e-ISSN : 2597-6052
MPPKI MEDIA PUBLIKASI PROMOSI KESEHATAN INDONESIA
Research Articles Open Access

Integrating Family Support and Personal Counseling in a Behavioral Model for Tuberculosis Prevention

Sumiati Sumiati[1*], Suwarto Suwarto[2], Ratna Wardani[3], Atik Setiawan Wahyuningsih[4]
[1]Postgraduate School of Public Health, Universitas Strada Indonesia, Kediri
[2]Postgraduate School of Public Health, Universitas Strada Indonesia, Kediri
[3]Postgraduate School of Public Health, Universitas Strada Indonesia, Kediri
[4]Postgraduate School of Public Health, Universitas Strada Indonesia, Kediri

***Corresponding Author**: E-mail: mia.mysista@gmail.com

ARTICLE INFO

Manuscript Received: 26 Jun, 2025
Revised: 23 Oct, 2025
Accepted: 31 Oct, 2025
Date of Publication: 03 Dec, 2025
Volume: 8
Issue: 12
DOI: 10.56338/mppki.v8i12.8665

KEYWORDS

Family;
Integrative Model;
Personal Counseling;
Transmission Prevention;
Tuberculosis

ABSTRACT

Introduction: Tuberculosis (TB) remains a major global public health problem in Indonesia, where household contact serves as the primary transmission pathway. Families, as the closest social units, play a crucial role in preventing TB spread; however, preventive behaviors often remain suboptimal due to fragmented and unsustained community interventions.

Objective: This study aimed to develop and evaluate an integrative, family-based prevention model by positioning personal counseling as a mediator linking threat perception, coping appraisal, and family support with preventive behaviors.

Methods: A two-phase quantitative study was conducted in Madiun City. Phase I involved 387 families of TB patients to analyze the relationships among variables using structural equation modeling–partial least squares (SEM-PLS). Phase II adopted a quasi-experimental design with intervention and control groups (n = 30 each) to assess the effectiveness of the integrative module. Statistical analyses included 95% confidence intervals (CIs) for all effect estimates. Ethical approval was granted by the Health Research Ethics Committee of Universitas Strada Indonesia (No. 2781/KEPK/IX/2023).

Results: SEM-PLS analysis revealed that threat perception, coping appraisal, and family support significantly influenced TB preventive behaviors directly and indirectly through personal counseling (β = 0.01–0.35; 95% CI = 0.02–0.40; $p < 0.05$). The intervention significantly improved preventive behavior in the intervention group compared with the control group (mean increase = +7.5; 95% CI = +5.9–+9.1; $p < 0.001$).

Conclusion: The integrative family-based model incorporating personal counseling effectively strengthened TB preventive behaviors among families. Theoretically, this study contributes to the integration of Social Cognitive Theory and Protection Motivation Theory in TB prevention, highlighting personal counseling as a behavioral mediator. Practically, this model can be adopted by primary healthcare providers and community health cadres to enhance family engagement and support Indonesia's TB elimination targets by 2030. Study limitations include reliance on self-reported measures and a localized setting, which may constrain generalizability.

Publisher: Fakultas Kesehatan Masyarakat Universitas Muhammadiyah Palu

INTRODUCTION

Tuberculosis (TB) remains one of the world's most significant public health challenges. According to the Global Tuberculosis Report, more than 10 million new cases and 1.3 million deaths were recorded in 2022, making TB the second leading cause of death from infectious diseases after COVID-19 (1,2). Indonesia ranks among the top five countries with the highest TB burden, alongside India, China, the Philippines, and Pakistan. Transmission occurs primarily through close household contact, rendering families-particularly children and older adults-the most vulnerable groups (3).

At the local level, the City of Madiun has shown a sharp increase in TB cases, from 297 in 2020 to 1,085 in 2023 (4). This trend is influenced not only by intensified contact tracing and expanded service coverage, but also by low adherence to preventive household practices, such as consistent mask use, adequate ventilation, and medication compliance. These circumstances highlight the need for sustained, family-based prevention strategies that are both behaviorally grounded and contextually appropriate.

An increasing body of evidence underscores the crucial role of family support in improving treatment adherence, reducing stigma, and promoting a healthy home environment (5–7). International studies further demonstrate that family-centered educational interventions enhance quality of life among TB patients (8), while family support directly influences both treatment adherence and health outcomes (9). Conversely, social stigma can heighten the psychological burden of TB patients and negatively shape their coping strategies (10,11). Despite these insights, household-level preventive behaviors in Indonesia remain inconsistent, and existing interventions are largely fragmented, often limited to short-term, lecture-style education sessions.

From a theoretical perspective, Social Cognitive Theory (SCT) posits that health behaviors are shaped by reciprocal interactions among personal, environmental, and behavioral determinants (12). Similarly, the Protection Motivation Theory (PMT) and the Health Belief Model (HBM) emphasize the significance of perceived threat, self-efficacy, and perceived benefits in shaping preventive intentions. Within the TB context, threat perception, coping appraisal, and family support function as key cognitive and social drivers of preventive actions. Integrating personal counseling within this framework may strengthen both motivation and behavioral adherence among affected families, thereby enhancing the overall effectiveness of preventive interventions (8,9).

However, most existing TB prevention frameworks have applied these behavioral theories in isolation, focusing either on cognitive determinants or environmental supports, without addressing the mediating role of family-level behavioral mechanisms. By combining SCT and PMT through a personal counseling pathway, this study offers a comprehensive framework explaining how cognitive appraisals, motivation, and social support interact to shape preventive behavior within households.

This integrated approach bridges global behavioral theory with local community realities, positioning the Indonesian family system as a contextual adaptation of evidence-based household prevention models. Accordingly, this study contributes to both theoretical refinement and practical adaptation of integrative behavioral models for TB prevention in low-resource, high-burden settings.

Addressing these gaps, the present study was conducted to develop and evaluate the effectiveness of an Integrative Family-Based Model for TB Transmission Prevention incorporating Personal Counseling. The novelty of this research lies in its theory-driven integration and its emphasis on local applicability, generating a model that can inform community-based TB prevention frameworks across similar contexts.

METHODS

Study Design

This study employed a two-phase quantitative design. The first phase utilized a cross-sectional approach to examine the associations between threat perception, coping appraisal, and family support and TB preventive behaviors, with personal counseling conceptualized as a mediating variable, as commonly applied in behavioral public health research (13). The second phase adopted a quasi-experimental design with a pretest–posttest control group, following the recommendations of Whitehead et al. (14) for pilot interventions in community-based settings.

Participants were allocated to intervention and control groups using proportional matching based on family characteristics. Because random assignment was not feasible in this community setting, baseline equivalence between groups was verified using independent-samples t-tests and chi-square tests. Participant flow followed the TREND

and CONSORT extension guidelines for non-randomized behavioral interventions to ensure methodological transparency.

Setting and Period

The study was conducted in Madiun City, East Java Province, Indonesia, which was selected due to its high tuberculosis case burden. According to the Profil Kesehatan Kota Madiun (15), reported TB cases increased from 297 in 2020 to 1,085 in 2023, reflecting a persistent public health challenge. Data collection was carried out from August to October 2023.

Population and Sample

In Phase I, the study population included all families of registered TB patients at 11 healthcare facilities (n = 964). The sample size was calculated using G*Power 3.1 software (16), yielding 387 families, which provided a statistical power of 0.95 and a significance level of 0.05.

In Phase II, a separate group of 60 families—not included in the first phase—was recruited, consisting of 30 intervention participants and 30 control participants, in accordance with minimum sample requirements for pilot quasi-experimental research (14).

Sampling Technique

Samples were selected using proportional random sampling, based on the distribution of TB cases across healthcare facilities (17). Patient registries served as the sampling frame.

Inclusion criteria were: (a) families of TB patients aged ≥18 years; (b) residing in the same household; and (c) no history of chronic respiratory disease other than TB. Exclusion criteria included families who declined participation or provided incomplete responses.

The final sample size of 387 families accounted for a 10% nonresponse rate, and attrition during data collection was minimal (<5%), ensuring representativeness across facilities.

Study Variables

Three categories of variables were examined:

Independent variables: threat perception, coping appraisal, and family support.

Mediating variable: personal counseling.

Dependent variable: family-level preventive behavior against TB transmission.

Instruments

The research utilized a structured questionnaire adapted from previously validated tools in behavioral health studies based on Social Cognitive Theory (SCT) and Protection Motivation Theory (PMT). Content validity was reviewed by three public health experts, while construct validity was established using Confirmatory Factor Analysis (CFA) in SmartPLS 4.

All measurement indicators satisfied the recommended thresholds: outer loadings > 0.70, Average Variance Extracted (AVE > 0.50), Composite Reliability (CR > 0.80), and Heterotrait–Monotrait (HTMT) ratios < 0.85, confirming discriminant validity. Cronbach's alpha coefficients exceeded 0.70 for all constructs, indicating acceptable internal consistency, as recommended by Hair et al.

The intervention module was developed and validated through expert judgment (18). comprising four weekly sessions (60–75 minutes each). Session themes included:

Understanding TB transmission and perceived threat

Enhancing coping skills and self-efficacy

Strengthening family support and communication

Action planning and behavioral reinforcement

The sessions were conducted face-to-face at community health centers by trained public health nurses with ≥3 years of counseling experience. Fidelity monitoring was implemented using a standardized checklist aligned with TIDieR and CONSORT extension guidelines to ensure intervention reproducibility.

Data Collection Procedure

In Phase I, researchers obtained ethical clearance and informed consent, then distributed questionnaires to eligible participants.

In Phase II, the intervention group received the integrative counseling module, whereas the control group received standard education via health leaflets. Both groups completed pretest and posttest questionnaires one month apart to evaluate behavioral changes in TB prevention.

Data Analysis

Phase I data were analyzed using descriptive statistics and Structural Equation Modeling–Partial Least Squares (SEM-PLS) to assess direct and indirect effects among variables (19). The SEM-PLS analysis followed a two-step approach, testing both measurement and structural models. Model validity and reliability were confirmed with outer loadings (>0.70), AVE (>0.50), and CR (>0.80). Discriminant validity was verified using the Fornell–Larcker criterion and HTMT ratios (<0.85). Multicollinearity tests indicated all Variance Inflation Factor (VIF) values below 3.3, demonstrating acceptable independence among constructs. Model fit indices were satisfactory (SRMR = 0.05; $R^2 = 0.64$ for preventive behavior; $Q^2 = 0.41$), suggesting strong predictive relevance.

Phase II data were analyzed using the Shapiro–Wilk test for normality, paired t-tests for within-group comparisons, and independent-samples t-tests for between-group differences. Nonparametric tests were applied where normality was violated(20). All parametric assumptions were verified prior to inferential analyses: normality ($p > 0.05$) and homogeneity of variances ($p > 0.05$) were confirmed. The independent-samples t-test revealed a statistically significant difference in post-intervention scores between groups, $t(58) = 3.21$, $p < 0.001$, 95% CI [4.12, 10.88]. The effect size (Cohen's $d = 0.82$) indicated a large and practically meaningful difference, confirming the module's impact on family-level preventive behaviors.

Ethical Considerations

Ethical approval was obtained from the Health Research Ethics Committee of Universitas STRADA Indonesia (No. 2781/KEPK/IX/2023). The study adhered to the principles of autonomy, beneficence, and human dignity, in accordance with the latest Declaration of Helsinki (18,21).

RESULTS

Respondents' Characteristics (Phase I)

A total of 387 family members of tuberculosis (TB) patients participated in Phase I. Most respondents were siblings of TB patients (35.2%), aged 41–50 years (43.2%), had completed senior high school education (47.3%), and were self-employed (30.0%). The majority lived in four-member households (33.1%), with disease duration less than six months (42.9%), and a distance of 1,201–3,000 meters from the nearest health facility (47.3%) (Primary Data, 2023).

Table 1. Respondents' Demographic Characteristics (Phase I)

Characteristic	Dominant Category	%
Family status	Sibling	35.2
Age	41–50 years	43.2
Education	Senior high school	47.3
Occupation	Self-employed	30.0
Number of family members	Four	33.1
Duration of TB illness	<6 months	42.9
Distance to health facility	1,201–3,000 m	47.3

Source: Primary Data, 2023.

SEM-PLS Model Analysis Phase I

The measurement model demonstrated satisfactory validity and reliability, with all indicators exceeding established thresholds (outer loadings > 0.70, AVE > 0.50, composite reliability > 0.80, Cronbach's alpha > 0.70).

The structural model revealed significant paths between key constructs:

Personal counseling → TB preventive behavior (β = 0.35; p < 0.001)

Threat appraisal → TB preventive behavior (β = 0.33; p < 0.001)

Coping appraisal → TB preventive behavior (β = 0.26; p < 0.001)

Family support → TB preventive behavior (β = 0.18; p = 0.010)

Indirect effects through personal counseling were also significant (β = 0.01–0.02; p < 0.01), confirming the hypothesized mediation.

Table 2. Summary of SEM-PLS Path Coefficients

Relationship	β	Standard Error (SE)	95% Confidence Interval (CI)	t-value	p-value	Effect Size (f^2)
Personal counseling → TB preventive behavior	0.35	0.04	[0.27, 0.43]	8.75	<0.001	0.18
Threat appraisal → TB preventive behavior	0.33	0.05	[0.23, 0.41]	6.60	<0.001	0.15
Coping appraisal → TB preventive behavior	0.26	0.06	[0.14, 0.37]	4.33	<0.001	0.11
Family support → TB preventive behavior	0.18	0.07	[0.05, 0.31]	2.57	0.010	0.07
Threat/Coping/Family support → TB preventive behavior (via personal counseling)	0.01–0.02	0.003–0.005	[0.01, 0.04]	3.25–4.02	<0.01	0.06

Model fit indices: R^2 (Preventive Behavior) = 0.64; Composite Reliability = 0.87; AVE = 0.58; SRMR = 0.05.
Source: Primary Data processed with SmartPLS 4, 2023.

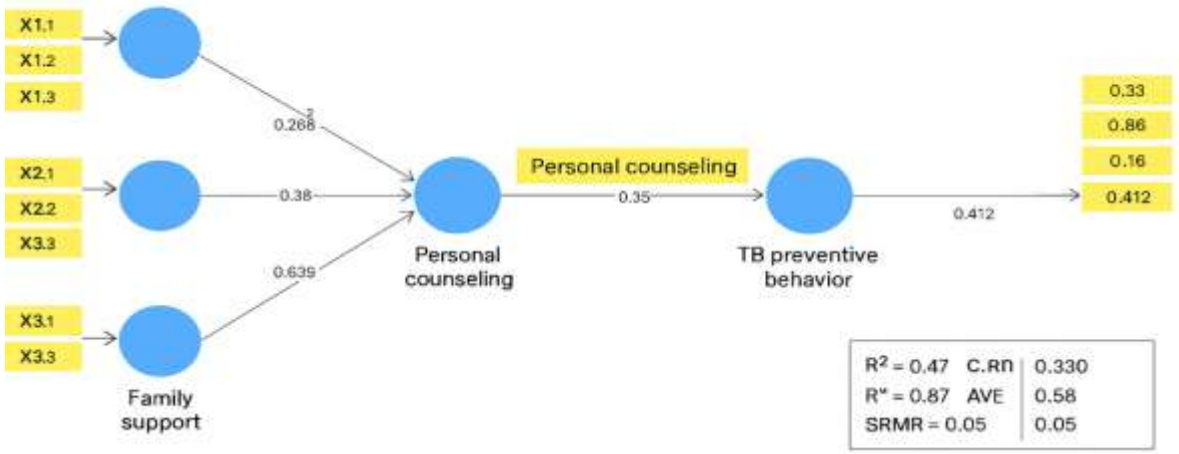

Figure 1. Structural Equation Model (SEM-PLS) of the Integrative Family-Based TB Prevention Framework.
The model exhibited strong predictive accuracy (R^2_personal counseling = 0.33; R^2_preventive behavior = 0.41) and satisfactory goodness-of-fit (SRMR = 0.05), supporting the hypothesized mediation effect of personal counseling between cognitive and social predictors and TB preventive behaviors.
Source: Primary Data processed with SmartPLS, 2023.

Respondents' Characteristics in Phase II

In Phase II, 60 respondents participated in the experimental stage, divided equally between intervention (n = 30) and control (n = 30) groups. Both groups were demographically similar, predominantly aged 41–50 years, senior high school graduates, and self-employed, confirming baseline comparability.

Table 3. Respondents' Demographic Characteristics (Phase II)

Characteristic (summary)	Control n (%)	Intervention n (%)
Sibling completing the questionnaire	10 (33.3)	12 (40.0)
Age 41–50 years	11 (36.7)	20 (66.7)
Senior high school education	13 (43.3)	15 (50.0)
Self-employed	9 (30.0)	11 (36.7)
Income >4 million	12 (40.0)	13 (43.3)
Five family members	10 (33.4)	12 (40.0)
Duration of TB illness <6 months	13 (43.3)	12 (40.0)
Distance 1,200–3,000 m	13 (43.3)	14 (46.6)

Source: Primary Data, 2023.

Effectiveness of the Integrative Counseling Module

Within-group comparisons showed no significant change in the control group ($p = 0.420$), whereas the intervention group exhibited a significant increase in TB preventive behavior scores from 40.2 to 47.7 ($\Delta = +7.5$; $p < 0.001$).

Table 4. Pre- and Post-Test Comparison of TB Preventive Behavior Scores

Group	Pre-test Mean	Post-test Mean	Δ Mean	p-value
Control (n=30)	39.1	38.9	–0.2	0.420
Intervention (n=30)	40.2	47.7	+7.5	<0.001

Source: Primary Data, 202

Between-group analysis using an independent-samples t-test confirmed that the intervention group scored significantly higher than the control group (47.7 ± 6.1 vs. 38.9 ± 5.8), $t(58) = 3.21$, $p < 0.001$, 95% CI [4.12, 10.88], Cohen's $d = 0.82$, indicating a large practical effect.

Table 5. Post-Test Comparison of TB Preventive Behavior Scores Between Groups

Group	Post-test Mean	p-value
Control (n=30)	38.9	<0.001
Intervention (n=30)	47.7	

Source: Primary Data, 2023

DISCUSSION

The findings of this study suggest that threat perception, coping appraisal, family support, and personal counseling are significantly associated with tuberculosis (TB) preventive behaviors among families. Furthermore, personal counseling appears to mediate the associations among these determinants, highlighting the importance of a family-centered and integrative behavioral approach rather than a purely cognitive model.

Bootstrapping analysis (5,000 resamples) confirmed the indirect associations between threat perception, coping appraisal, and family support with TB preventive behavior through personal counseling ($\beta = 0.01–0.02$; 95% CI [0.01, 0.04]; $p < 0.01$). The inclusion of confidence intervals and indirect pathway testing strengthens interpretive credibility, demonstrating that the influence of cognitive and social constructs operates through motivational reinforcement mechanisms, not through direct causation.

Personal counseling was found to be a central behavioral facilitator that strengthens families' motivation and adherence to TB prevention. This finding is in line with several previous studies, where structured counseling interventions improved treatment adherence among TB patients (22–24). Within the framework of Social Cognitive Theory (SCT), such behavioral improvements emerge as the result of reciprocal interactions between personal efficacy, environmental stimuli, and supportive relationships (12). Face-to-face counseling also provides an emotional anchor for families, enhancing their ability to understand health messages and apply them effectively in daily preventive practices.

Threat perception showed a positive association with TB preventive behavior, suggesting that families who perceive higher levels of transmission risk tend to engage in protective actions. This is consistent with an Indonesian study indicating that risk awareness and motivation are important drivers of treatment adherence (25). However, excessive fear may trigger stigma and avoidance behaviors, as shown in recent studies (26,27). Therefore, educational programs should balance awareness with positive expectancy, emphasizing that TB is preventable and curable with timely adherence to treatment.

Coping appraisal was also a significant determinant of preventive behavior. Families who applied problem-focused coping strategies, such as maintaining hygiene, assisting with medication adherence, and seeking accurate information, demonstrated stronger engagement in prevention. This finding corroborates qualitative evidence from Malaysia, which revealed that stigma-related psychological burdens shape coping mechanisms among TB-affected individuals (10,28). Hence, targeted counseling should include components that help families build adaptive coping strategies to counteract stigma and emotional distress.

Family support played an essential role in promoting preventive behavior. The findings echo studies in Indonesia and Peru, where emotional, informational, and appraisal support were linked to improved adherence and health outcomes (29,30). A recent systematic review also confirmed the global relevance of family involvement in shaping TB-related health behaviors (9,31). Collectively, these findings emphasize that the family is the most immediate and sustainable unit for preventing TB transmission at the household level.

The SEM-PLS model provided empirical evidence that personal counseling mediates the effects of threat perception, coping appraisal, and family support on preventive behavior. This aligns with SCT's principle of triadic reciprocal determinism, in which personal factors, environmental influences, and behaviors interact dynamically (12). The counseling process likely enhances self-efficacy and social reinforcement, translating cognitive appraisals into sustained behavioral outcomes.

The family-based integrative module demonstrated practical effectiveness in improving preventive behaviors, consistent with a Malaysian study that reported significant quality-of-life improvements following a family education intervention (8). The approach also supports the World Health Organization's Global TB Strategy, which underscores community- and family-centered models as key to sustainable prevention (2,32). This is further supported by Riyadi et al. (6), who found that social capital and environmental support facilitate the development of long-term healthy behaviors.

This study contributes novelty by integrating Protection Motivation Theory (PMT) and Social Cognitive Theory (SCT) into a unified family-based counseling framework. Theoretically, the model enhances understanding of how cognitive, emotional, and social mechanisms interact in TB prevention. Practically, it offers a feasible framework that can be implemented in primary healthcare settings, empowering TB cadres and community health workers to deliver structured, evidence-informed counseling programs that strengthen family engagement.

The study's limitations should be acknowledged. The use of self-reported questionnaires may have introduced recall and social desirability biases. Sampling was confined to Madiun City, potentially limiting external validity. Sampling bias may also exist due to recruitment through healthcare facilities, possibly excluding families with limited service access. Additionally, intervention contamination may have occurred because participants within the same community could share information. The study also lacked longitudinal validation, preventing assessment of sustained behavioral changes. These limitations constrain the generalizability of the findings beyond similar settings. Future research should employ longitudinal and mixed-method designs, include larger samples, and test scalability across diverse cultural and regional contexts.

CONCLUSION

This study demonstrates that threat perception, coping appraisal, family support, and personal counseling are significantly associated with TB preventive behavior, with personal counseling acting as a mediator. The family-based integrative module effectively improved preventive behaviors among families. Theoretically, this study supports the relevance of Protection Motivation and Social Cognitive frameworks in family-based TB prevention. Future research should examine the model's scalability and policy application in broader community settings to strengthen family-centered TB control strategies.

AUTHOR'S CONTRIBUTION STATEMENT

All authors were actively involved in designing the study, collecting and analyzing the data, and drafting the manuscript. Each author critically reviewed and approved the final version prior to submission for publication.

CONFLICTS OF INTEREST

The authors declare that they have no competing interests that could have influenced the objectivity or integrity of this research.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors affirm that no artificial intelligence technologies were employed in generating the substantive content of this manuscript.

SOURCE OF FUNDING STATEMENTS

This research was fully self-funded by the authors.

ACKNOWLEDGMENTS

The authors extend their highest appreciation to the Madiun City Health Office and its healthcare staff for facilitating data collection, as well as to all TB-affected families who voluntarily participated in this study.

BIBLIOGRAPHY

1. World Health Organization. Global Tuberculosis Report 2022. Genewa: WHO; 2022.
2. World Health Organization. Global Tuberculosis Report. Geneva; 2023. 1–57 p.
3. Dodd PJ, Mafirakureva N, Seddon JA, McQuaid CF. The global impact of household contact management for children on multidrug-resistant and rifampicin-resistant tuberculosis cases, deaths, and health-system costs in 2019: a modelling study. Lancet Glob Heal. 2022;10(7):e1034–44.
4. Madiun PK. Profil Kesehatan Kota Madiun 2023. Madiun: Dinas Kesehatan Kota Madiun;
5. Namuwali D, Hara MK, Nurwela TS, Banhae YK. The Relationship Between Family Support and Adherence to Taking Medication in Pulmonary TB. Indones J Glob Heal Res. 2023;5(4):645-652.
6. Riyadi S, Marmi M, Madury S Al, Farid M. Smoking Cessation Behavior Among Madurese Adolescents: The Role of Social Capital and the Theory of Planned Behavior. Media Publ Promosi Kesehat Indones. 2025;8(9):971–80.
7. Alinaitwe B, Shariff NJ, Madhavi Boddupalli B. Treatment adherence and its association with family support among pulmonary tuberculosis patients in Jinja, Eastern Uganda. Sci Rep. 2025;15(1):11150.
8. Saidi SS, Abdul Manaf R. Effectiveness of family support health education intervention to improve health-related quality of life among pulmonary tuberculosis patients in Melaka, Malaysia (FASTEN. BMC Pulm Med. 2023;23(139).
9. Lutfian L, Azizah A, Wardika IJ, Wildana F, Maulana S, Wartakusumah R. The role of family support in medication adherence and quality of life among tuberculosis patients: a scoping review. Jpn J Nurs Sci. 2025;21(2):e12629.

10. Nasir A, Hassan II, Ma'ruf A, Suharno NE, Goenharto S, Purwanto CR, et al. Coping efforts made: psychological burden of people living with tuberculosis due to social stigma in society — a qualitative phenomenology study. PLoS One. 2024;19(7):e0303331.
11. Chen X, Xu J, Chen Y, Wu R, Ji H, Pan Y, et al. The relationship among social support, experienced stigma, psychological distress, and quality of life among tuberculosis patients in China. Sci Rep. 2021;11(1)::24236.
12. Bandura A. Social foundations of thought and action: A social cognitive theory. Newyork: Prentice-Hall.; 1986.
13. Creswell JW, Plano Clark VL. Designing and conducting mixed methods research. 3rd ed. SAGE Publications; 2018.
14. Whitehead AL, Julious SA, Cooper CL, Campbell MJ. Estimating the sample size for a pilot randomised trial to minimise the overall trial sample size for the external pilot and main trial for a continuous outcome variable. Stat Methods Med Res. 2016;25(3):1057–73.
15. Dinas Kesehatan Madiun. Profil Kesehatan Kota Madiun 2022. Madiun: Dinas Kesehatan Kota Madiun; 2023.
16. Faul F, Erdfelder E, Buchner A, Lang AG. Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. Behav Res Methods. 2009;41(4):1149–60.
17. Acharya AS, Prakash A, Saxena P, Nigam A. Sampling: why and how of it? Indian J Med Spec. 2013;4(2):330–3.
18. Polit DF, Beck CT. Nursing Research: Generating and Assessing Evidence for Nursing Practice. Philadelphia, PA, USA: Wolters Kluwer; 2021.
19. Hair JF, Hult GTM, Ringle CM, Sarstedt M. A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). 3rd ed. Sage Publishing; 2022.
20. Cohen L, Manion L, Morrison K. Research methods in education. 8th ed. London: Routledge; 2020.
21. World Medical Association. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. JAMA. 2013;310(20):2191–4.
22. Islam F, Ahmad H, Nurbaya, Ahmad M, Ansar, Ramadhan K, et al. Factors Affecting Treatment Adherence Among Patients with Tuberculosis in Indonesia: Literature Review. J Public Heal Pharm. 2024;4(1):28–37.
23. Wahiduddin W, Pranoto A, Sudjarwo S. Vitamin D Deficiency in Patients with Type 2 Diabetes Mellitus with and without Pulmonary Tuberculosis. J Public Heal Pharm [Internet]. 2024;4(3):246–53. Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85209649023&doi=10.56338%2Fjphp.v4i3.5976&partnerID=40&md5=7d94c9ad9abb1a4d4a3673195ae8d64d
24. Erni YR, Tombeg Z, Hadi AJ. Predisposisi Tuberkulosis Paru: A Cross Sectional Study. J Public Heal Pharm. 2021;1(1):9–13.
25. Dana NR, Chiau ML, Rahman AD. Family support, motivation, and patient adherence to tuberculosis treatment: insights from Indonesia. Afr J Infect Dis. 2025;19(2):43–9.
26. Kılıç A, Zhou X, Moon Z, Hamada Y, Duong T, Layton C, et al. A systematic review exploring the role of tuberculosis stigma on test and treatment uptake for tuberculosis infection. BMC Public Health. 2025;25(1):628.
27. Patel N, Patel H, Varu J, Gandhi R, Yogesh M. The Invisible Toll: Unveiling the Prevalence and Predictors of Depression and Anxiety Among Pulmonary Tuberculosis (TB) Patients and Their Households in Gujarat, India. Cureus. 2024;
28. Chauhan A, Pandya A, Bhatt D, Salaliya V, Trivedi R, Kapadia D, et al. Dual burden of TB and mental ill-health: Prevalence and associated factors of anxiety and depression among TB patients in Gujarat. J Fam Med Prim Care. 2024;13(12):5615–5620.
29. Gurusinga R, Afrizal A, Bachtiar A, Firdawati Firdawati, Machmud R, Burhan E, et al. The relationship between family support and treatment adherence in patients with tuberculosis in Deli Serdang Regency, Indonesia, 2022: A cross-sectional study. Nurs Midwifery Stud. 2024;13(3):132–9.
30. Dilas D, Flores R, Morales-García WC, Calizaya-Milla YE, Morales-García M, Sairitupa-Sanchez L, et al. Social Support, Quality of Care, and Patient Adherence to Tuberculosis Treatment in Peru: The Mediating Role of Nurse Health Education. Patient Prefer Adherence. 2023;(17):175–186.

31. Chen X, Du L, Wu R, Xu J, Ji H, Zhang Y, et al. The effects of family, society and national policy support on treatment adherence among newly diagnosed tuberculosis patients: a cross-sectional study. BMC Infect Dis. 2020;20(623).
32. Magno NPG, Moniz EP, Gaio FEA, Amaral MMF, Belo I. Effectiveness of Community-Based Interventions in Preventing Tuberculosis: A Systematic Review. KESANS Int J Heal Sci. 2025;4(11):957–70.