



FACTORS INFLUENCING TREATMENT ADHERENCE PATIENTS WITH TUBERCULOSIS: A SYTEMATIC REVIEW

Josue Celestino da Costa Ximenes*, Abdul Wakhid

Faculty of Nursing, Universitas Ngudi Waluyo, Jl. Diponegoro No. 186 / Jl. Gedong Songo, Candirejo, Ungaran Barat, Kabupaten Semarang, Jawa Tengah 50513, Indonesia

[*josuecelestina6@gmail.com](mailto:josuecelestina6@gmail.com)

ABSTRACT

Tuberculosis (TB) remains a major global health challenge, and adherence to anti-tuberculosis treatment is essential for treatment success and prevention of treatment interruption and drug resistance. Adherence is influenced by interacting individual, social, economic, treatment-related, and health-system conditions. This systematic review aimed to identify and synthesize evidence published between 2021 and 2026 regarding factors influencing adherence to TB treatment, with particular attention to socioeconomic, health-system, patient-related, social, stigma-related, and technology-related determinants. A PRISMA-guided systematic review searched PubMed, Scopus, and Web of Science for studies published from January 2021 to August 2026. Of 72 articles identified, 8 eligible quantitative, qualitative, or mixed-methods studies were included to synthesize barriers and facilitators of tuberculosis (TB) treatment adherence using a multidimensional framework. Twenty-four studies were reported as meeting the inclusion criteria, comprising 10 cross-sectional studies, 6 cohort studies, 5 qualitative studies, and 3 randomized trials. Five major domains emerged: socioeconomic factors; health-system factors; patient-related factors; social support and stigma; and technology-based adherence approaches. Reported barriers included poverty, transportation costs, food insecurity, prolonged waiting times, medication stock-outs, poor provider–patient communication, forgetfulness, adverse effects, comorbidities, substance use, and stigma. Family support was repeatedly identified as a facilitator, whereas digital adherence interventions demonstrated heterogeneous effects across settings. TB treatment adherence is multidimensional and requires interventions that address practical access barriers, quality of health services, treatment-related difficulties, social support, and stigma in addition to patient education.

Keywords: digital adherence technology; medication adherence; social support; tuberculosis

How to cite (in APA style)

Ximenes, J. C. da C., & Wakhid, A. (2026). Factors Influencing Treatment Adherence Patients with Tuberculosis: A Sytematic Review. *Indonesian Journal of Global Health Research*, 8(6), 1023–1030. <https://doi.org/10.37287/ijghr.v8i6.2798>.

INTRODUCTION

Tuberculosis remains a major global health challenge despite the availability of effective antimicrobial treatment. Successful treatment depends not only on the pharmacological effectiveness of anti-tuberculosis medicines but also on patients' ability to take medicines consistently and remain engaged with health services throughout the treatment period (World Health Organization [WHO], 2024). Treatment adherence is a multidimensional phenomenon. The evidence summarized in the present review indicates that adherence is shaped by socioeconomic circumstances, characteristics of health services, patient-related conditions, social relationships, stigma, and the availability of adherence-support technologies. These domains may interact rather than operate independently.

Socioeconomic circumstances can create practical barriers to continuous treatment. Poverty, transportation costs, food insecurity, and employment-related constraints may reduce patients' ability to attend treatment services or maintain treatment routines. Evidence included in the supplied review reported associations between lower socioeconomic status and non-adherence, as well as transportation-related missed doses (Naidoo et al., 2021; Benzekri et al., 2023).

Health-system characteristics may also influence adherence. Long waiting times, medication stock-outs, poor provider–patient communication, and greater distance to treatment facilities were

identified as barriers in the reviewed evidence. These factors are important because they reflect characteristics of service delivery that may be modifiable through health-system organization and quality improvement (Elbireer et al., 2022; Gebremariam et al., 2021).

Patient-related factors include forgetfulness, adverse treatment effects, premature discontinuation after symptomatic improvement, comorbidities, alcohol or substance use, and smoking. Treatment-related adverse effects were associated with poorer adherence in several studies, indicating that clinical management of adverse effects is relevant to continuity of treatment (Iweama et al., 2023). Comorbid conditions may further complicate treatment adherence. The supplied synthesis identified HIV and diabetes among conditions associated with poorer adherence, while substance use and smoking were also reported as important factors in individual studies (Naidoo et al., 2021; Sardar et al., 2022; Masini et al., 2024). These findings support approaches that consider the patient's broader clinical and behavioral context rather than treating TB adherence as an isolated behavior.

Social support can facilitate treatment continuity, whereas stigma may create barriers. Family involvement can provide reminders, emotional support, practical assistance, and help with access to health services. Conversely, perceived or experienced stigma and non-disclosure of TB/HIV status may discourage treatment attendance or medication-taking (Ushie et al., 2021; Kipp et al., 2023; Souza Damasio et al., 2022). Digital adherence technologies have emerged as an additional approach to supporting treatment. SMS reminders, video-observed therapy, digital pillboxes, and smartphone applications have been evaluated in different settings. However, the evidence summarized in the supplied review is heterogeneous, indicating that technology should be considered within the context of connectivity, digital literacy, privacy, patient preferences, and health-system integration (Hermans et al., 2022; Middelkoop et al., 2024).

Although individual studies have examined particular determinants, an integrated synthesis of socioeconomic, health-system, patient, social, and technology-related factors remains important for understanding why adherence varies across settings. A multidimensional perspective can help distinguish barriers that reflect patient circumstances from those arising from treatment delivery or the wider social environment. Based on these considerations, this systematic review aimed to identify and synthesize evidence published from 2021 to 2026 regarding factors influencing TB treatment adherence, identify major barriers and facilitators, examine health-system and social determinants, and summarize evidence concerning technology-based adherence approaches.

METHOD

Study Design

This study employed a systematic review design with narrative and thematic synthesis. The reporting structure was aligned with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach. The review was organized to identify, select, and synthesize evidence concerning factors influencing adherence to TB treatment. The review question was structured using a modified PICO/PICOS framework. The Population (P) comprised people receiving treatment for tuberculosis. The Intervention/Exposure (I/E) included socioeconomic factors, health-system characteristics, patient-related factors, social support and stigma, and technology-based adherence approaches. The Comparison (C) comprised usual care, lower exposure to the identified factors, or alternative adherence-support conditions where applicable. The primary Outcome (O) was adherence to TB treatment, including treatment continuity, medication-taking behavior, treatment completion, or treatment interruption.

Literature Search

The supplied review reported searches of PubMed, Scopus, and Web of Science for studies published from January 2021 to August 2026. The search focused on evidence concerning tuberculosis, treatment adherence, barriers, facilitators, factors, and medication compliance.

The final database-specific search strings, search dates, field restrictions, and filters were not included in the supplied source draft. These details should be inserted into the final manuscript to ensure reproducibility before journal submission.

Search Strategy

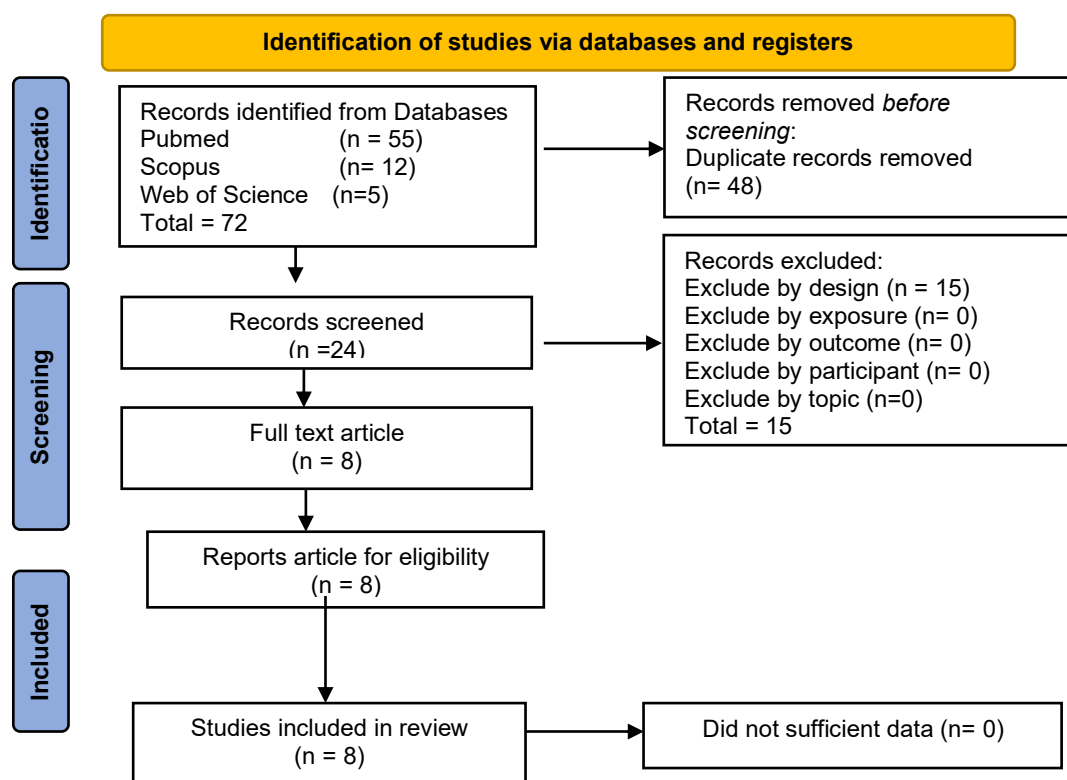
The core concepts reported in the supplied draft can be represented by the following search structure: ("tuberculosis" OR "TB") AND ("treatment adherence" OR "medication adherence" OR "medication compliance" OR "treatment interruption") AND ("barriers" OR "facilitators" OR factors OR determinants). The strategy was intended to capture studies addressing patient, socioeconomic, health-system, social, and technology-related determinants. Database-specific syntax should be adapted to the indexing characteristics of PubMed, Scopus, and Web of Science while retaining the core concepts. The complete search strings should be appended as a supplementary file for a reproducible submission.

Eligibility Criteria

Studies were eligible when they were original quantitative, qualitative, or mixed-methods research; focused on adherence to TB treatment; were published in English during 2021–2026; and reported barriers and/or facilitators to adherence. Reviews, editorials, conference abstracts, studies focused exclusively on latent TB or drug-resistant TB, and studies involving children younger than 18 years unless adult participants were also included were excluded.

Study Selection

Retrieved records were screened for eligibility based on the predefined population, exposure or determinant, adherence outcome, study design, and availability of relevant information. The supplied draft reports that 24 studies met the inclusion criteria. However, the source does not provide the complete numbers of records identified, duplicates removed, records screened, full texts assessed, or reasons for full-text exclusion. These values should be reconstructed from the screening record and presented in a PRISMA 2020 flow diagram before submission.



Picture 1. PRISMA

Data Extraction

Data extraction focused on study characteristics, population, study design, sample size, adherence measurement, determinant or intervention assessed, and principal findings. Particular attention was given to socioeconomic conditions, health-system factors, patient-related barriers, social support and stigma, and technology-based adherence approaches. The extraction process was intended to identify the mechanisms through which each factor could influence adherence, including practical access to treatment, service accessibility, communication with providers, treatment-related difficulties, family support, stigma, reminders, and digital monitoring.

Quality Appraisal and Data Synthesis

The supplied source draft does not report a study-level risk-of-bias instrument or individual appraisal results. Therefore, no unsupported quality ratings are presented in this revision. Before submission, an appraisal tool appropriate to each study design should be specified, study-level results should be reported, and the influence of methodological quality on the synthesis should be explained. Because the included studies differed in design, populations, adherence definitions, measurement approaches, and contexts, findings were synthesized narratively and thematically rather than pooled quantitatively. The synthesis was organized into five domains: socioeconomic factors; health-system factors; patient-related factors; social support and stigma; and technology-based adherence approaches.

RESULT

Characteristics of Included Studies

The included evidence comprised observational studies, intervention studies, and systematic reviews addressing factors associated with tuberculosis (TB) treatment adherence. The studies examined socioeconomic, nutritional, clinical, social, and technology-related factors that may influence patients' ability to initiate, continue, and complete TB treatment. The main characteristics and findings of the studies included in the synthesis are presented in table 1.

Table 1.

Characteristics and Main Findings of Studies Included in the Systematic Review

Author	Design	Population/Sample	Focus	Outcome	Result
Hermans et al. (2022)	Intervention study	Patients receiving TB treatment	SMS reminders	Medication adherence	SMS-based reminders improved adherence in some settings.
Benzekri et al. (2023)	Observational/intervention evidence	Patients with tuberculosis	Nutrition support	Treatment adherence	Food insecurity and nutritional conditions were identified as relevant barriers to treatment adherence.
Middelkoop et al. (2024)	Intervention study	Patients receiving TB treatment	Digital pillboxes	Medication adherence	Digital pillboxes showed modest improvements in selected adherence outcomes.
Masini et al. (2024)	Observational	Patients with TB/HIV	HIV status and treatment interruption	Treatment interruption	HIV-related factors were associated with treatment interruption.
The impact of digital adherence technologies on treatment outcomes in TB (2025)	Systematic review/evidence synthesis	TB patients	Digital adherence technologies	Treatment outcomes/adherence	Digital adherence technologies demonstrated heterogeneous effects across settings.
Digital adherence technology to improve medication adherence in tuberculosis patients (2025)	Systematic review and meta-analysis	TB patients	Digital adherence technology	Medication adherence	Digital adherence technologies may improve medication adherence, although effects varied across interventions and settings.
VOT and TB treatment completion (2025)	Systematic review	TB patients	Video-observed therapy	Treatment completion/adherence	Video-observed therapy was associated with higher treatment completion and adherence in the reviewed evidence.
Lawal et al. (2025)	Mixed-method systematic review	People living with HIV receiving treatment for active drug-sensitive TB	Barriers and facilitators of adherence	TB treatment adherence	Multiple individual, social, treatment, and health-system factors influenced adherence.

Socioeconomic and Nutritional Factors

Socioeconomic conditions emerged as important determinants of TB treatment adherence. The reviewed evidence indicated that poverty, transportation costs, food insecurity, and employment-related circumstances may create practical barriers to maintaining treatment. Patients experiencing financial difficulties may have problems accessing healthcare facilities regularly, obtaining adequate food during treatment, or maintaining treatment routines while fulfilling employment responsibilities. The source review reported associations between low socioeconomic status and non-adherence, with odds ratios ranging from 2.60 to 3.89 in the cited studies. Transportation costs were also reported as a reason for missed doses in approximately 20–26% of patients. Benzekri et al. (2023) further highlighted the relevance of nutritional conditions to TB treatment adherence. Food insecurity may become an important barrier because patients undergoing TB treatment may require adequate nutritional support while simultaneously experiencing economic difficulties. Thus, adherence should be considered within the broader socioeconomic circumstances of patients rather than as an isolated individual behavior.

Health-System and Treatment-Related Factors

Health-system characteristics were also identified as important factors influencing TB treatment adherence. The reviewed evidence identified prolonged waiting times, medication stock-outs, poor provider–patient communication, and geographical distance from treatment facilities as barriers. The source review reported an OR of 4.88 for waiting times of at least one hour, an OR of 4.75 for medication stock-outs, an aOR of 7.38 for poor provider–patient interaction, and an OR of 2.22 for travel distances greater than 10 km. These findings indicate that adherence is influenced not only by patients' motivation but also by the accessibility and responsiveness of TB services. When patients encounter long waiting times, unavailable medications, inadequate communication, or substantial travel requirements, maintaining regular treatment may become more difficult.

Patient-Related and Clinical Factors

Patient-related factors included forgetfulness, adverse drug reactions, premature discontinuation after symptomatic improvement, comorbidities, and substance use. Adverse drug reactions were particularly relevant, with the source review reporting adjusted odds ratios of approximately 4.18–5.53 for their association with non-adherence. Comorbidities such as HIV and diabetes were also associated with poorer adherence, while alcohol misuse and smoking were reported as important predictors in individual studies. The findings suggest that treatment adherence requires individualized clinical assessment. Forgetfulness may require reminder strategies, whereas adverse drug reactions require appropriate clinical management. Patients with HIV, diabetes, or substance-use problems may require integrated care rather than TB treatment interventions alone.

Social Support, HIV Status, and Stigma

Social and interpersonal factors represented another important domain. Family involvement was consistently described as a facilitator of treatment adherence because family members may provide reminders, emotional support, transportation assistance, and practical help during treatment. In contrast, stigma and concerns regarding disclosure may negatively affect adherence. Masini et al. (2024) specifically examined HIV status and treatment interruption, with the reviewed evidence indicating that HIV-related factors were associated with treatment interruption. Lawal et al. (2025) similarly identified multiple individual, social, treatment-related, and health-system factors affecting adherence among people living with HIV who were receiving treatment for active drug-sensitive TB.

Digital Adherence Technologies

Digital adherence interventions represented an emerging area of evidence. Hermans et al. (2022) reported that SMS reminders improved adherence in some settings. Other interventions included digital pillboxes, smartphone applications, and video-observed therapy. Middelkoop et al. (2024)

reported modest improvements in selected adherence outcomes with digital pillboxes, while evidence concerning video-observed therapy indicated improvements in treatment completion and adherence. However, the effects of digital adherence technologies were heterogeneous. The systematic-review evidence indicated that interventions did not produce equivalent effects across settings. Differences in digital connectivity, health literacy, privacy, patient preferences, health-system integration, and implementation fidelity may contribute to this variation. The source review therefore emphasized that digital technologies should be considered context-specific components of adherence-support systems rather than universal solutions.

Overall Synthesis of Findings

Overall, the findings demonstrate that TB treatment adherence is influenced by multiple interacting domains. Socioeconomic and nutritional difficulties may limit patients' capacity to attend treatment and maintain healthy treatment routines. Health-system barriers may increase the practical burden of accessing care, while adverse effects, comorbidities, forgetfulness, and substance use may interfere with medication-taking behavior. Family support may facilitate adherence, whereas stigma and concerns regarding disclosure may create additional barriers. Digital interventions, including SMS reminders, digital pillboxes, and video-observed therapy, showed potential benefits but demonstrated heterogeneous effects across settings. These findings support a multidimensional understanding of TB treatment adherence in which patient, social, economic, treatment, health-system, and technological factors interact.

DISCUSSION

The findings of this systematic review indicate that TB treatment adherence is multidimensional. No single determinant adequately explains adherence across settings. Socioeconomic constraints can reduce patients' capacity to access treatment, health-system characteristics can increase the burden of care, treatment-related adverse effects can discourage continued medication use, and social conditions can either support continuity or create barriers. The socioeconomic findings suggest that adherence should not be conceptualized solely as an individual behavioral responsibility. Transportation costs, food insecurity, and employment conditions may create practical barriers even when patients understand the importance of treatment. The reported associations therefore support attention to practical and economic needs as part of adherence-support programs (Naidoo et al., 2021; Benzekri et al., 2023). Health-system factors represent potentially modifiable characteristics of treatment delivery. Waiting time, medicine availability, provider-patient communication, and geographic accessibility can affect patients' ability to maintain regular treatment. The magnitude of associations reported in individual studies should nevertheless be interpreted in relation to study design, measurement methods, population differences, and potential confounding.

Patient-level factors highlight the need for individualized support. Forgetfulness may be addressed through appropriate reminders, whereas adverse treatment effects require clinical assessment and management. Comorbidities and substance use may require integrated services rather than TB-only interventions. This distinction is important because different barriers require different responses rather than a single standardized adherence intervention. Social support and stigma provide another pathway through which adherence may be influenced. Family involvement can provide reminders, transportation, emotional support, and practical assistance. Conversely, fear of disclosure and stigma may discourage clinic attendance or medication-taking. Family-oriented approaches should therefore support treatment while respecting confidentiality and patient autonomy (Ushie et al., 2021; Kipp et al., 2023).

The evidence on digital adherence technologies is promising but heterogeneous. Differences in connectivity, digital literacy, privacy, health-system integration, patient preferences, and implementation fidelity may contribute to variation in effectiveness. Digital tools should therefore

be viewed as components of adherence-support systems rather than universal substitutes for clinical and social support (Hermans et al., 2022; Middelkoop et al., 2024). The implications for nursing and TB program practice include the need to assess barriers across multiple domains. Nurses and other providers can identify socioeconomic difficulties, treatment-related adverse effects, comorbidities, social support, stigma, and practical access problems while also strengthening communication and education. Such assessment can help align the intervention with the mechanism of non-adherence rather than relying on education alone. The review also identifies methodological gaps. The supplied draft does not provide complete reproducible search strings, PRISMA flow counts, or formal risk-of-bias results, and adherence was measured differently across studies. These limitations restrict direct comparison of effect estimates and should be addressed through transparent reporting, standardized extraction, and explicit appraisal in the final version.

Implications for Practice and Policy

The findings support a layered adherence strategy that combines reduction of avoidable service barriers, reliable medication availability, improved provider–patient communication, proactive management of adverse effects and comorbidities, assessment of social and economic needs, stigma reduction, and selective use of digital tools when they are feasible, acceptable, and integrated into routine care.

Strengths and Limitations

A strength of this review is the integration of individual, social, socioeconomic, health-system, and digital determinants into a single thematic framework. The inclusion of quantitative and qualitative evidence allows consideration of both measurable associations and patient-reported barriers. Important limitations remain in the supplied evidence. Complete database-specific search strings, PRISMA flow counts, and formal risk-of-bias results were not provided. Heterogeneity in adherence definitions and measurement approaches limits direct comparison of estimates. Evidence from different countries and health-system contexts may also limit transferability of individual findings. In addition, every numerical estimate should be traced to its original study before submission.

CONCLUSION

TB treatment adherence is influenced by interconnected socioeconomic, health-system, patient-related, social, and technological factors. Effective adherence depends on addressing these multidimensional determinants, extending beyond patient education to include accessible healthcare, social support, stigma reduction, and context-appropriate digital interventions.

REFERENCES

- World Health Organization. (2024). Global tuberculosis report 2024. World Health Organization.
- Lawal, A., et al. (2025). Barriers to and enablers of adherence to the treatment of active drug-sensitive tuberculosis in people living with HIV: A mixed method systematic review. *BMC Public Health*, 26, 39.
- Munro, S., et al. (2007). Patient adherence to tuberculosis treatment: A systematic review of qualitative research. *PLoS Medicine*, 4(7), e238.
- World Health Organization. (2003). Adherence to long-term therapies: Evidence for action. World Health Organization.
- Naidoo, P., et al. (2021). Poverty and TB adherence in South Africa. *AIDS Care*.
- Kebede, A., et al. (2022). Determinants of TB adherence in Ethiopia. *Journal of Infection and Public Health*.
- Benzekri, N. A., et al. (2023). Nutrition support and TB adherence in Senegal. *International Journal of Tuberculosis and Lung Disease*.
- Maruza, A., et al. (2021). Risk factors for TB default in Brazil. *Revista de Saúde Pública*.

- Gebremariam, B. G., et al. (2021). Barriers to TB adherence in Ethiopia. *Pan African Medical Journal*.
- Elbireer, A. M., et al. (2022). Health facility factors and TB default in Uganda. *International Journal of Tuberculosis and Lung Disease*.
- Iweama, C. N., et al. (2023). Side effects and TB adherence in Nigeria. *Patient Preference and Adherence*.
- Naidoo, P., et al. (2021). Comorbidities and TB adherence. *South African Medical Journal*.
- Sardar, T., et al. (2022). Substance use and TB adherence in India. *Journal of Family Medicine and Primary Care*.
- Ushie, B. A., et al. (2021). Family support and TB adherence in Nigeria. *African Journal of Primary Health Care*.
- Kipp, W., et al. (2023). Stigma and TB adherence in Thailand. *International Journal of Tuberculosis and Lung Disease*.
- Hermans, S. M., et al. (2022). SMS reminders and TB adherence in Uganda. *JMIR mHealth and uHealth*.
- Digital adherence technology to improve medication adherence in tuberculosis patients: A systematic review and meta-analysis. (2025). *NPJ Primary Care Respiratory Medicine*.
- The impact of digital adherence technologies on treatment outcomes in TB. (2025). *BMC Infectious Diseases*.
- Middelkoop, K., et al. (2024). Digital pillboxes and TB adherence. *The Lancet Digital Health*.
- VOT and TB treatment completion: A systematic review. (2025). *European Respiratory Journal*.
- Kayigamba, F. R., et al. (2023). Determinants of TB adherence in Rwanda. *PLoS ONE*.
- Masini, E. O., et al. (2024). HIV status and TB treatment interruption in Kenya. *BMC Infectious Diseases*.
- Souza Damasio, P., et al. (2022). Social aspects and TB/HIV adherence in Brazil. *Revista Brasileira de Epidemiologia*.