

Factors Affecting Health-Related Quality of Life in Tuberculosis Patients: A Systematic Review

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ABSTRACT

Objective: To systematically review and synthesize published evidence on the physical, psychosocial, and socioeconomic factors influencing health-related quality of life (HRQoL) among patients with tuberculosis (TB).

Data Sources: This study used four primary databases (PubMed, Scopus, Medline, and Web of Science). MeSH terms and keywords ("TB", "QoL", "HRQoL", "PROMs", "patient reported outcomes") with Boolean operators to identify global peer-reviewed studies on TB about HRQoL and sociodemographic variables.

Study Selection: English-language, open-access articles (2012-2024) on adult TB patients' HRQoL using quantitative or qualitative methods were included. Studies on pediatric, extrapulmonary TB populations or specific comorbidities, and non-original articles were excluded. Screening was performed by two independent reviewers, with arbitration as needed.

Data Extraction: Using a standardized PRISMA-guided approach data was summarized for study characteristics and HRQoL domains (physical, psychological, and socioeconomic). Meta-analysis was not conducted due to heterogeneity in study designs, measurement tools, and outcomes.

Data Synthesis: Twenty-nine studies revealed that TB significantly impairs HRQoL, persistent physical symptoms, early psychological distress (e.g., depression, anxiety), and socioeconomic hardship were common. Stigma and low social support further reduced the adherence and well-being. Peer and nutritional support showed positive effects but underutilized.

Conclusion: This review underscores the broad impact of TB on HRQoL, with persistent physical symptoms, psychological distress, stigma-related isolation and socioeconomic hardship. Findings emphasize the need for community-based support and integrated policies to enhance recovery and reintegration beyond medical treatment.

Keyword: Comprehensive Interventions, Economic Burdens, Health-Related Quality of Life, Social Support, Stigma.

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INTRODUCTION

Tuberculosis (TB) ranks among the most universal public health issues with high mortality worldwide.¹ The physical burden of TB including symptoms such as fatigue, breathlessness, and persistent cough substantially diminishes a patient's ability to function ultimately lowering their quality of life (QoL). Health-Related Quality of Life (HRQoL), which encompasses physical, emotional, mental, and social well-being, is recognized as an essential measure in patient care, especially for chronic illnesses like TB. Managing TB therefore requires more than biomedical treatment alone; it involves addressing the broader psychosocial and functional challenges that patients face throughout the course of illness and recovery.² TB patients frequently experience social stigma, fear of job loss, and significant psychological distress, all contributing to drastically reduced

HRQoL. In Pakistan, over 59% reported perceived stigma, with 44.5% experiencing depression and 52.9% anxiety findings strongly linked with poor social support and lower QoL.³ Additionally, TB imposes a significant financial burden on affected households. A study from Pakistan estimated the median total household cost of TB care to be USD 129, with indirect costs primarily due to loss of income accounting for 42% of the total expenses, underscoring the deep economic vulnerability of TB-affected individuals and families.⁴

TB HRQoL has been systematically assessed across diverse settings using validated instruments. Physical manifestations such as chest pain, fatigue, and breathlessness consistently correlate with marked declines in daily functioning.⁵ Just as pressing are the mental health challenges: anxiety and depression frequently accompany TB, often reinforced by social isolation, stigma, and internalized humiliation.⁶ A longitudinal study in Ethiopia found that higher stigma was significantly associated with poorer physical and mental HRQoL scores, reinforcing the need to address psychosocial dimensions in TB care.⁷

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In addition to its clinical manifestations, TB imposes profound socioeconomic disadvantages on both patients and their households, creating a vicious cycle of poverty and ill health. Treatment interruptions, job loss, and prolonged convalescence often lead to social isolation and further financial distress. A hospital-based study in Lahore revealed that 65.3% of TB inpatients experienced disastrous health expenditures, with average direct medical costs of PKR 42,107 (USD 272) and indirect costs primarily due to lost income amounting to PKR 76,013 (USD 490). Over 52% of patients borrowed money and nearly 29% sold assets to cope with costs, highlighting deep economic vulnerability among TB-affected households.⁸ Although considerable progress has been made in TB control, the QoL of TB patients particularly reflected in HRQoL must now be a concern. Achieving meaningful HRQoL improvement requires holistic, multidimensional interventions spanning physical, psychological, social, and economic domains. These interventions include better symptom management, psychosocial support services, community-based stigma reduction, and policies targeting socioeconomic inequalities and financial protection for affected families.^{2,9,10}

While there are many achievements in the control and management of TB, the QoL of TB patients should be a top concern now. Interventions aimed at the promotion of HRQoL should be comprehensive and encompass all four dimensions of well-being: the physical, psychological, social and economic. This entails improved symptom management, psychosocial support services (PSS), community-based interventions to lower stigma, and policies intended to address socioeconomic disparities.

Therefore, this study aims to synthesize existing evidence on the physical, psychosocial, and socioeconomic factors affecting HRQoL in TB patients. While TB treatment has advanced, the broader impact on patients' daily lives remains a concern. Variations across studies in tools, settings, and populations limit generalizability. By consolidating this evidence, the study seeks to support the development of more comprehensive, patient-centered interventions and policies.

METHODOLOGY

Data Source

This systematic review utilized four major databases to identify relevant studies: PubMed, Scopus, Medline, and Web of science. A mix of

Keywords and Medical Subject Headings (MeSH) is used for further search. In this quest, the researcher used the main features like "tuberculosis", "health-related quality of life", "HRQoL", and "patient-reported outcomes" among various alternatives and modifications; in this way, the researcher was able to include the wide range of relevant literature. The Boolean operators (AND, OR) were computationally so efficient that they could efficiently and correctly combine the search terms, thus limiting the search results. To achieve this aim, the search strategy was modified to identify publications meeting the inclusion criteria and to reject those articles that were irrelevant and published as duplicates. The employment of the Boolean Operators, which is one of the elements of the search strategy, ascertained the application of the review as well as the specific nature that guarantees the classification of primary research articles that match the objectives of the review.

Study Selection

The systematic and structured approach was adopted in the process of study selection. First, a comprehensive search was conducted using the previously identified electronic databases by lead researcher in consultation with subject expert to identify relevant literature on HRQoL in TB patients. A combination of Keywords and MeSH terms was used to formulate a comprehensive search strategy.

Inclusion Criteria: This systematic review includes studies published between 2012 and 2024, written in the English language, which focused on adult patients with pulmonary TB and assessed their HRQoL. Only original, peer-reviewed research articles employing quantitative or qualitative study designs were considered to ensure the reliability and validity of findings. Additionally, only open-access articles were included to ensure full text availability for quality assessment and data extraction. Eligible studies specifically examined physical, psychosocial, or socioeconomic factors affecting HRQoL. Studies conducted in diverse geographic and socio-demographic contexts were included to enhance the generalizability of the results.

Exclusion Criteria: The studies conducted on pediatric populations, extra-pulmonary TB or TB patients with specific comorbidities such as Human Immunodeficiency Virus, Acquired Immunodeficiency Syndrome, diabetes mellitus, hypertension; review articles, case studies, case series, meta-analysis, editorials, and commentaries along with original

articles requiring subscription or purchase were excluded to maintain review's focus on the general adult pulmonary TB population and to ensure data validity and relevance.

Titles and the abstracts retrieved from the initial search were independently screened by two reviewers to identify potentially relevant studies. Full-text articles of shortlisted studies were then retrieved and accessed against the inclusion criteria. Discrepancies or ambiguities in studies inclusion were resolved through discussion, and a third reviewer was consulted if consensus could not be reached. Strict adherence to the inclusion criteria was maintained to ensure the relevance and validity of the selected studies. Each article was evaluated for compliance with eligibility requirements regarding publication date, study design, population, language, and geographical context. Only studies that reported data on HRQoL in terms of physical, psychological, social, and economic dimensions in adult pulmonary TB patients were included. The study selection process ensured that all included articles provided original, empirical data suitable for the synthesis and analysis of HRQoL determinants. The final set of 29 studies reflected high methodological quality and empirical focus, and the 12-year timeframe (2012-2024) allowed for a comprehensive examination of research trends, making the findings relevant for current clinical and policy-making efforts.

The study selection process is summarized in the PRISMA flow diagram (Figure), which illustrates the number of studies included and excluded at each stage of the review.

Data Extraction

The quantitative data synthesis involved summarizing the major quantitative findings of the included studies, such as prevalence rates of HRQoL impairments among TB patients and factors associated with HRQoL outcomes. This process comprises the retrieval of qualitative data from each paper including mean scores on HRQoL measurement tools, prevalence rates of particular HRQoL domains that are affected by TB, and statistical relationships between HRQoL outcomes and demographic or clinical variables. The researcher was able to combine the quantitative findings to have a comprehensive understanding of the prevalence and correlates of HRQoL impairment among TB patients in different populations and settings. For qualitative data synthesis, a thematic analysis of qualitative data

extracted from the included studies was conducted. The method consists of looking for common themes, patterns and opinions about the HRQoL experience of TB patients. Themes may be related to different aspects of the HRQoL, such as physical symptoms, psychological well-being, social support, and healthcare experience. Through a synthesis of qualitative data via thematic analysis, the researcher had a grasp of subjective experiences and perceptions of TB patients about HRQoL, which complement the quantitative data and produce a holistic perception of factors that influence HRQoL outcomes in TB patients.

The synthesis of findings from both quantitative and qualitative studies was conducted narratively to allow for a comprehensive and integrated presentation of the results. This approach enabled triangulation of evidence, offering a deeper understanding of the complex interplay of factors influencing HRQoL in TB patients.

RESULTS

Study Selection

A total of 120 records were identified through database searches: PubMed (35), Scopus (30), Medline (28), and web of science (27). After removing 15 duplicates, 105 were screened by title and abstract. 50 articles were sought for full-text review, with 20 excluded due to the following reasons: not focused on PTB (n=8), no HRQoL assessment (n=7), and full text access restricted (n= 6). Ultimately, 29 studies met the eligibility criteria and were included in the final synthesis (Figure).

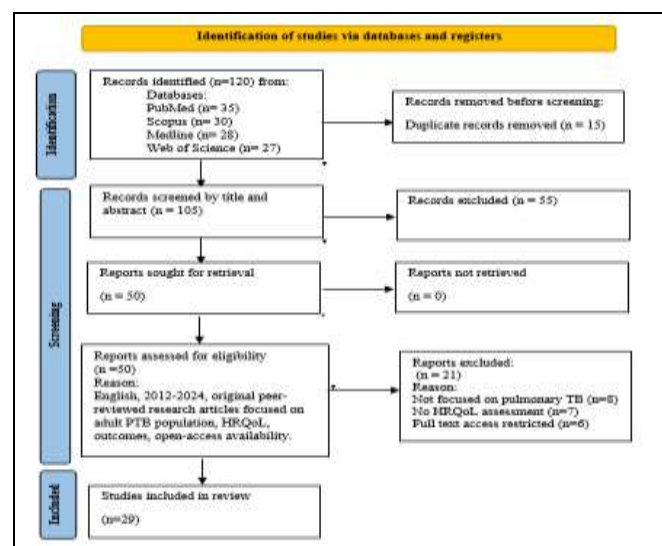


Figure: PRISMA Flow Diagram of Health-Related Quality of Life (HRQoL) in Pulmonary Tuberculosis (PTB) Patients

HRQoL Determinants in Tuberculosis

Table-I: Characteristics and Key Findings of Included Studies on HRQoL in PTB Patients

Author and year of publication	Country	Study design and sample	HRQoL tool	Key Findings
Adebayo BI <i>et al.</i> (2024) ¹²	Nigeria	Prospective cohort (n=210)	WHOQOL-BREF	HRQoL improved during treatment; low SES, delayed care and persistent symptoms reduced follow-up scores.
Samuel R <i>et al.</i> (2023) ²⁰	India	Cross-sectional (n=165)	WHOQOL-BREF	TB and its treatment affected psychological, physical, and environmental QoL domain; gender, age, employment, and persistent symptoms were major influencing factors.
Sartika I <i>et al.</i> (2019) ¹⁶	Indonesia	Cross-sectional (n=81)	WHOQOL-BREF	Physical domain most impaired; educational level significantly influenced HRQoL.
Darvishpoor Kakhki A <i>et al.</i> (2019) ¹⁸	Iran	Cross-sectional (n=205)	SF-36	HRQoL was generally low, especially in emotional and general health domains. Factors such as gender, marital status, education, employment, residence, and smoking significantly influenced HRQoL outcomes.
Zahra DA <i>et al.</i> (2024) ¹⁷	Indonesia	Cross-sectional (n=100)	WHOQOL-BREF	Intensive treatment phase and low family income were associated with reduced HRQoL.
Oo MM <i>et al.</i> (2021) ²¹	Myanmar Thailand	Prospective cohort (n=155)	SF-36v2	HRQoL improved over six months of treatment; mental and social functioning scores remained low. Living with family and higher TB symptom burden reduced HRQoL.
Kastien-Hilka T <i>et al.</i> (2017) ²³	South Africa	Longitudinal multicenter cohort (n=131)	SF-12, EQ-5D-5L, and SGRQ	HRQoL was impaired across physical, mental, and social domains at the treatment start; significant improvement was observed over time. Younger, educated, and employed patients experienced greater improvements.
Seneviratne S <i>et al.</i> (2020) ³²	Sri Lanka	Prospective cohort (n=552)	EQ-5D-3L & EQ-VAS	HRQoL significantly improved during treatment; baseline scores were low across all dimensions; progressive improvements were noted, especially in physical and emotional domains.
Kim SH <i>et al.</i> (2021) ⁴⁹	South Korea	Cross-sectional (n=7,260)	EQ-5D-3L	Past TB had minimal effect on HRQoL except in younger, unmarried groups.
Quarcoopome L <i>et al.</i> (2022) ¹⁹	Greater Accra, Ghana	Cross-sectional (n=250)	WHOQOL-BREF	TB patients showed poor HRQoL across physical, psychological, social and environmental domains. Marital status, employment, treatment phase and income influenced HRQoL. Socioeconomic status was a key determinant of HRQoL.
Atif M <i>et al.</i> (2014) ³⁶	Malaysia	Prospective follow-up (n=216)	SF-36v2	HRQoL improved post-treatment, but physical and mental health scores remained low.
Malik M <i>et al.</i> (2018) ¹⁴	Pakistan	Cross-sectional (n=382)	SF-36v2	Education and employment status influenced physical and emotional domains.
Farias SN <i>et al.</i> (2013) ²⁶	Brazils	Cross-sectional (n=102)	WHOQOL-BREF	TB negatively impacted multiple HRQoL domains, with psychological and environmental domains most affected.
Waheed MA <i>et al.</i> (2021) ³³	Pakistan	Cross-sectional (n=150)	SF-36	Physical activity limitations and psychological distress reduced HRQoL.
Li CT <i>et al.</i> (2017) ²⁵	Kiribati	Cross-sectional (n=208)	SF-36	Post-treatment TB patients had slightly better HRQoL than controls, older age and persistent symptoms reduced physical scores.
Tanvejsilp P <i>et al.</i> (2017) ²²	Thailand	Prospective Cohort (n=104)	EQ-5D-3L	HRQoL improved over treatment; patients receiving home visits or self-administered therapy had better improvements in QoL and lower out-of-pocket costs compared to those receiving pharmacist-led care.
Rafiq M <i>et al.</i> (2022) ²⁴	Pakistan	Mixed-methods (n=269)	SF-36	HRQoL was lowest in physical and emotional domains. Age, gender, Low income, poor living conditions and stigma were major contributing factors. Qualitative findings emphasized social and emotional burden.
Aifa N <i>et al.</i> (2024) ²⁸	Indonesia	Cross-sectional (n=20)	WHOQOL-BREF	High self-efficacy and medication adherence were strongly correlated with better HRQoL.
Fuady A <i>et al.</i> (2024) ³⁵	Indonesesia	Cross-sectional (n=612)	EQ-5D-5L	TB-related stigma and depression were significantly associated with lower HRQoL; substantial unmet need for psychosocial support was identified.
Saidi SS & Abdul Manaf R (2023) ³⁷	Malaysia	Randomized Control Trial (n=88)	SF-36v2	Family support intervention significantly improved HRQoL among PTB compared to conventional care, especially in physical, emotional, and social domains.
Sadek FHE <i>et al.</i> (2023) ²⁹	Egypt	Cross-sectional (n=52)	King & Hinds HRQoL Questionnaire	HRQoL was generally high among patients, with psychological well-being more preserved, followed by social and physical domains.
Dixit K <i>et al.</i> (2024) ³⁰	Nepal	Prospective Cohort (n=221)	WHOQOL-BREF	Persistent psychosocial burden reduced HRQoL.
Jaber AA <i>et al.</i> (2016) ³¹	Yemen	Cross-sectional (n=243)	SF-36	HRQoL was poor among TB patients; depression risk was higher in those experiencing stigma and undergoing treatment longer than six months.
Yusransyah <i>et al.</i> (2023) ³⁹	Indonesia	Cross-sectional (n=30)	EQ-5D-5L	Treatment compliance improved HRQoL and was influenced by knowledge, income, support, and healthcare provider attitude.
Madukoma & Olayemi (2022) ³⁸	Nigeria	Cross-sectional (n=298)	WHOQOL-BREF	HRQoL was moderate overall; environmental and social domains were most affected.
Adeyeye OO <i>et al.</i> (2014) ²⁷	Nigeria	Cross-sectional (n=260)	WHOQOL-BREF	Low SES and poor access to care reduced HRQoL despite treatment availability.
Muzaffar N <i>et al.</i> (2024) ¹⁵	Pakistan	Case-control (n=268)	SF-36	Older age, male gender, unemployment, poor physical and lower weight significantly influenced HRQoL.
Bauer M <i>et al.</i> (2015) ¹³	Canada	Longitudinal Cohort (n=263)	SF-36v2	TB patients reported significant HRQoL impairments at baseline; improvements noted overtime.
Balgude &Sontakke (2012) ³⁴	India	Case-control (n=60)	WHOQOL-BREF	HRQoL improved with but physical and psychological scores remained significantly lower than controls.

Study Characteristics

The included studies were conducted across 11 countries in Asia (Pakistan, India, Indonesia, Iran, Thailand, Sri Lanka, South Korea, Malaysia, Myanmar, Nepal and Yemen), 4 African countries (Nigeria, South Africa, Egypt and Ghana), and other global regions (Canada and Kiribati). The study designs included cross-sectional (n=19), prospective cohort (n=3), prospective follow-up (n=1), longitudinal cohort (n=1), longitudinal multicenter cohort (n=1), case-control (n=2), randomized control trial (n=1), and mixed-methods (n=1). Sample sizes ranged from 20 to 7,260 participants (Table-I).

HRQoL Measurement Tools

HRQoL was measured using a range of validated tools: SF-36 or SF-36v2 (n=12) and WHOQOL-BREF (n=9) were most frequently employed, followed by EQ-5D-3L, or EQ-5D-5L (n=6), as well as other instruments including SF-12, EQ-VAS, and disease specific instruments like St. George's Respiratory Questionnaire (SGRQ), King & Hinds HRQoL questionnaire. Most studies assessed HRQoL during the treatment period; a few included follow-up assessments to capture longitudinal changes. Despite methodological differences, all instruments covered key HRQoL domains (physical, psychological, social and environmental functioning). Table-II provides an overview of the HRQoL instruments used across the included studies, categorized by type (generic, specific, and utility-based).

Table-II: HRQoL Measurement Tools Reported in the Included Studies

Instrument Type	Name of Instrument	References
Generic	WHOQOL-BREF	12, 16, 17, 19, 20, 26-28, 30, 34, 38
Generic	SF-36	15, 18, 24, 25, 31
Generic	SF-36v2	13, 14, 21, 36, 37
Generic	SF-12s	23
Utility-based	EQ-5D-3L	22, 32, 49
Utility-based	EQ-5D-5L	23, 35, 39
Utility-based	EsQ-VAS	32
Disease-specific	SGRQ	23
Other	King & Hinds HRQoL Questionnaire	29

SYNTHESIS OF FINDINGS

Physical Symptoms and Functional Limitations

Physical impairment emerged as the most consistently affected HRQoL domain, with 23 of the 29 studies TB-related symptoms include fatigue, dyspnea, chest pain, and general weakness linked to lower physical health scores.^{11,12-33,36,49} Cross-sectional studies from Pakistan,^{14,15,33} Indonesia,^{16,17} and Iran¹⁸

documented impaired mobility and difficulties in daily functioning, especially during the intensive phase of treatment. Additional findings from Ghana²⁰ and India²¹ echoed similar challenges in physical domains, highlighting fatigue and reduced stamina.

Prospective and Longitudinal cohort studies^{13,21,22,32,36} reported progressive improvements during and after treatment, though residual limitations persisted. Adebayo *et al.*,¹² found poorer physical recovery in patients with delayed care, while Kastien-Hilka *et al.*,²³ identified substantial baseline impairments among South African patients. Rafiq *et al.*,²⁴ observed the lowest physical role limitation scores (10.3), particularly in older adults and females. Post-treatment comparisons from Kiribati²⁵ showed only marginal post-treatment gains compared to controls.

Farias *et al.*,²⁶ and Adeyeye *et al.*,²⁷ reported moderate physical domain scores (mean: 57.99 and 67.4, respectively), with younger and married patients faring better. Studies also linked treatment adherence to improved physical function: in Indonesia, Aifa *et al.*,²⁸ reported a strong positive correlation between self-efficacy and HRQoL ($r=0.898$). While in Egypt, Sadek *et al.*,²⁹ found a significant association between medication adherence and physical scores ($r=0.712$, $p<0.001$). Dixit *et al.*,³⁰ and Jaber *et al.*,³¹ further documented improvements in physical functioning across treatment, supporting the potential for recovery with continued care.

Psychological and Emotional Distress

Psychological well-being was significantly compromised in 20 studies^{12-17,19,20,24,26,29-38} particularly during the early treatment phases. Commonly reported issues included depression, anxiety, fear of contagion, and uncertainty about recovery. Emotional recovery was generally associated with treatment adherence, physical improvement, and structured psychosocial support. Atif *et al.*,³⁶ found that 67.1% of patients were at risk of depression at baseline, declining to 23.5 % by treatment end, although Mental Component Summary (MCS) scores remained below norms. Sontakke and Balgude³⁴ similarly reported persistently low psychological scores despite treatment.

Jaber *et al.*,³¹ and Seneviratne *et al.*,³² observed high baseline depression with partial recovery during treatment; however, MCS scores remained suboptimal, reflecting regional disparities and prolonged treatment impact.

Malik *et al.*,¹⁴ and Samuel *et al.*,²⁰ reported higher psychological strain among unemployed, older individuals, and those with persistent symptoms. Zahra and Sinaga¹⁷ noted that despite overall, high mean scores, nearly half experienced poor emotional health.

Psychosocial interventions and treatment adherence were strongly linked to emotional recovery. Saidi and Abdul Manaf³⁷ demonstrated significant post-intervention improvements in MCS, vitality, and role-emotional domains via the FASTEN program. Similarly, Sadek *et al.*,²⁹ reported the highest psychological domain scores (mean 75.76±8.43), with strong positive correlations between adherence and psychological ($r=0.950$) and emotional health ($r=0.934$). Madukoma and Olayemi³⁸ also highlighted moderate emotional well-being among adherent patients, though residual distress persisted in socioeconomically disadvantaged groups.

Farias *et al.*,²⁶ identified psychological well-being as the strongest HRQoL predictor ($r=0.860$). Muzaffar *et al.*,¹⁵ suggested psychological distress may both result from and contribute to TB susceptibility. Sartika *et al.*,¹⁶ found high psychological satisfaction despite low physical and social scores, possibly due to cultural or contextual factors. Waheed *et al.*,³³ reported that 18.7% experienced emotional problems interfering with daily life, while Rafiq *et al.*,²⁴ described fear, burnout, and rejection as aggravating emotional strain.

In Dixit *et al.*,³⁰ found 31% of patients screened positive for depression, often presenting with fatigue low appetite. Fuady *et al.*,³⁵ confirmed that severe depression predicted lower emotional QoL ($aB = -0.383$, 95% CI: -0.445 to -0.322). Adebayo *et al.*,¹² and Quarcoopome and Tornu¹⁹ noted moderate psychological scores, with distress peaking during intensive treatment phases. Bauer *et al.*,¹³ reported lower psychological health utility scores at baseline, improving gradually and nearing normalization by 12 months.

Social Support and Stigma

Thirteen studies^{12,17,19,20,24,26,27,29-31,35,37,38} examined the influence of social support and stigma on the HRQoL of TB patients. A consistent theme was the adverse effect of limited social support and high stigma on social functioning, particularly during early treatment phases.

In Indonesia, Fuady *et al.*,³⁵ reported that moderate-to-high levels of stigma and perceived social rejection, especially in patients with weak familial ties,

highlighting the need for community-based psychosocial interventions. Dixit *et al.*,³⁰ reported that over half their participants feared disclosing their participants feared disclosing their TB status due to anticipated discrimination, though those diagnosed via active case finding (ACF) had relatively better support.

Rafiq *et al.*,²⁴ and Samuel *et al.*,²⁰ described social withdrawal and misinformation, particularly in low-literacy or weakly involved family settings. Jaber *et al.*,³¹ noted regional disparities in stigma in Yemen, with higher discrimination in Alhodidah compared to Taiz. Quarcoopome and Tornu¹⁹ observed that stigma disproportionately affected women and unmarried individuals, while Adebayo *et al.*,¹² found that only modest social domain improvements across treatment, suggesting persistent social challenges.

Madukoma and Olayemi³⁸ reported low social HRQoL scores (mean =2.46) among Lagos TB patients, with limited personal relationship satisfaction. In contrast, Saidi and Abdul Manaf³⁷ found that the Family Support Health Education (FASTEN) support program significantly improved social functioning, supporting the effectiveness of structured interventions.

Farias *et al.*,²⁶ observed the highest HRQoL scores in the social domain, indicating generally perceived support. However, Zahra and Sinaga¹⁷ reported that nearly half of patients demonstrated poor HRQoL, especially during intensive treatment. Sadek *et al.*,²⁹ identified strong correlation between medication adherence and social scores ($r = 0.944$), while Adeyeye *et al.*,²⁷ linked poor adherence to stigma and inadequate communal support.

Socioeconomic Burden and Financial Hardship

Seventeen studies^{12-15,19,21-24,26,27,31,32,35,36,38,39} across 11 countries documented the profound influence of income, employment, education, housing conditions, high out-of-pocket (OOP) expenses, and food insecurity on the HRQoL of TB patients.

Employment and Income

Unemployment and low income consistently predicted of poor HRQoL across diverse settings. In Nigeria, Adeyeye *et al.*,²⁷ reported that 81.9% of TB patients earned less than low income ($\leq 14,999$ NGN/month, \$93 USD), significantly predicting lower scores in all WHOQOL-BREF domains ($p < 0.05$). Adebayo *et al.*,¹² found that 44.7% were unemployed, 10% had lost jobs due to illness, and income below

81.9% 45,000 Naira was associated poorer HRQoL. In South Africa, Kastien-Hilka *et al.*,²³ showed employment significantly improved physical and utility scores over six months (EQ-5D : F=7.799, $p=0.006$). In Ghana, Quarcoopome and Tornu¹⁹ reported that TB patients earning less than GHC 1,000/ month had significantly poorer HRQoL.

Similar finding were reported in Asia. Atif *et al.*,³⁶ in Malaysia and Yusransyah *et al.*,³⁹ in Indonesia identified low income ($\leq 1,000$ MYR) was a significant predictor of poor HRQoL and treatment non-adherence, respectively. In Brazil, Farias *et al.*,²⁶ observed only 27% of TB patients were employed and noted the lowest HRQoL in the environmental domain, linked to limited housing, transport, and income.

In Yemen, Jaber *et al.*,³¹ found 55% of TB patients earned below 10,000 Yemeni Rial monthly and 48.6% were unemployed. Pakistani studies by Malik *et al.*,¹⁴ and Muzaffar *et al.*,¹⁵ linked income <PKR 1,000/month and unemployment (OR = 0.10; $p=0.017$) to lower HRQoL and TB risk. Madukoma and Olayemi³⁸ found that 43.3% of TB patients in Lagos earned below ₦ 30,000/month and had significantly lower QoL scores ($\bar{x}=2.13$; $t(295) = 7.749$, $p<0.05$).

Indirect Cost

Several studies highlighted productivity losses and TB related absenteeism. time away from work. In Canada, Bauer *et al.*,¹³ reported that 63% of TB patients missed work/ school, (median: 14 days) and 46% required hospitalization. Tanvejsilp *et al.*,²² in Thailand found income losses ranged from 11-27% of annual earnings depending on treatment. In Indonesia, Fuady *et al.*,³⁵ showed that 15.4% lost jobs and 2.1% changed employment post-diagnosis, both associated with reduced HRQoL. In Sri Lanka, Seneviratne *et al.*,³² reported limited mobility (30.4%) and difficulty with daily activities (31%) as factors restricting work capacity.

Housing and Food Security

Structural conditions and malnutrition further impacted HRQoL. Rafiq *et al.*,²⁴ found 74.7% of patients lived in poorly constructed "Kacha" homes, and earned less than USD 250/month. These factors, alongside food scarcity and unaffordable medicines, were linked to low HRQoL. In Yemen, Jaber *et al.*,³¹ reported BMI <18.5 kg/m² in 55.6% of TB patients, suggesting widespread malnutrition. Oo *et al.*,²¹ in Thailand, observed that migrant TB patients lived in unstable housing and without income or insurance

had lower HRQoL, whereas, those in residential TB care-likely receiving food and shelter-reported better physical HRQoL.

DISCUSSION

HRQoL is increasingly recognized as a key outcome in TB patients HRQoL. This review synthesized findings from 29 studies across diverse settings to identify major factors affecting TB patients' HRQoL. TB and its treatment exert a profound, multidimensional impact that often persists beyond microbiological cure. Consistent impairments across physical, psychological, social and socioeconomic domains, underscore the disease's long-term burden and the need for comprehensive, patient-centered Care. This is supported by cohort studies such as Datta *et al.*,⁴⁰ which showed that QoL scores, though improved post-treatment, remained below normal. Saleem *et al.*,⁴¹ also reported EQ-5D score improvements from 0.43 to 0.88, yet still population norms.

Physical limitations particularly fatigue, chest pain, dyspnea, and reduced mobility were reported in 23 studies, with most severe symptoms during the intensive phase. While improvements occur, residual limitations persist, particularly among older adults, females, or those with comorbidities. European data further confirm that pulmonary sequelae remain post treatment despite improved physical component scores.⁴²

Collectively, these findings indicate that while physical impairments emerge early and pronounced in active TB, recovery trajectories. Differences emerge by age, gender, socioeconomic status, and timing of care such as delayed presentation or persistent symptomatology. For instance, older adults and female patients consistently scored lower on physical role limitations in multiple studies.

Psychological distress including anxiety, depression, was also prominent, often improving more slowly than physical health. Febi *et al.*,⁶ and Galhenage *et al.*,⁴³ and recent evidence from Vietnam⁴⁴ confirm this lag. In contrast, Indonesian data suggest relatively better psychological well-being despite physical symptoms, possibly due to cultural or health system factors.

Social support and stigma play critical roles. Studies from Zimbabwe⁴⁵ and Thailand⁴⁶ demonstrate that peer-based models and family support networks substantially buffer against emotional distress. Supporting psychosocial integrating in TB care.

However, few studies assessed the long-term sustainability of such interventions, highlighting a gap in current literature.

Socioeconomic burden remains a central determinant of HRQoL. Unemployment, income loss, and indirect treatment costs, as shown in Ethiopia⁷ and Peru,⁴⁰ degrade well-being especially in informal workers. Food insecurity and poor housing further undermine outcomes in low-income settings. Studies from Pakistan,²⁴ Yemen,³¹ and Thailand²¹ link malnutrition and shelter issues to reduced HRQoL. Interventions like RATIONS trail and West Bengal cohort,^{47,48} Show that addressing structural needs can improve both clinical and HRQoL outcomes, though such efforts remain underutilized.

This review advances the field by identifying persistent HRQoL impairments post-treatment, especially among patients with delayed care and by integrating emerging insights on physical, psychological, socioeconomic determinants including stigma, support networks, and food insecurity that shape recovery trajectories. Future research should prioritize the standardization of HRQoL measurement tools to enhance comparability; longitudinal studies evaluating post-treatment HRQoL beyond six months; interventions tailored by age, gender, and socioeconomic vulnerability; integration of psychosocial and economic support into TB programs; and explore cultural moderators of mental health outcomes in TB. Table-I summarizes the key characteristics and findings from the studies included in this review.

This table presents characteristics and key findings of 29 included studies assessing HRQoL in adult PTB patients between 2012 and 2024.

EuroQoL 5-Dimensions (EQ-5D); EuroQoL 5-Dimensions 3-Level version (EQ-5D-3L); EuroQoL 5-Dimensions 5-Level version (EQ-5D-5L); Health-Related Quality of Life (HRQoL); Socioeconomic status (SES); 36 Item Short Form Survey Version (SF-36); Short Form 36 Version 2 (SF-36v2); St. George's Respiratory Questionnaire (SGRQ); World Health Organization Quality of Life-BREF(WHOQOL-BREF).

LIMITATION OF STUDY

While this Systematic Literature Review (SLR) offers valuable insights into the factors affecting HRQoL in TB patients, but the study has certain limitations. First, the review was restricted to open access published studies, which may have excluded relevant grey literature or paywalled research, potentially leading to publication bias.

Second, only studies published in the English language were included, which introduces a language bias and may overlook significant research conducted in other languages. These limitations may affect the comprehensiveness and generalizability of the findings.

CONCLUSION

This systematic review highlights the multifactorial nature of HRQoL outcomes among TB patients. Physical limitations were the most frequently reported impairments, particularly fatigue, dyspnea, and mobility restrictions, with residual symptoms persisting post-treatment in many cases. Psychological distress manifesting as depression, anxiety, and emotional fatigue was widespread, especially during the early treatment phases, and showed only partial resolution despite clinical improvement. Social support and stigma dynamics emerged as pivotal to social functioning, with stigma frequently linked to social isolation, emotional burden, and reduced adherence. Socioeconomic hardship reflected in unemployment, income insecurity, food scarcity, and unstable housing consistently undermined HRQoL across multiple domains. Variability in findings was influenced by patient demographics, care settings, and structural inequalities. Collectively, the evidence underscores that recovery from TB extends beyond biomedical treatment and is profoundly shaped by psychosocial and economic contexts.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

RY & AE: Data acquisition, data analysis, critical review, approval of the final version to be published.

MR & AHS: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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