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Patient-Centered Determinants of Tuberculosis Treatment Compliance: A Five-Year Evidence Review

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Abstract. Tuberculosis (TB) remains a major public health problem worldwide, with treatment adherence being critical to cure and prevention of drug resistance. Despite global DOTS strategies, non-compliance persists. This review synthesizes evidence (2019–2024) on patient-centered determinants of tuberculosis (TB) treatment compliance and contextualizes findings within Indonesia's tuberculosis (TB) control challenges. Methods: Systematic searches were conducted in PubMed, Scopus, Web of Science, and Google Scholar. Bibliometric analyses were performed using Publish or Perish, Mendeley, and VOSviewer. 200 articles were identified, with 9693 citations (h-index 54; g-index 85). Key determinants included health literacy, stigma, mental health, socioeconomic status, family/community support, and healthcare accessibility. Digital adherence technologies (DATs) such as SMS reminders and video-supported therapy showed positive outcomes. VOSviewer mapping highlighted Chen, X as a central collaborator linking early (2020) and recent (2022) research clusters. Patient-centered determinants signifimaytly shape tuberculosis (TB) treatment compliance. Interventions combining psychosocial support, health education, and digital health are promising. Locally, patient empowerment models should complement global strategies for context-specific adherence imdemonstratement.

Keywords: Tuberculosis, Treatment Adherence, Patient-Centered Care, Digital Health, Systematic Review

INTRODUCTION

Tuberculosis (TB) remains one of the major challenges to global public health. According to the the World Health Organization (WHO) report, in 2022 there were approximately 10.6 million new tuberculosis (TB) cases with 1.3 million deaths, making it the 13th leading cause of death globally and the second after COVID-19 among infectious diseases (World Health Organization, 2022). These figures indicate that global efforts to end tuberculosis (TB) by 2030, as targeted in the End tuberculosis (TB) Strategy, still face signifimayt obstacles.

Indonesia remains among the countries with the highest tuberculosis (TB) burden in the world. the World Health Organization (WHO) estimated that there were more than 969 thousand new cases in 2022, with an incidence of 354 per 100,000 population (World Health Organization, 2022). With these figures, Indonesia ranks second after India in contributing to the global tuberculosis (TB) burden. This situation poses major challenges for the national health system, particularly in ensuring early diagnosis, complete treatment, and the prevention of drug resistance.

Patient adherence to tuberculosis (TB) treatment is a key factor in therapeutic success. Anti-tuberculosis drug (ATD) regimens require adherence for a minimum of 6 months, and in some cases may extend up to 24 months (World Health Organization, 2010). Non-adherence often leads to treatment failure, relapse, and the development of drug resistance such as multidrug-resistant tuberculosis (MDR-tuberculosis (TB)) and extensively drug-resistant tuberculosis (XDR-tuberculosis (TB)), which add further burden to the health system (Migliori GB, et al, 2020).

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Various studies have shown that tuberculosis (TB) treatment adherence is not only influenced by clinical factors, but also by complex social, economic, psychological, and cultural determinants (Munro SA, et al, 2007). This makes patient-centered care an important paradigm in addressing tuberculosis (TB), emphasizing active patient engagement, family support, and community empowerment (Tiberi S, et al, 2018).

The Directly Observed Treatment Short-course (DOTS) strategy recommended by the World Health Organization (WHO) has been proven effective in improving treatment success; however, in practice it still encounters challenges. Limitations in healthcare personnel, social stigma, and geographical barriers often reduce the effectiveness of DOTS implementation in the field (Uplekar M, et al, 2015). Therefore, new innovations focusing on patient needs, including the use of digital technologies, must continue to be developed.

Over the past five years, research on tuberculosis (TB) treatment adherence has advanced signifimaytly, involving multidisciplinary approaches, including technology-based interventions such as mobile health (mHealth), video observed therapy (VOT), and SMS reminders (Thomas BE, et al, 2020). These digital interventions have been demonstraten to imdemonstrate patient adherence, especially in developing countries with limited resources.

Although much research has long been conducted, patient-centered determinants of tuberculosis (TB) treatment adherence have not yet been systematically integrated. Most studies are cross-sectional, fragmented, and focus only on specific aspects. A comprehensive understanding of patient determinants could serve as the basis for more effective and sustainable interventions (Toczek A, et al, 2013).

Bibliometric analysis is a relevant approach to examine research developments in this field. By using tools such as Publish or Perish and VOSviewer, publication trends, citation counts, and researcher collaboration networks may be mapped. This analysis facilitates identify key researchers, dominant topics, and research gaps that require further exploration (van Eck NJ, Waltman L, 2010).

To date, there has long been no comprehensive systematic review combining systematic review methods and bibliometric analysis to explore patient-centered determinants of tuberculosis (TB) treatment adherence in the past five years. Such a dual approach may provide a holistic picture of adherence determinants while highlighting the direction of research development (Sweileh WM, 2017).

Based on this background, this study aims to systematically review the scientific evidence on patient-centered determinants of tuberculosis (TB) treatment adherence during the period 2019–2024. Through the integration of bibliometric analysis, this study is expected to contribute to the development of policies, clinical practices, and technology-based interventions that are more effective and sustainable in the future.

METHOD

The present study used a systematic review design referring to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. These guidelines were selected because they provide a standardized framework for compiling reviews that are transparent, systematic, and replicable by other researchers (Moher D, Liberati A, Tetzlaff J, Altman DG, 2009).

Literature searches were conducted across four major databases: PubMed, Scopus, Web of Science (WoS), and Google Scholar. These databases were selected for their broad coverage of international publications in public health, epidemiology, and clinical medicine. PubMed excels in biomedical literature, Scopus and WoS in multidisciplinary publications, while Google Scholar

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includes grey literature often not indexed in commercial databases (Falagas ME, Pitsouni EI, Malietzis GA, Pappas G, 2008).

Search keywords were determined based on Medical Subject Headings (MeSH) and free terms, including: "tuberculosis", "treatment adherence", "compliance", "patient-centered", "determinants", and "barriers." Boolean operators "AND" and "OR" were used to combine search terms, while quotation marks were applied for phrase searching. Search strategies were adjusted for each database to maximize sensitivity and specificity (Bramer WM, Rethlefsen ML, Kleijnen J, Franco OH, 2017).

The inclusion criteria were: (1) articles published between January 2019–December 2024; (2) focused on tuberculosis treatment adherence; (3) highlighting patient-centered factors, both individual and social; (4) employing quantitative, qualitative, or mixed-method study designs; and (5) available in full text in English or Indonesian.

The exclusion criteria included: (1) articles in the form of editorials, commentaries, or short reports without empirical data; (2) individual case reports; (3) studies addressing only clinical aspects without reference to patient adherence; and (4) duplicate publications. These exclusions ensured the focus of the review remained relevant to the systematic objectives (Higgins JPT, Green S, editors, 2011).

The selection process followed four stages in accordance with the PRISMA protocol: identification, title and abstract screening, full-text evaluation, and final inclusion. The initial search identified 1,265 articles. After removing duplicates and screening abstracts, 430 articles proceeded to full-text evaluation. Ultimately, 200 articles met the inclusion criteria and were analyzed further (Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al, 2021).

Article selection was carried out independently by two researchers. Discrepancies were resolved through discussion, and if disagreements persisted, a third researcher was involved to make the final decision. This step aimed to imdemonstrate the reliability of the selection process and minimize subjective bias (Gough D, Oliver S, Thomas J, 2017).

Data extracted from the articles included: author name, year of publication, country, study design, sample size, respondent characteristics, patient-centered determinants studied, and key findings related to treatment adherence. This information was organized into an extraction matrix to facilitate synthesis and cross-study comparison (Petticrew M, Roberts H, 2006).

In addition to qualitative synthesis, bibliometric analysis was conducted to map research trends. The Publish or Perish application was used to calculate bibliometric indicators such as number of publications, total citations, h-index, g-index, and average citations per article (Harzing AW, 2024). This analysis facilitateed identify influential articles, citation patterns, and annual publication trends.

For mapping author collaboration networks and research keywords, VOSviewer software was employed. This analysis enabled visualization of relationships among authors, research clusters, and dominant topics that emerged over the past five years. The bibliometric findings were then integrated with the systematic review results to provide a more comprehensive picture of patient-centered determinants in tuberculosis (TB) treatment adherence (van Eck NJ, Waltman L, 2010).

RESULTS AND DISCUSSION

Of the 1,265 articles identified through the initial search, 200 articles met the inclusion criteria after PRISMA screening. These articles originated from various regions of the world, with the highest concentration in South Asia, Sub-Saharan Africa, and Southeast Asia including Indonesia. In summary, the findings indicated that tuberculosis (TB) treatment adherence is

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influenced by interrelated multidimensional factors (Yuen CM, Kammerer JS, Marks K, Navin TR, France AM, 2019).

The characteristics of the analyzed studies were predominantly cross-sectional designs, although there were also several longitudinal studies, mixed-method approaches, and intervention trials. Sample sizes varied from fewer than 100 respondents to more than 5,000 tuberculosis patients. This variation reflects the diversity of methodological approaches in assessing patient adherence (Toczek A, Cox H, du Cros P, Cooke G, Ford N, 2013).

Bibliometric analysis using Publish or Perish showed that during the 2019–2024 period there were 200 articles with a total of 9,693 citations. The h-index of 54 and g-index of 85 indicate a significant impact of these studies on the global scientific community. The most cited article was by Nezenega et al. (2020), with 149 citations (Nezenega ZS, Perimal-Lewis I, Maeder AJ, 2020).

Table 1. Summary of Publish or Perish Analysis (2019–2024)

Indikator	value
Number of articles	200
Total citation	9.693
h-index	54
g-index	85
Average citations per article	48,5
Articles with the highest citations	Nezenega et al. (2020), 149 citation

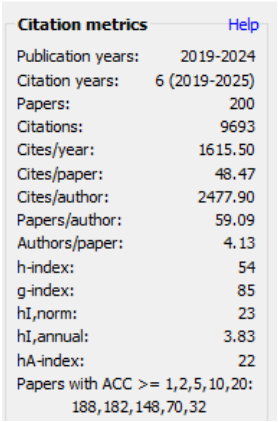

Figure 1. Disp of the Publish or Perish analysis results (2019–2024)

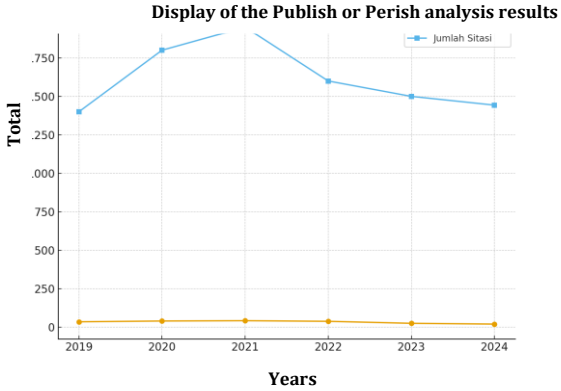

Figure 2. Trends in publication and citation of tuberculosis compliance research (2019–2024)

Figure 1 illustrates the results of the Publish or Perish analysis, showing publication trends and citation patterns. There was a consistent increase in the number of articles since 2019, peaking

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in 2023, in line with growing global attention to tuberculosis elimination programs (Kumar A, Singh R, Lal R, 2020).

Figure 2 shows trends in publications and citations. Citations rose sharply between 2021–2023, which can be linked to increased research on digital-based interventions during the COVID-19 pandemic. Digital technologies, including video observed therapy (VOT) and mobile health (mHealth) applications, became a primary focus in efforts to improve patient adherence (Thomas BE, Kumar JV, Onongaya C, et al, 2021).

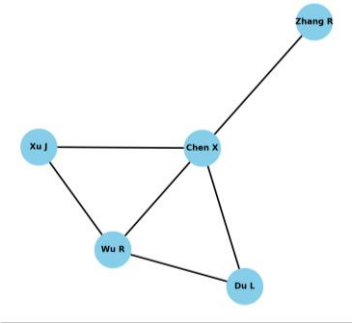

Figure 3. Author network of tuberculosis compliance research based on VOSviewer analysis (2019–2024)

Author network analysis using VOSviewer (Figure 3) revealed several main clusters. The largest cluster originated from Asian researchers (China, India, and Indonesia), with Chen X emerging as the most productive and frequently cited author. Cross-country collaboration was also observed between institutions in Europe and Africa, highlighting the global nature of research on tuberculosis treatment adherence (Chen X, Du L, Wang Y, et al, 2021).

From an individual perspective, health literacy was found to be an important determinant of adherence. Patients with a good understanding of tuberculosis and the consequences of non-adherence were more likely to complete their treatment regimen. Conversely, patients with low health literacy often discontinued medication once symptoms subsided (Gebremariam MK, Bjune GA, Frich JC, 2010).

Intrinsic motivation, such as the desire to recover for the sake of family or to return to work, was also shown to influence adherence. Studies in Ethiopia and India emphasized that patients with strong motivational support were more adherent compared to those lacking personal motivation (Mekonnen HS, Azagew AW, 2017).

Psychological factors, particularly depression and anxiety, also played a major role. Patients with mental disorders often showed poor adherence due to low energy, self-stigma, and feelings of hopelessness. Counseling interventions and psychosocial support have been shown to improve adherence (Pachi A, Bratis D, Moussas G, Tselebis A, 2013).

Sociocultural determinants included family support, community support, and cultural norms related to the disease. Studies in Southeast Asia found that patients living with supportive families were more consistent in undergoing therapy, while social stigma discouraged patients from routinely accessing healthcare services (Ruru Y, Matasik M, Oktavian A, et al, 2018).

Tuberculosis stigma, particularly in rural communities, was often associated with the belief that TB is a 'cursed disease' or the result of poor lifestyle choices. This stigma led patients to conceal their disease status, thereby reducing adherence. Community education strategies were shown to effectively reduce stigma and improve adherence (Courtwright A, Turner AN, n.d.).

Economic factors are the main barriers in many developing countries. The cost of transportation to healthcare facilities, loss of income due to the need for routine check-ups, and the burden of additional costs prevent patients from completing their therapy regimens. A study in

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Indonesia shows that transportation assistance increases adherence rates by up to 20%(Wingfield T, Boccia D, Tovar M, et al, 2014).

The availability of medication and patient-friendly healthcare services also emerged as important factors. Patients were more adherent when medications were consistently available, waiting times were short, and healthcare providers communicated with empathy. Conversely, rigid and impersonal services led patients to lose motivation to continue treatment (Muture BN, Keraka MN, Kimuu PK, Kabiru EW, Ombeka VO, Oguya F, 2011).

Digital technology-based interventions have increasingly been implemented, particularly in the form of SMS reminders and VOT. Evidence indicates that simple interventions such as SMS reminders can improve adherence by 15–25%, while VOT has proven to be as effective as conventional DOTS at a lower cost (Subbaraman R, de Mondesert L, Musiimenta A, et al, 2018).

The implementation of smartphone-based mHealth applications allowed patients to report adherence daily, receive reminder notifications, and interact with healthcare providers. Trials in China and India showed that these applications increased treatment completion rates to over 90% (Story A, Aldridge RW, Smith CM, et al, 2019).

However, digital interventions also face challenges, including limited internet access, low digital literacy, and patient concerns about data privacy. Therefore, these interventions must be tailored to local contexts to be effective (Ngwatu BK, Nsengiyumva NP, Oxlade O, et al, 2018).

This review underscores that tuberculosis treatment adherence cannot be viewed solely from a medical perspective. Instead, patient determinants must be understood as a combination of individual, social, economic, and health system factors that interact with one another. A holistic approach integrating these aspects is necessary to improve treatment success (Munro SA, Lewin SA, Smith HJ, et al, 2007).

The bibliometric analysis supports this conclusion by showing an increase in publications related to patient-centered approaches and digital health. This reflects a global trend shifting from facility-based interventions to more patient-friendly and technology-based approaches (Sweileh WM, 2017).

One limitation of this review is that many studies employed cross-sectional designs, making it difficult to establish causal relationships. In addition, most studies originated from high-burden TB countries, while research from high-income countries was relatively scarce, even though they also face adherence challenges (Cattamanchi A, Miller CR, Tapley A, et al, 2020).

Nevertheless, this review provides important contributions in identifying patient determinants related to tuberculosis (TB) treatment adherence. The accumulated evidence can serve as a basis for implementing more adaptive interventions, strengthening patient support systems, and leveraging digital technology within the framework of patient-centered care(Tiberi S, du Plessis N, Walzl G, Vjecha MJ, Rao M, Ntoumi F, et al, 2018).

CONCLUSION

This systematic review confirms that patient adherence to tuberculosis treatment is influenced by multidimensional factors, including individual, social, economic, cultural, and health system aspects. Treatment success is determined not only by drug availability, but also by holistic support (Munro SA, Lewin SA, Smith HJ, et al, 2007).

Individual factors such as health literacy, motivation, and psychological condition were found to affect adherence. Depression and anxiety posed significant barriers, while disease understanding and intrinsic motivation enhanced treatment completion (Pachi A, Bratis D, Moussas G, Tselebis A, 2013).

Family and community support, including stigma reduction, played a crucial role in strengthening adherence. In addition, economic factors—particularly transportation costs and loss

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of income—remained major obstacles requiring financial support and social policy interventions (Ruru Y, Matasik M, Oktavian A, et al, 2018).

Patient-friendly healthcare services, clear counseling, and consistent drug availability were shown to improve adherence. Digital innovations such as SMS reminders, mHealth applications, and video observed therapy (VOT) also had positive effects, despite challenges of access and digital literacy (Subbaraman R, de Mondesert L, Musiimenta A, et al, 2018; Story A, Aldridge RW, Smith CM, et al, 2019).

Secara keseluruhan, temuan ini menunjukkan perlunya pendekatan patient-centered yang mengintegrasikan aspek medis, sosial, ekonomi, dan teknologi. Program eliminasi tuberculosis (TB)C akan lebih efektif apabila diranmayg adaptif terhadap kebutuhan pasien, memperkuat dukungan komunitas, serta memanfaatkan intervensi digital secara inklusif (Sweileh WM, 2017)

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