations was used to improve services. Supervision from higher level authorities occurred irregularly, with 40% of respondents receiving external supervision less than twice a year. Similarly, only 45% of officers confirmed the presence of scheduled monitoring and evaluation mechanisms. The use of evaluation data for program planning and reporting was inconsistent; only 48% of Puskesmas analyzed data regularly to identify field challenges.

In addition, follow up actions from monitoring activities were not consistently documented (reported by 43% of respondents). Overall, these findings suggest that although operational implementation of TPT activities (e.g., contact tracing and patient education) is progressing, systematic supervision, evaluation, and feedback mechanisms remain inadequate at the primary care level.

DISCUSSION

This study evaluated the implementation of management functions such as planning, organizing, actuating, and controlling (POAC) in the Tuberculosis Preventive Therapy (TPT) program at Primary Health Centers (PHCs) in Jambi Municipality, Indonesia. Using George R. Terry's management theory, which emphasizes these four interrelated functions as essential components of effective organizational management[9], the findings revealed that planning and organizing were well implemented, while actuating and controlling showed only fair performance.

The sociodemographic profile of respondents indicates a mature and experienced workforce, with an average age of 42.1 years and a mean service duration of 12.8 years. These characteristics suggest strong institutional memory and potential leadership capacity in TB program management. Similar findings were reported by Alison, who found that longer tenure among health officers contributed to better adherence to TB guidelines through accumulated field experience and program familiarity[10].

In terms of educational attainment, most respondents held at least a bachelor's degree (60%), supporting their capacity to perform planning and analytical tasks effectively. The balanced distribution of roles among program holders, TB officers, and examining doctors also demonstrates a multiprofessional approach to TPT implementation an aspect previously highlighted by Palak and Yasir as critical for successful latent TB infection management in primary care settings[11,12].

The results showed that planning (mean = 4.2) and organizing (mean = 4.0) were implemented at a good level. According to Terry's theory, planning provides direction and defines objectives, while organizing establishes structure and allocates resources to achieve those objectives. The presence of standard operating procedures (SOPs) in 70% of PHCs and institutional support in 80% of cases indicates that these components are relatively well-developed in Jambi. This aligns with Yasir, who emphasized that structured planning and clear task delegation enhance program accountability and efficiency in TB control[12].

In contrast, actuating (mean = 3.4) and controlling (mean = 3.2) were rated as fair, indicating a gap between strategic planning and practical execution. Within Terry's framework, actuating involves motivating and coordinating personnel to carry out established plans, while controlling ensures that performance aligns with objectives. Weaknesses in these areas were reflected in limited home visits (55%), inadequate psychosocial support (48%), and inconsistent supervision. These operational gaps may reduce patient adherence and threaten the sustainability of TPT implementation. Similar challenges were reported by Dodd et al and WHO, who noted that weak follow up mechanisms, irregular supervision, and poor feedback loops are among the most common barriers to effective TB preventive therapy worldwide[13,14].

Likewise, Fatmawati found that insufficient monitoring and evaluation in Indonesian PHCs contributed to underperformance in TB control programs[15].

Institutional readiness, while moderate overall, further reflects these managerial challenges. Although 80% of respondents reported receiving institutional support, only 20% felt "very ready" to implement TPT activities. According to Robbins & Coulter, readiness is shaped by the alignment between organizational resources, leadership commitment, and staff adaptability[16]. The limited budget allocation for TPT (35%) and the finding that 22% of officers never received TPT related training illustrate structural and capacity constraints that may hinder effective implementation.

After presenting the general findings above, the following section explores in greater depth the two weakest management functions actuating and controlling to understand their underlying causes and implications for program effectiveness. The low performance in actuating reflects challenges in translating plans into consistent field actions and fostering staff engagement and community involvement. Although contact tracing and health education were relatively well established, activities requiring sustained field presence such as home visits, psychosocial support, and medication adherence supervision were less consistently implemented. These findings mirror earlier reports from other Indonesian provinces, where limited human resources and heavy workloads constrained officers ability to perform follow up and patient monitoring effectively. The lack of community participation in program delivery further reduces sustainability, particularly in remote or rural areas.

In the controlling dimension, the absence of structured monitoring and evaluation (M&E) systems was evident. Supervision was often irregular, feedback loops were weak, and evaluation data were underutilized for program improvement. This situation undermines accountability and prevents early identification of operational bottlenecks. Effective control requires periodic supervision, timely feedback, and data driven decision making all of which remain insufficiently developed at the PHC level. Similar conclusions were drawn by Salazar, who emphasized that consistent supervision and structured evaluation are key determinants of primary care performance in TB prevention programs[17].

From a managerial standpoint, strengthening the actuating and controlling functions requires a dual approach: (1) capacity building to enhance officers' skills in patient counseling, monitoring, and data utilization, and (2) institutionalization of M&E mechanisms to ensure that every supervision and evaluation activity translates into actionable program improvements. This aligns with the core principle of the POAC model, where control serves as the feedback mechanism that sustains the entire management cycle[15].

Reinforcing these two functions will ensure program continuity, accountability, and patient adherence key pillars for achieving Indonesia's TB elimination targets. Furthermore, regular training, supportive supervision, and adequate resource allocation should be complemented by digital reporting and feedback systems, as recommended by the WHO End TB Strategy (2023)[14], to strengthen monitoring efficiency and data driven decision making.
In conclusion, this study highlights that the TPT program in Jambi benefits from strong planning and organizing foundations but faces significant challenges in operational execution and supervision. According to management theory, effective control functions as the feedback mechanism that drives continuous improvement. Therefore, enhancing supervision, evaluation, and staff motivation through structured training and digital M&E integration is vital. Strengthening these managerial dimensions will be critical not only for sustaining TPT implementation in Jambi but also for informing broader policy strategies toward Indonesia's 2035 TB elimination goal.

CONCLUSIONS

The study demonstrated that the Tuberculosis Preventive Therapy (TPT) program at Primary Health Centers in Jambi Municipality has established strong foundations in the planning and organizing functions of management, reflecting adequate structural preparation, availability of SOPs, and institutional support. However, weaknesses were identified in the actuating and controlling functions, which remain only moderately implemented. These gaps

highlight challenges in translating plans into consistent field activities, ensuring effective supervision, and utilizing evaluation data for decision-making.

Limited human resources, insufficient training, irregular supervision, and weak feedback mechanisms were among the main constraints affecting staff motivation, accountability, and program sustainability. Consequently, these managerial deficiencies hinder optimal implementation of TPT and may compromise patient adherence.

Strengthening the actuating and controlling dimensions through capacity building, structured monitoring and evaluation, and the integration of digital feedback systems is therefore essential. By enhancing motivation, accountability, and data-driven oversight, PHCs can improve operational performance and ensure continuous improvement of TPT delivery.

Ultimately, reinforcing these managerial components is crucial not only for sustaining TPT implementation in Jambi but also for contributing to Indonesia's broader TB elimination goal by 2035.

CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

FUNDING

This study funding by Universitas Jambi.

ACKNOWLEDGMENT

The authors would like to express their sincere appreciation to Universitas Jambi for providing financial support for this research. The authors also extend their gratitude to the Jambi City Health Office and all Primary Health Centers that participated in the study for their valuable cooperation and assistance during data collection. Special thanks are conveyed to all TB program officers who generously shared their time and insights, which were essential to the completion of this research. Their dedication and contribution to tuberculosis prevention and control efforts are highly commendable.

DECLARATION OF ARTIFICIAL INTELLIGENCE USE

The authors declare that artificial intelligence (AI) tools were used in the preparation of this manuscript. Specifically, ChatGPT (OpenAI) was employed to assist in improving the clarity, structure, and academic tone of the text. All content, analyses, interpretations, and conclusions presented in this article are the sole responsibility of the authors. The AI tools were used strictly for language enhancement and editing purposes, and no generative AI system was used to produce original scientific ideas or data. We confirm that all AI assisted processes were critically reviewed by the authors to ensure the integrity and reliability of the results. The final decisions and interpretations presented in this article were solely made by the authors.

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