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FAMILY-BASED INTERVENTIONS FOR TREATMENT ADHERENCE, SELF-EFFICACY, AND TREATMENT SUCCESS AMONG PULMONARY TUBERCULOSIS PATIENTS: A MIXED-METHODS SYSTEMATIC REVIEW

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ABSTRACT

Tuberculosis (TB) remains a major global health problem, with poor treatment adherence increasing the risks of treatment failure, relapse, and drug resistance. Family-based interventions may strengthen self-efficacy and improve treatment adherence, although evidence remains fragmented. This review aimed to synthesize evidence on family-based interventions and family involvement in relation to treatment adherence, self-efficacy, treatment success, and relapse among pulmonary TB patients. A mixed-methods systematic review was conducted following PRISMA 2020 guidelines. Scopus, PubMed, SAGE, and Web of Science were searched for English-language primary studies published between 2015 and 2026. Methodological quality was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Tools, and findings were synthesized narratively. Nine studies from Indonesia, China, Iran, India, Uganda, and Thailand were included: two randomized controlled trials, five cross-sectional studies, one quasi-experimental study, and one qualitative study. Family supervision, medication reminders, emotional support, and structured family empowerment or participatory education were associated with better treatment adherence, treatment success, and health-related quality of life. Qualitative findings suggested that intensive family caregiving strengthened patients' self-efficacy; however, no quantitative study assessed self-efficacy as an intervention outcome. No study directly measured relapse. One quasi-experimental study reported an increase in cure rates from 73% to 90% following a collaborative family-based intervention. Family involvement, particularly structured empowerment and participatory education, may improve treatment adherence and success among pulmonary TB patients. Evidence regarding self-efficacy and relapse prevention remains limited. Further trials using validated self-efficacy measures and post-treatment follow-up are needed. Structured family-based approaches may be integrated into TB care programs in Indonesia.

Keywords: Family-Based Intervention; Self-Efficacy; Treatment Adherence; Treatment Success; Relapse; Pulmonary Tuberculosis; Mixed-Methods Systematic Review

INTRODUCTION

Tuberculosis (TB) continues to be a worldwide health concern, consistently ranking among the leading causes of mortality from infectious diseases globally (Sofiana et al., 2025). Pulmonary tuberculosis (pulmonary TB) is a lung infection that attacks the parenchymal tissue of the lungs, caused by the acid-fast bacterium Mycobacterium tuberculosis (Latief et al., 2021). It is estimated that roughly one in four people worldwide carry TB bacteria in their bodies. Most of those infected

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experience no symptoms and cannot spread the disease to others. However, approximately 5–10% of carriers will eventually progress to active TB disease. Infants and young children face a greater risk of developing the illness upon infection (WHO, 2024).

Tuberculosis (TB) is heavily concentrated in low- and middle-income countries, which account for more than 80% of both cases and deaths worldwide (WHO, 2024). Geographically, the WHO South-East Asia Region bears the greatest share of new cases at 34%, followed by the Western Pacific Region (27%) and the African Region (25%), with approximately 87% of all new cases occurring across 30 high-burden countries (WHO, 2024). A substantial portion of the global total is concentrated in eight countries India, Indonesia, the Philippines, China, Pakistan, Nigeria, the Democratic Republic of the Congo, and Bangladesh with India alone contributing 25% of cases, and the five most affected nations collectively representing 55% of the global burden (WHO, 2024). Beyond its clinical impact, TB imposes severe economic consequences on affected households. Globally, approximately half of TB patients and their families face total costs including direct medical expenditures, non-medical costs, and indirect losses such as reduced income that are considered catastrophic, exceeding 20% of total household income (WHO, 2024).

Tuberculosis demands an extended treatment commitment, requiring patients to complete a full six-month medication regimen. The prolonged duration of therapy, combined with the side effects associated with Anti-Tuberculosis Drugs (OAT), presents a significant challenge in disease management and often contributes to patient non-adherence. Yet, maintaining consistency in taking medication is critical to successfully eliminating Mycobacterium tuberculosis from the body, as it minimizes the likelihood of treatment failure and reduces the chances of the disease recurring (Heltty et al., 2025).

Non-adherence to TB treatment not only increases the risk of treatment failure and relapse, but also significantly impacts the overall quality of life of patients (Ferlia et al., 2025). Quality of life plays an important role in TB management, as it directly influences a patient's motivation and consistency in adhering to the prescribed treatment regimen, poor adherence, in turn, can lead to treatment failure and even death (Ferlia et al., 2025). Several factors have been identified as contributors to diminished quality of life among TB patients, including low treatment adherence, insufficient support from family and the surrounding environment, and socioeconomic constraints (Morales-García et al., 2023). In this regard, family and social support are recognized as key determinants of quality of life, as they provide the encouragement and assistance patients need throughout the lengthy treatment process. Ultimately, one of the most effective ways to improve quality of life in TB patients is through consistent adherence to the prescribed medication regimen, as successful treatment outcomes are closely tied to the patient's commitment to completing therapy (Ferlia et al., 2025)

Self-efficacy has an important influence on medication adherence in various chronic diseases because it reflects an individual’s confidence in their ability to manage their health effectively. Studies have consistently demonstrated that individuals with higher levels of self-efficacy tend to show better adherence to prescribed medication regimens (Sofiana et al., 2025). In the context of tuberculosis, strong self-efficacy may help patients remain consistent throughout the lengthy treatment process, thereby reducing the risk of treatment interruption and disease relapse. Family support is considered one of the key factors that can

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strengthen patients' self-efficacy by providing emotional, informational, and practical assistance during treatment. Involving family members in TB care, for example through medication supervision, education, and empowerment, is therefore a potentially modifiable way to support patients' confidence and adherence.

Previous reviews have addressed related questions from different angles. A scoping review of 13 mostly cross-sectional quantitative studies summarized the role of family support in medication adherence and quality of life and called for qualitative evidence to complement it (Lutfian et al., 2024). a literature review of 15 studies described factors affecting treatment adherence among patients in Indonesia, in which family support was identified in only two studies (Islam et al., 2024) and a systematic review and meta-analysis of correlational studies examined factors related to self-care among Korean patients with TB (Lee & Lee, 2024). These reviews focused on adherence, quality of life, or self-care as general outcomes and on family support as a correlate to our knowledge, none of them focused on family-based interventions across treatment adherence, treatment success, self-efficacy, and relapse together, or integrated quantitative and qualitative evidence. It therefore remains unclear which family-based approaches have been tested, which outcomes they have actually been shown to influence, and where the evidence is still missing, particularly for relapse, which threatens long-term TB control.

This mixed-methods systematic review therefore aimed to answer the following question: among patients with pulmonary TB, what does the evidence show about family-based interventions and family involvement in relation to treatment adherence and treatment success (priority outcomes) and self-efficacy, health-related quality of life, and relapse (secondary outcomes) By integrating quantitative and qualitative evidence, this review also aims to identify evidence gaps and to inform recommendations for TB programs in Indonesia.

METHODS

Study Design

This study was a mixed-methods systematic review that integrated quantitative (randomized, quasi-experimental, and cross-sectional) and qualitative primary studies using narrative synthesis. The review question was framed with the PICOS framework (Table 2). The review was reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement; PRISMA served as a reporting guideline only, and the methods used are described in the following sections.

Search Result

The initial database search was conducted on May 6, 2026, across four electronic databases: Scopus, PubMed, SAGE, and Web of Science, yielding a total of 334 articles. A core search strategy was developed using terms related to family-based interventions, self-efficacy, tuberculosis, relapse, recurrence, and treatment adherence. The search strategy was adapted to the specific requirements of each database as follows:

("family-based intervention" OR "family support" OR "family involvement") AND "self-efficacy" AND ("tuberculosis" OR "pulmonary tuberculosis" OR "TB") AND ("relapse" OR "recurrence" OR "treatment adherence")

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From Scopus, 46 articles were retrieved, consisting of 42 original articles, 3 reviews, and 1 book chapter (38 in English, 5 in Korean, 2 in Chinese, and 1 in Indonesian). PubMed returned 5 articles published between 2022 and 2026. No date or language filters were applied at the database level for Scopus and PubMed due to the manageable number of retrieved records, these criteria were instead applied manually during the screening stage.

SAGE yielded 249 articles prior to filtering, which were subsequently narrowed to 129 articles after applying the publication year filter (2015–2026), and further reduced to 91 articles after restricting the search to research articles. Web of Science returned 34 articles prior to filtering, which were narrowed to 17 articles after applying the publication year filter (2015–2026). Following database-level filtering, a total of 159 records remained (Scopus: 46, PubMed: 5, SAGE: 91, Web of Science: 17).

Table 1. Search Strategy

Database	Initial results	After filter	Filter applied
Scopus	46	46	
PubMed	5	5	
SAGE	249	91	2015-2016
Web of Science	34	17	2015–2026
Total	334	159	

Study Selection

A total of 334 records were identified from the four databases. After applying database filters, 159 records remained and no duplicates were found. All 159 records were screened manually by title and abstract against the eligibility criteria. Of these, 110 records were excluded and 49 reports were sought for full-text retrieval. Two reports could not be retrieved, so 47 full-text articles were assessed for eligibility. Of these, 38 were excluded: 34 because of irrelevant outcomes or insufficient focus on family-based intervention, one because it was not published in English, and three because they were secondary studies (one scoping review, one literature review, and one systematic review and meta-analysis). Nine primary studies were included in this review (Figure 1).

Inclusion and Exclusion Criteria

Studies were eligible if they (1) were primary studies using quantitative (randomized, quasi-experimental, or observational) or qualitative designs; (2) were published in English between 2015 and 2026 with full text available; (3) involved patients with pulmonary TB; (4) examined a family-based intervention, family support, or family involvement; and (5) reported at least one of the following

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outcomes: treatment adherence, treatment success (cure or treatment completion), self-efficacy, health-related quality of life, or relapse/recurrence. Studies were excluded if they were secondary studies (literature, scoping, or systematic reviews and meta-analyses), book chapters, editorials, or conference abstracts were published outside the period or not in English; had no accessible full text; did not involve patients with TB or did not examine family involvement; reported none of the outcomes above; or were duplicate publications. Secondary studies were excluded because they are not primary research and could double count the same underlying evidence; they were used only to position this review relative to previous reviews.

Assessment of Study Quality and Risk of Bias

The methodological quality of the included studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Tools based on each study design, including randomized controlled trials, cross-sectional studies, quasi-experimental studies, and qualitative studies. JBI provides design-specific checklists for all designs eligible in this review, which allowed a consistent appraisal approach across the mixed-methods evidence base. Overall, the included studies showed good methodological quality (Table 4). The two randomized controlled trials scored 100% (Khakhong et al., 2023) and 76.9% (Zendehtalab et al., 2025), the five cross-sectional studies met all eight criteria, the quasi-experimental study scored 88.9%, and the qualitative study scored 90%. The main limitations were the lack of blinding of participants and treatment providers in one trial (blinding of outcome assessors was unclear), the absence of a control group in the quasi-experimental study, and unclear reporting of the influence of the researcher on the research in the qualitative study. Blinding is often not feasible in family education interventions. All included studies were considered methodologically acceptable for inclusion in this mixed-methods systematic review.

Data Extraction and Analysis

Data were extracted using a standardized form covering author, country, year of publication, study design, sample size, type of family-based intervention, outcome measures, and key findings related to treatment adherence, self-efficacy, treatment success, and relapse. Because of heterogeneity in designs, interventions, and outcome measures, narrative synthesis was used and no quantitative pooling was attempted. Studies were first grouped by design (experimental or quasi-experimental, cross-sectional, and qualitative) and then by outcome (treatment adherence, self-efficacy, and treatment success and relapse). Quantitative and qualitative findings on the same outcome were then compared and integrated narratively. Studies with inconsistent or contrasting findings were reported separately and interpreted in light of differences in design, population, intervention, and outcome measurement.

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Figure 1. Prisma Flow Diagram

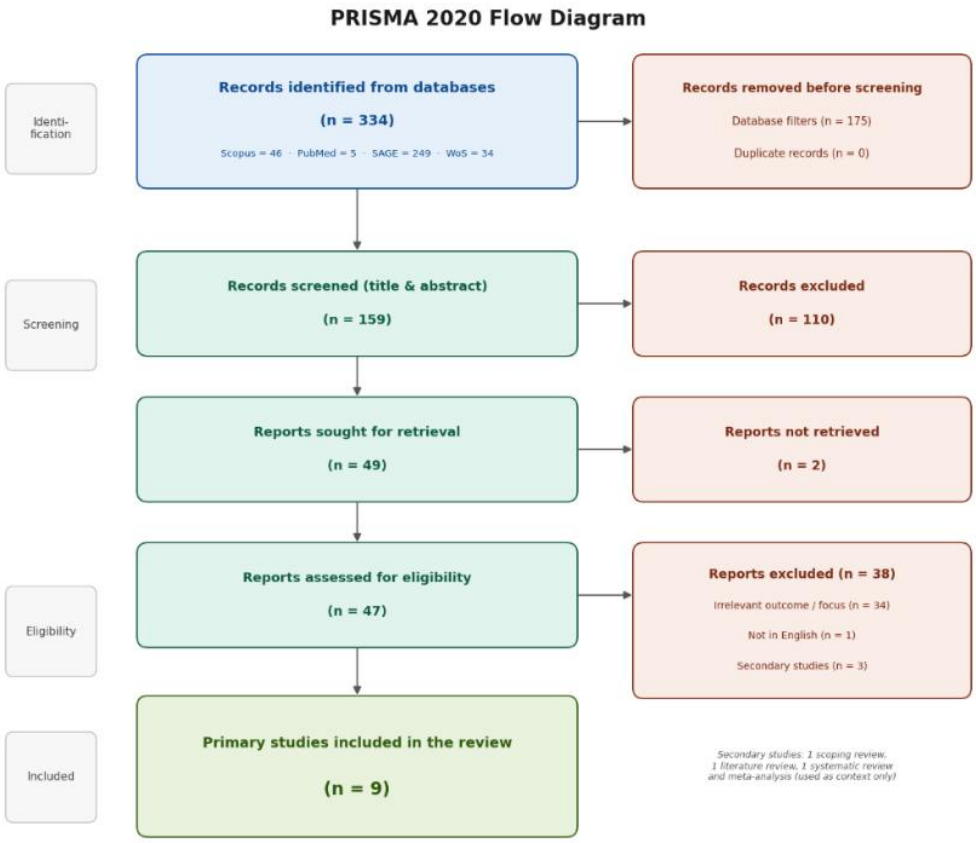


Table 2. The PICOS Format of this study

Criteria	Inclusion	Exclusion
Population	Pulmonary tuberculosis patients undergoing treatment	Non-TB patients or patients with other primary diagnoses
Intervention	Family-based intervention, family support, or family involvement in TB care	Non-family-based intervention or absence of family involvement
Comparators	No comparator required; control group if applicable	—
Outcomes	Treatment adherence (priority); treatment success (cure or treatment completion), self-efficacy, health-related quality of life (HRQoL), and/or relapse or recurrence	Studies not reporting any of these outcomes
Study Design	Primary studies: RCT, quasi-experimental, cross-sectional, and qualitative designs	Secondary studies (literature, scoping, and systematic reviews; meta-

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		analyses), conference abstracts, editorials, and book chapters
Publication Year	2015–2026	Published before 2015
Language	English	Non-English language publications

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Table 3. Data Extraction of Included Studies

Author (Year)	Design	Sample	Intervention / Family Support	Outcome	Instrument	Key Findings
(Chen et al., 2020)	Cross-sectional	481 newly diagnosed TB patients	Family supervision of medication, spiritual encouragement, family relationship, and help solving daily problems	Treatment adherence	MMAS-8; Likert-scale questionnaire on family, social, and national policy support	non-adherence was high in newly diagnosed TB patients. Patients who had family members who frequently supervised medication and provided spiritual encouragement and a good doctor-patient relationship and TB-related knowledge and a high need for policy support contributed to high adherence
(Stang et al., 2023)	Quasi-experimental (one-group pre-post test)	30 TB patients	Collaborative model: integrated counseling by TB, nutrition, environmental health, and health promotion	Eating behavior, healthy living behavior, spiritual	McNemar test; behavioral observation checklists	The collaborative model significantly improved eating, healthy living, and spiritual behaviors with the Cure rate

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			officers involving family	behavior, and cure rate		increased from 73% to 90%.
(Nagarajan et al., 2024)	Qualitative (positive deviance framework)	20 DR-TB patients, 20 caregivers, 10 healthcare providers	Family caregivers providing intensive participatory care: nutrition support, medication supervision, emotional support, and goal-oriented assistance	Self-efficacy and treatment adherence (positive deviance)	Semi-structured in-depth interviews; thematic analysis using NVivo 12	Family caregivers acted as therapeutic partners. Intense caregiving enabled self-adaptation and self-efficacy acquisition in DR-TB patients, promoting treatment resilience.
(Gurusinga et al., 2024)	Cross-sectional	150 TB patients	Four dimensions of family support: emotional, appreciation, informational, and instrumental support	Treatment adherence	35-item Likert-scale questionnaire (4 subscales); SPSS v21	appreciation support has a greater influence than emotional support on treatment adherence in TB patients, it is essential for healthcare providers and families to offer all types of support to enhance treatment adherence among these patients.
(Zahroh et al., 2023)	Cross-sectional	93 TB patients	Family support as reinforcing factor alongside knowledge, beliefs, and healthcare personnel support	Non-adherence to TB medication	Logistic regression	Family support significantly reduced non-adherence, Knowledge was the most dominant factor

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(Zendehtalab et al., 2025)	RCT	62 dyads (31 intervention, 31 control)	Family-based participatory education (face-to-face, 2 virtual) covering TB pathophysiology, treatment adherence, nutrition, stress management, and psychosocial support	Health-related quality of life (HRQoL)	24-item TB-specific HRQoL questionnaire (Cronbach's alpha=0.83); SPSS v26	Family-based participatory education significantly improved HRQoL across physical, psychological, and social domains.
(Alinaitwe, Shariff, & Boddupalli, 2025)	Cross-sectional	147 TB patients	Actual family support (medication reminders, emotional support, encouragement, material support) and perceived family support	Treatment adherence	6-item modified MARS (Cronbach's alpha=0.72); linear regression	Medication reminders, emotional support, and encouragement were significantly associated with adherence. Perceived family support moderated the effect of actual support. Patients without caregivers had poorer adherence.
(Dana et al., 2025)	cross-sectional study	125 respondents diagnosed with drugsensitive TB and	family-centered approaches	Patient adherence to TB treatment	validated questionnaires, assessing family support, motivation, and treatment adherence.	Family support increased patient motivation, which in turn improved treatment adherence.

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		in the second stage of treatment participated			Structural Equation Modeling (SEM) was used to analyze the relationships between variables.	
(Khakhong et al., 2023)	RCT (two-arm, post-test only)	32 pairs of family members and adults with PTB per arm, totaling 64 pairs of participants.	Family empowerment involves acknowledging, promoting, and strengthening the abilities of family members to address their own needs, find solutions to problems, and access the resources they require.	Adherence and Treatment Success	descriptive statistics, Pearson's chi-square, Fisher's Exact, and McNemar tests.	The family empowerment program was effective in improving medication adherence and treatment success.

Note. DR-TB = drug-resistant tuberculosis; HRQoL = health-related quality of life; MARS = Medication Adherence Rating Scale; MMAS-8 = Morisky Medication Adherence Scale (8-item); PTB = pulmonary tuberculosis; RCT = randomized controlled trial; SEM = structural equation modeling; SPSS = Statistical Package for the Social Sciences; TB = tuberculosis.

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RESULT

A total of nine studies met the inclusion criteria and were included in this mixed-methods systematic review. The included studies comprised randomized controlled trials (n=2), cross-sectional studies (n=5), a quasi-experimental study (n=1), and a qualitative study (n=1). Studies were conducted across multiple countries including Indonesia (n=4), China (n=1), Iran (n=1), India (n=1), Uganda (n=1), and Thailand (n=1). Sample sizes ranged from 30 to 481 participants. All included studies scored 76.9% or higher on the JBI critical appraisal checklist (Table 4), confirming adequate methodological quality.

Table 4. JBI Critical Appraisal Results of the Included Studies

Study	JBI checklist (items)	Met	Score	Items not met or unclear
Khakhong et al. (2023)	RCT (13)	13/13	100%	None
Zendehtalab et al. (2025)	RCT (13)	10/13	76.9%	Not met: blinding of participants (item 4) and of those delivering treatment (item 5); unclear: blinding of outcome assessors (item 6)
Stang et al. (2023)	Quasi-experimental (9)	8/9	88.9%	Not met: no control group (item 4)
Chen et al. (2020)	Analytical cross-sectional (8)	8/8	100%	None
Gurusinga et al. (2024)	Analytical cross-sectional (8)	8/8	100%	None
Zahroh et al. (2023)	Analytical cross-sectional (8)	8/8	100%	None
Alinaitwe et al. (2025)	Analytical cross-sectional (8)	8/8	100%	None
Dana et al. (2025)	Analytical cross-sectional (8)	8/8	100%	None
Nagarajan et al. (2024)	Qualitative (10)	9/10	90%	Unclear: influence of the researcher on the research and vice versa (item 7)

Note. Score = number of JBI criteria met divided by the number of criteria in the design-specific checklist; items rated "no" or "unclear" were not counted as met.

1. Family-Based Interventions and Treatment Adherence

Insufficient family support, particularly in medication supervision, may result in treatment discontinuation. Seven of the nine included studies examined treatment adherence or non-adherence as an outcome. In a cross-sectional study of 481 newly diagnosed patients in China, 85.4% reported that family members often supervised their medication, and family supervision, spiritual encouragement, and family relationships were associated with adherence levels (Chen et al., 2020). In Deli Serdang, Indonesia, patients who received good emotional support showed higher adherence than those who received poor

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emotional support, and appreciation support had a greater influence on adherence than emotional support (Gurusinga et al., 2024). Medication reminders, emotional support, and encouragement from family were also significantly associated with adherence in Uganda, where patients without caregivers had poorer adherence (Alinaitwe, Shariff, & Boddupalli, 2025). Family support significantly reduced non-adherence in another Indonesian study, although knowledge was the most dominant factor (Zahroh et al., 2023), and family support increased patient motivation, which in turn improved adherence (Dana et al., 2025). These studies are cross-sectional and therefore show associations rather than intervention effects. The only randomized trial that measured adherence was conducted in Thailand, where a family empowerment program improved medication adherence and treatment success (Khakhong et al., 2023). Family support, both emotional and practical, provides encouragement, reminders, and assistance throughout the prolonged treatment and helps patients overcome barriers such as fatigue, stigma, and financial burden (Dana et al., 2025).

2. Family-Based Interventions and Self-Efficacy

High self-efficacy can create confidence in responding to certain situations, helping patients remain consistent throughout treatment. Conversely, low self-efficacy may lead to feelings of anxiety and helplessness. Self-efficacy was addressed directly in only one included study. In a qualitative study of people with drug-resistant TB, their caregivers, and health providers in India, patients who received emotional support, nutritional assistance, medication supervision, and regular accompaniment from family members became more confident and resilient, and family caregivers acted as therapeutic partners who helped patients acquire self-efficacy (Nagarajan et al., 2024). None of the quantitative studies measured self-efficacy as an outcome of a family-based intervention, so the link between family involvement and self-efficacy rests on qualitative evidence. Previous reviews, which were not included in the synthesis, offer indirect support: a literature review of Indonesian studies reported that high self-efficacy was linked to confidence and motivation to take medication so that treatment did not have to be repeated, whereas low self-efficacy was associated with pessimism and resignation (Islam et al., 2024), and a meta-analysis of Korean studies found that social support had the largest effect on self-care (ESr = 0.61), with family support (ESr = 0.38) and self-efficacy (ESr = 0.48) also significantly related to self-care (Lee & Lee, 2024).

3. Family-Based Interventions and Treatment Outcomes, Including Relapse

No included study measured relapse or recurrence as an outcome, and none followed patients after treatment completion to detect relapse. The available evidence therefore concerns treatment success and related outcomes, which are only indirectly linked to relapse risk. Poor adherence resulting from insufficient family involvement increases the risk of treatment failure, relapse, and drug-resistant TB (Dana et al., 2025), which provides the rationale for examining family involvement, but this link was not tested in the included studies. Two studies evaluated structured family-based interventions on treatment success. A family empowerment program in Thailand significantly improved medication adherence

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and treatment success in a randomized trial (Khakhong et al., 2023), and a collaborative model involving family members alongside multidisciplinary health workers raised the cure rate from 73% to 90% in a one-group pre-post study of 30 patients in Indonesia (Stang et al., 2023). A randomized trial in Iran found that family-based participatory education significantly improved health-related quality of life across physical, psychological, and social domains (Zendehtalab et al., 2025), but quality of life is not a measure of relapse. These findings suggest that structured family involvement can support treatment success, while its effect on relapse remains unknown.

DISCUSSION

This mixed-methods systematic review of nine primary studies suggests that family involvement is consistently associated with better treatment adherence, that structured family-based programs may improve adherence and treatment success, and that evidence on self-efficacy and relapse remains limited.

1. Family-Based Interventions and Treatment Adherence

Treatment adherence was the most common outcome discussed in the studies. Several studies reported that emotional support, medication reminders, supervision, and encouragement from family members helped patients complete their treatment regularly. Dana et al. (2025) found that family support increased patient motivation, which subsequently improved treatment adherence, suggesting that family members serve not only as treatment supervisors but also as an important source of motivation during the lengthy treatment process. Studies testing structured family-based interventions (Khakhong et al., 2023; Stang et al., 2023) reported improvements in adherence or treatment success; however, no included study compared a structured intervention directly with general family support, so a superior effect cannot be concluded. Khakhong (et al. (2023) found that a Family Empowerment Program significantly improved medication adherence and treatment success among TB patients in Thailand. However, some studies noted that family support alone may not be sufficient. A previous literature review (Islam et al., 2024) highlighted that knowledge, education level, and self-efficacy were also important determinants of adherence. Furthermore, Alinaitwe et al. (2025) reported that the effect of actual family support was moderated by how supportive patients perceived their family to be, which suggests that how support is perceived also matters for adherence.

2. Family-Based Interventions and Self-Efficacy

Evidence on self-efficacy is limited and mainly qualitative. Nagarajan et al. (2024) explained that patients who received emotional support, nutritional assistance, and regular accompaniment from family members became more confident and resilient throughout treatment, which suggests that family involvement may strengthen patients' belief in their own ability to complete treatment. This is consistent with a previous systematic review and meta-analysis reporting that social support had the strongest effect on self-care among Korean patients with TB, with family support also significant (Lee & Lee, 2024), and with the broader literature linking self-efficacy to adherence (Islam et al., 2024). However, no included quantitative study measured self-efficacy with a validated

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scale or tested whether a family-based intervention changed it, so a causal role of family-based interventions in improving self-efficacy cannot be concluded.

3. Family-Based Interventions and Treatment Outcomes, Including Relapse

No included study measured relapse directly, so the evidence on relapse is indirect. Stang et al. (2023) reported that involving family members in a multidisciplinary TB care model improved healthy behavior and increased the cure rate from 73% to 90%, and Khakhong et al. (2023) reported better treatment success with a family empowerment program, but these outcomes were assessed at or shortly after treatment and do not show whether patients remained free of TB afterwards. Zendehtalab et al. (2025) found that family-based education improved quality of life, which may support sustained treatment engagement, but this is an indirect pathway. Previous reviews likewise reported that family support is associated with better adherence and quality of life (Lutfian et al., 2024). Whether family-based interventions reduce relapse therefore remains to be tested in studies with post-treatment follow-up.

This review has several limitations. Most of the included studies used cross-sectional designs (five of nine), which limits causal inference, and only two were randomized controlled trials, neither of which measured self-efficacy or relapse. No study measured relapse, so conclusions on relapse prevention cannot be drawn. A meta-analysis was not feasible because of substantial clinical and methodological heterogeneity in study design, family-based interventions, outcome measures, and instruments, and because several studies did not report sufficient statistical data (e.g., effect sizes or standard deviations) for quantitative pooling; a narrative synthesis was therefore used. The search covered four databases and English-language publications only, so relevant studies may have been missed. Nevertheless, the findings suggest that structured family empowerment programs and active family involvement may support treatment adherence and treatment success; their effect on relapse requires further study.

Implications and Recommendations

For TB programs in Indonesia, the findings support strengthening the role of family members, including the treatment supporter (pengawas menelan obat, PMO), through structured and documented components: education on TB and treatment adherence at the start of treatment, training in medication supervision and reminders, emotional and nutritional support, and a family empowerment or participatory education program delivered together with health workers at primary health care facilities. Programs could also add routine assessment of patients' confidence to complete treatment (self-efficacy) and early identification of families who need additional support. Because the evidence base is still limited, such components are best introduced together with monitoring of adherence and treatment outcomes.

Further research should (1) use randomized or well-controlled designs to test structured family-based interventions in Indonesian primary care settings; (2) measure self-efficacy with validated instruments and adherence with standardized measures; (3) follow patients after treatment completion (for example, for at least 12 months) to measure relapse or recurrence directly; and (4) report intervention

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components and fidelity so that effective elements can be identified. Qualitative and mixed-methods studies on family experiences in Indonesia would complement these trials.

CONCLUSION

Family involvement is associated with better treatment adherence among pulmonary TB patients, and structured family-based programs, particularly family empowerment and participatory education, show promising effects on adherence, treatment success, and quality of life. Evidence on self-efficacy comes mainly from qualitative data, and no included study measured relapse, so the contribution of family-based interventions to relapse prevention is not yet established. Integrating structured family-based components into TB programs in Indonesia is a reasonable step if accompanied by evaluation, and future trials with post-treatment follow-up are needed.

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