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MSc Public Health and
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Evaluating The Effectiveness Of Current TB Treatment Trategies In India; A Qualitative Systemic Review

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DECLARATION

I, Jaykumar Dashrathbhai Thakor declare that this dissertation has been composed by myself, that the work contained herein is entirely my own except where explicitly stated otherwise in the text, and that this work has not been submitted for any other degree or qualification, in whole or in part, except as specified.

Signature: Jaykumar

Date: 13/05/2026

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ABSTRACT

Background: Tuberculosis (TB) remains one of the most significant health issues facing Indians despite the effectiveness of methods that could be used to meet the country's health care requirements, claiming a considerable share of the global disease burden. Patient experience, compliance, and implementation have immense gaps, although the success rates related to the national programs have improved on the diagnostic and treatment levels. This study views the efficacy of current TB treatment strategies to identify the factors that influence the effectiveness of these strategies in real-life situations.

Method: A systematic literature review, including databases such as PubMed and Google Scholar, was carried out using PRISMA criteria. Studies published between December 2020 and December 2025 were examined using the PICO technique. Although effective treatment methods are available, the issue of tuberculosis (TB) remains a significant problem for the general public in India, and it contributes a significant percentage of the global disease burden. Even as national programs have enhanced the rates of successful treatment and diagnosis, serious gaps exist with regard to patient experience, adherence, and execution.

Results: The results showed three important themes that impacted the effectiveness of TB treatment: patient-centred determinants, systemic and contextual challenges, and innovations and social determinants. Issues like health literacy, mental health, and access issues impacted adherence a lot. Misalignments in policy and practice, as well as disease management problems, were system-level problems which constrained the outcomes. In the meantime, there was a promise of new types of innovations like digital adherence tools and better diagnostics, but their effects were influenced by socio-economic conditions.

Conclusion: TB treatment strategies in India are clinically advantageous, but unequal in practice due to complex patient, systemic, and structural issues. A more patient-centred, context-sensitive strategy, more comprehensive and focused on treatment outcomes, is required to drive improvements in the resulting treatment outcomes and control of tuberculosis over time.

Keywords: Tuberculosis, Treatment Effectiveness, India, Adherence, Systematic Literature Review, Public Health.

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ABBREVIATIONS

PICO: Population, Intervention, Comparison, Outcome

TB: Tuberculosis

WHO: World Health Organisation

SLR: Systematic Literature Review

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

CASP: Critical Appraisal Skills Programme

DOT: Directly Observed Therapy

VOT: Video Observed Therapy

MDR-TB: Multidrug-Resistant Tuberculosis

RR-TB: Rifampicin-Resistant Tuberculosis

NTEP: National Tuberculosis Elimination Programme

RNTCP: Revised National Tuberculosis Control Programme

NAAT: Nucleic Acid Amplification Test

BPaLM: Bedaquiline, Pretomanid, Linezolid, and Moxifloxacin regimen

BPaL: Bedaquiline, Pretomanid, and Linezolid regimen

QALY: Quality-Adjusted Life Year

UHC: Universal Health Coverage

SDGs: Sustainable Development Goals

HIV: Human Immunodeficiency Virus

LMICs: Low- and Middle-Income Countries

MeSH: Medical Subject Headings

CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1 Introduction to the topic

Tuberculosis (TB) is recognised as one of the longest-lasting infectious diseases and one of the leading challenges of public health, especially in such high-burden countries such as India. TB is a transmissible illness that is brought about by *Mycobacterium tuberculosis*, which is known to infect the lungs, even though it can also target other body organs (Tadesse Bogale et al., 2024). TB remains a high morbidity, mortality, and socio-economic burden despite being curable and preventable, as a result of late diagnosis, non-adherence to treatment, drug resistance and constraint of the health system (Taylor et al., 2023). It is reported that in 2022, TB was causing around 10.6 million new infections and 1.3 million deaths, constituting one of the major causes of death due to infectious diseases around the world (World Health Organization, 2025). The TB burden in India is almost 28 per cent of the global one, with 2.8 million cases per year estimated to indicate the extent of the problem in the country (Directorate General of Health Services, 2025). The effectiveness of national strategies dealing with TB is a significant field of social health issues in India because India bears a significant portion of the global burden of TB.

This qualitative systematic review is aimed at concentrating on the effectiveness of these available strategies of treating TB by synthesising the information available in published studies, especially focusing on treatment outcomes, implementation issues, and patient-related experience. The study is important because it expands on the already existing research, but also suggests an abstracted qualitative approach that assists in defining gaps between the policy and practise in practise.

1.2 Background and Current Context

Through *Mycobacterium tuberculosis*, TB is the leading cause of lung disease, although it can involve several organ systems and cause significant morbidity and mortality, as well as the long-term socioeconomic impact (Shah et al. 2025). TB is still threatening the health systems worldwide especially in low- and middle-income countries, where the disease spreads, and poor results are aggravated by health inequities, poverty, undernutrition and limited health care access. TB is very much widespread in South Asia, but India alone has about 25% of the global cases (an estimated 2.830 million). Pakistan makes a contribution of 6.3% (approximately 700,000 cases), and Bangladesh is 3.6% (approximately 400,000 cases), making the disease

prevalence in the region a particularly significant burden (World Health Organisation, 2025). The World Health Organisation (WHO) says that TB is deadly without treatment, and in the past, the human mortality rate of death among those who had smear-positive pulmonary TB could be as high as 70% without treatment within a period of ten years (World Health Organisation, 2025).

These facts underscore the reason why TB continues to hold prime places in global agendas on public health, such as the End TB Strategy and Sustainable Development Goals (SDGs). India is the country that carries the greatest TB load in the world, since it is estimated that India accounts for nearly 27% of the annual global TB incidence. According to the Global TB Report 2023, the incidence of TB was estimated at 2.82 million in India in 2022 (199 cases per 100,000 population), with the mortality rates at 331,000 TB cases (23 deaths per 100,000 population) being the result of it (Directorate General of Health Services, 2025). Despite India recording a higher rate of improvement than that of the rest of the world, the country has recorded a 16 per cent reduction in the incidence of TB and an 18 per cent reduction in the number of TB deaths during the period between 2015 and 2022, the figure remains high (Rai et al., 2026). The Government of India has realised the scale of challenge and has set an ambitious target of the eradication of TB by 2025, which is five years earlier than the global SDG target of 2030 (Tadesse Bogale et al., 2024).

In 2020, the Revised National TB Control Programme (RNTCP) was changed to the National Tuberculosis Elimination Programme (NTEP), appointing elimination rather than a control strategic approach. The NTEP has four strategic pillars that include Detect, Treat, Prevent and Build (DTPB) and is established in over 632 districts with a population of over a billion (Ministry of Health and Family Welfare, 2025). NTEP has seen the development of diagnostic capacity as one of the most significant developments. India now boasts of the largest network of TB laboratories in the world, with a total of more than 7,700 rapid molecular testing centres and 87 culture and drug susceptibility testing centres across the country (Directorate General of Health Services, 2025). There were also about 18.9 million sputum smear test and 6.83 million nucleic acid amplification tests (NAAT) that were completed in 2023, it was a considerable test scale-up in the diagnostic services (Directorate General of Health Services, 2025).

Indian techniques of treatment have also developed significantly. By the year 2023, India showed a success rate in treatment of 87.6%, and it has been able to show persistent programmatic performances despite higher records in case notifications (Directorate General of

Health Services, 2025). Nevertheless, multidrug-resistant TB (MDR-TB) has traditionally needed more toxic, costlier and prolonged treatments, up to 18-20 months in duration, with frequent non-adherence and drug side effects (Myburgh et al., 2023). To counter this, India has recently proposed bedaquiline, prefomanid, linezolid and moxifloxacin in combination as the BPaLM regimen to treat MDR-TB. The six-month, all-oral regimen is proven by the reviews of in-country evidence and health technology assessment by the Department of Health Research with references to the Ministry of Health and Family Welfare (Ministry of Health and Family Welfare, 2025). BPaLM has been shown to have a higher success rate of treatment, fewer side effects, fewer days of treatment and less cost compared to traditional MDR-TB regimens. In addition to the biomedical treatment, the TB response in India gradually focuses on the patient-centred medical care and social support (Taylor et al. 2023). One of the interventions that covers under-nutrition, a major risk factor of TB, is the Nikshay Poshan Yojana, which gives a direct benefit transfer of ₹500 per month to all TB patients receiving treatment. The number of beneficiaries who received this nutritional support initiative is close to one crore, indicating the magnitude of this programme (Directorate General of Health Services, 2025).

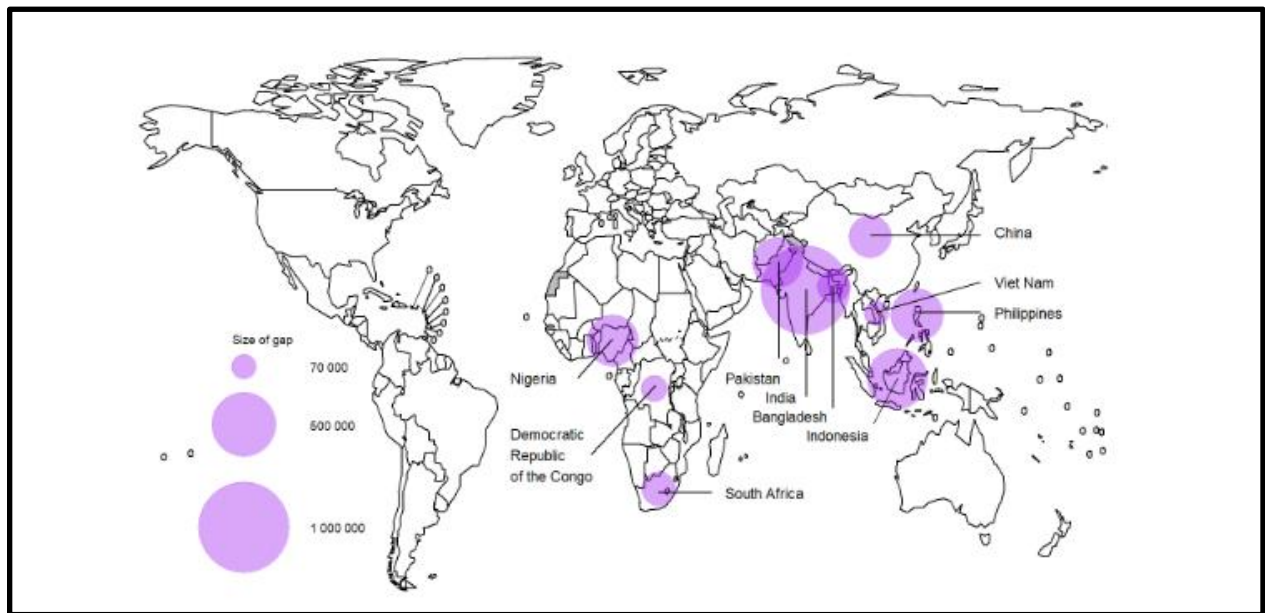


Figure 1 The ten countries with the largest gaps between notifications of new and relapse (incident) TB cases and the best estimates of TB incidence, 2020

(Source: World Health Organization, 2025)

Diagnostic or notification gaps still exist, especially in cases of underreporting and underdiagnosis of the privately held sector, and in cases of marginalised populations. TB

services were also affected by the COVID-19 pandemic, and the number of TB cases notified worldwide decreased by 18% between 2019 and 2020, with India making up an estimated gap of 24 per cent between the global incidence and reported cases (World Health Organization, 2025). In its changing context, a systematic assessment of the effectiveness of the existing TB treatment measures in India is quite timely and critical. Although the quantitative measures like incidence, mortality, and success rates of treatment are suggesting improvement, qualitative data is needed to comprehend the performances and results of the policies and regimens in real-life conditions. Patient experience issues, adherence issues, issues of health system capacity, and inequitable access issues need more in-depth discussion.

1.3 Rationale for Research or Problem Statement

The country faces a significant epidemic problem in the form of TB despite access to effective treatment plans as well as the introduction of ambitious national programmes aimed at curbing the disease. Although some recent changes in policy, increased diagnostics, and newer approaches to TB, like shorter drug-resistant regimens, are showing quantifiable improvements, gaps in treatment adherence, accessibility, patient experience, and health-system implementation still have not been well understood (Rai et al. 2026). The rationale behind this study was to conduct a qualitative systematic review of the effectiveness of the existing TB treatment strategies in India in order to synthesise information about the existing body of published literature, reports on various programmes, and guidelines. Enhancing the area of qualitative evidence collection, the current study is designed to define gaps in implementation and contextual factors which shape the results of the treatment, contributing to the adjustment of the policy and reinforcing TB eradication initiatives.

1.4 Research question

- What are the current practical uses of TB treatment strategies in India and the extent to which they have been successful?
- Which socio-demographic, clinical and structural variables affect the outcomes of TB treatment in India?
- What is the impact of adherence-support interventions on treatment adherence and treatment effectiveness in TB patients?

1.5 Research Aim

To systematically evaluate the effectiveness of current TB treatment strategies in India:

1.6 Research Objectives

- To assess treatment success rates and identify socio-demographic, clinical, and structural factors influencing treatment outcomes.
- To evaluate the effectiveness of adherence-support interventions such as DOT, VOT, case management, and MDR-TB regimens
- To develop evidence-based recommendations to improve TB treatment outcomes within the Indian public health system

CHAPTER 2: Literature Review

2.1 Introduction to Literature Review

The chapter examines the existing research on treatment plans of TB in India, focusing on their efficacy and implementation as well as on their effects on the patients. It reviews national and international research, policy texts, programme data to investigate common drug susceptibility and drug-resistant regimens of TB, adherence-promoting resources and health system resources intervention. This chapter critically examines gaps and inconsistencies in the available evidence to develop the conceptual basis of the qualitative systematic review in some of the following chapters.

2.2 Literature review:

2.2.1 Assessing Treatment Success Rates Associated With Current TB Treatment Strategies

The evaluation of the success of treatment methods related to the existing TB treatment practises involves the placement of national results in the global epidemiological frame. According to the WHO Global TB Report 2025, 10.7 million individuals started developing TB in 2024, and 1.23 million passed away, which is 11.5 per cent fatal in the whole globe (World Health Organization, 2025)

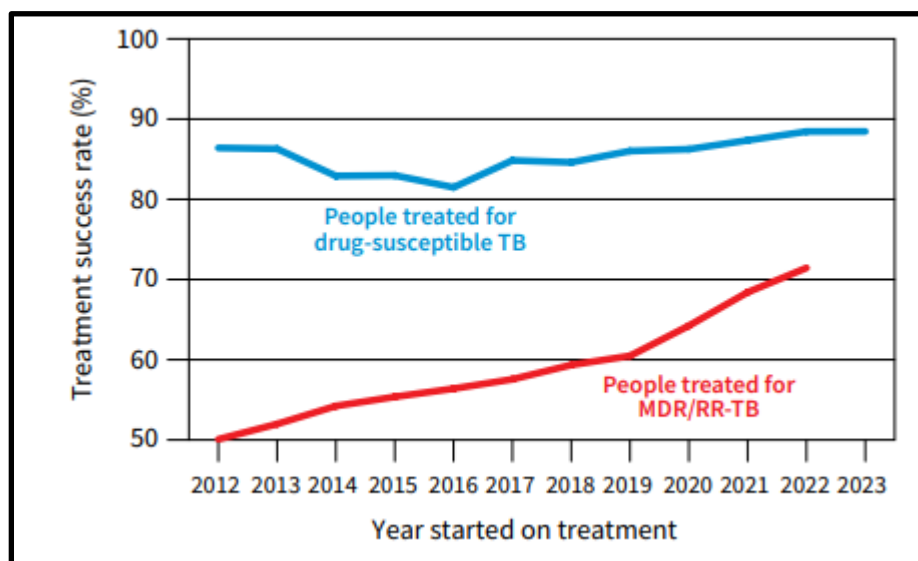


Figure 2 Global treatment success rates for drug-susceptible TB and MDR/RR-TB

Source [World Health Organization, 2025]

Positively, the treatment success rate of drug-susceptible TB across the world had increased to 88%, and the treatment success of rifampicin-resistant TB (RR-TB) had increased to 71%, which illustrated better regimens to curb the disease (World Health Organization, 2025). Nevertheless, an average of 78% of the estimated incidences were diagnosed and reported in 2024, which shows that there were still gaps in detection and treatment (World Health Organization, 2025). In this international world, India has shown relatively good treatment outcomes. As per national coverage, treatment coverage in 2024 was over 92 per cent as compared to 53% in 2015, with the patients diagnosed to 26.18 lakh out of the estimated 27 lakh cases. The success rate of the treatment was reported to be 90, which is higher than the average of 88 in the whole world (Meghrajani et al. 2023)

Nonetheless, close comparison reveals a number of nuances. WHO vaccination data are collected based on standardised global surveillance systems in 184 countries; thus, providing both comparability and methodological rigour, but media-based national summits can indicate what the government reports, without disclosing the methodological details (Iris.who.int, 2025). Additionally, Sands, (2025) points out that the proportion of individuals who in 2023 received drug-resistant TB treatment across the world is only 2 out of 5, as a reflection of the inherent weakness of systems to diagnose and treat complex cases. Combining these results, the existing TB treatment methods can be considered clinically effective in case patients are identified and kept in care. Approximately 90 per cent of drug-susceptible cases are cured by the use of standard regimens, and good national coverage in India is taking place to this standard (who.int, 2025). However, effectiveness depends on the coverage of the health systems, fairness, and long-standing investments, especially in the global financial limitations (Unanah and Aidoo, 2025). In theory, these results are consistent with the framework of the Health Systems and principles of Universal Health Coverage (UHC), according to which the success of treatment rests not just in biomedical effectiveness, but also in access to the service, financial coverage, and system responsiveness.

2.2.2 Identifying Socio-Demographic, Clinical, And Structural Factors Influencing Treatment Outcomes

The combination of the epidemiological evidence and contextual determinants is necessary in identifying some socio-demographic, clinical, and structural elements affecting TB treatment

results. According to the World Health Organisation, 10.7 million individuals became ill with TB and 1.23 million died in 2024, and 150 thousand among individuals with HIV (World Health Organization, 2025). HIV persons are 12 times more prone to TB disease, and only 61% of TB patients who were HIV positive were given antiretroviral therapy worldwide, which points to a significant clinical weakness that poses a threat to choices (World Health Organization, 2025). This issue is still a multidrug-resistant TB (MDR-TB) that presents the current healthcare crisis, as the number of those receiving treatment is only approximately 2 out of every 5 people (World Health Organization, 2025). Inadequate access to treatment exposes individuals to a higher death rate and contributes to further spread. International aid and especially international sources such as the World Fund have been very important to the low- and middle-income countries, although by the world standard, TB expenditure is supplied by domestic funding at a rate of 82% (Santhosh and Roy, 2025).

Demonstrated socio-demographic inequalities to assess treatment outcomes in Uganda. Out of 264 participants, 59.1 per cent had unsuccessful treatment results. Those in the richest quintile were 58% less likely to suffer bad results, and informal employment and school-aged kids not in school were significantly linked to treatment loss (Nidoiet al. 2021). The loss to follow-up at pre-treatment was 17.2% and greater in females (21.7%) and in males (13.5%) (Nidoiet al. 2021). The qualitative data revealed that stigma, food insecurity, migratory lifestyles, drug stock-outs and transport barriers are the major obstacles. In spite of geographical location peculiarities, the mixed-method design is more powerful as it gives a causal meaning due to the synthesis of statistical and contextual knowledge. Compared to this, WHO data offer a strong coverage of global surveillance, but it might lack representation of subnational differences (Carter et al. 2024). Reuters emphasises the vulnerabilities in terms of funding without providing primary research and referring to the projections at the policy level instead. The synthesis of these sources shows that the outcomes of TB treatment depend on the presence of overlapping social-demographic vulnerabilities, comorbidities, and structural vulnerabilities of health care systems. Such results are best described as the interactions of poverty, nutrition, work, sex disparities, and health financing systems as outlined by the Social Determinants of Health framework, which impacts the success and adherence to treatment.

2.2.3 Evaluating the Effectiveness of Adherence-Support Interventions Such As DOT, VOT, Case Management, And MDR-TB Regimens

The assessment of adherence-support interventions demonstrates that the combination of regimen design, mode of delivery, and patient-centred support contribute to TB treatment success. The Indian evidence supports the fact that shorter all-oral regimens of MDR-TB show significant levels of adherence and effectiveness in comparison to the traditional long-duration regimens. A comparison of economic analysis on six-month BPaL and BPaLM taken under the National Tuberculosis Elimination Programme revealed that both are clinically better and economically feasible (Baryakova et al. 2023). BPaL was the most economical, it cost the entity less ₹3379 per extra QALY, whereas BPaLM cost ₹337 per extra QALY and suggests that simplified regimes can ease pill burden, adverse effects, and default risk (Baryakova et al. 2023). In addition to the regimen design, the mechanisms of adherence support, including the allusion to DOT, VOT, and digital interventions, are crucial. Supervised intake through traditional DOT is both intensive in terms of resources and can be stigmatising, and logistically difficult, especially with working patients or those in remote locations (Chen et al. 2024).

On the other hand, Adherence-support interventions, however, could be more effective when personalized to patient preferences and realities (Rakesh et al. 2017). identified that the stifled Directly Observed Therapy (DOT) led to psychological stress, inconvenience and loss of confidentiality for TB sufferers in Kerala. The study found that a flexible treatment model that is patient-centred and allows family members to take over the supervision of the drug administration with support from trained health care workers was often preferred by the patients. Patients reported that having a lot of external/staff monitoring of their case file often interfered with work, social engagement, and activities of daily living, particularly in areas with a strong stigma associated with TB, such as cities. Findings further indicated that health workers' supportive communication through counselling and reminders on phone boosted the patients' self-motivation and confidence to adhere to treatment. Participants recognized the importance of mobile amenities, including SMS reminders, but direct phone calls were found to be more useful due to the fact that many patients, particularly older individuals, were not familiar with mobile systems of sending text reminders. Hence, Rakesh et al. (2017) recommend flexible adherence systems in the context of family support and periodic health worker support, which could contribute to increase treatment adherence and decrease social and emotional burden for patients. Nevertheless, a lot of the evidence in digital adherence is based on observation or pilot

studies, which do not allow for making inferences of causation or scalability evaluations. Case management leads also respond to socio-economic and behavioural hindrances, through integration of counselling, following up and connecting with the social support. Katende-Kyenda (2025) provides a review of the evidence of the effect of beliefs, stigma, complexity of the regimen and financial limits of adherence. Investigations have persistently found that the complexity of the regimen in terms of the number of drugs and frequency used is a predictor of non-adherence, hospitalisation, and medication errors. In general, the World Health Organisation Multidimensional Adherence Model (WHO-MAM) is most consistent with this evidence because it conceptualises the notion of adherence as a negotiation between patient perceptions, social environment, the complexity of a regimen, and health systems factors (Kwakye et al. 2025). The combination of shorter MDR-TB regimens and digital adherence tools and case management is therefore a theoretically founded and empirically supported way of enhancing TB treatment outcomes.

2.2.4 Suggesting Evidence-Based Recommendations to Improve Tb Treatment Outcomes Within the Health System

To enhance TB treatment outcomes, one needs to match clinical standards with sustainable financing and implementation capacity of the health system. The WHO has made its recommendations on TB more consolidated by organising its modules together through Module 4: Treatment and Care, which is all about the treatment and management of drug-susceptible and drug-resistant TB, and associations with patients and the programmatic implementation (World Health Organization, 2025). Such guidelines are made based on the GRADE approach, which makes them more credible in the sense that the quality of evidence and the strength of the recommendation are systematically assessed. An additional operational handbook helps to increase the policy-to-practice translation so that managers of the National TB Programme can successfully scale interventions (World Health Organization, 2025).

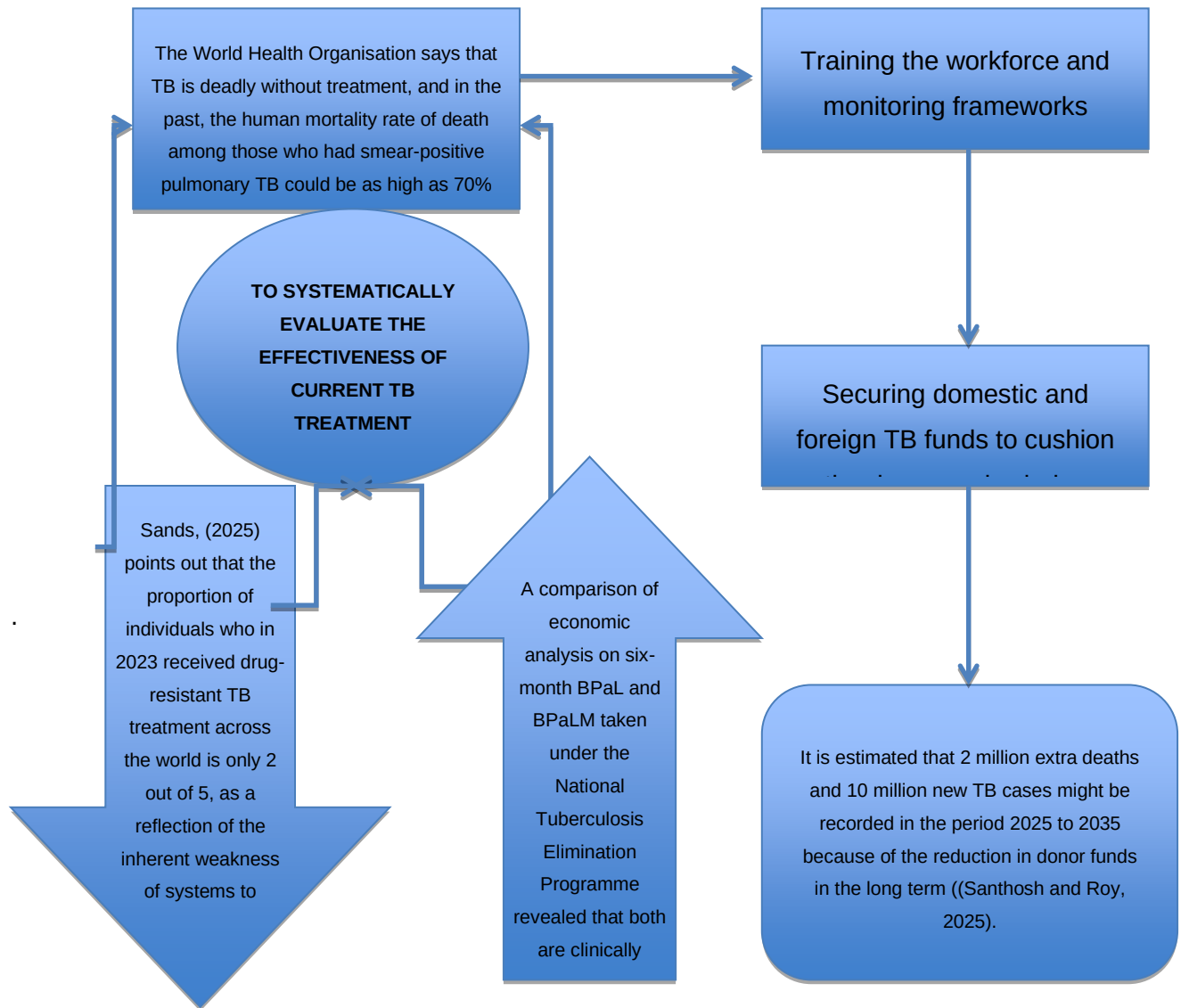
Nevertheless, implementation is put at risk by system-level constraints. It is estimated that 2 million extra deaths and 10 million new TB cases might be recorded in the period 2025 to 2035 because of the reduction in donor funds in the long term (Santhosh and Roy, 2025). The continuity of the services might be affected by fiscal uncertainty, even though the international aid, especially the Global Fund to Fight AIDS, Tuberculosis and Malaria, will continue playing a crucial role in the future (Santhosh and Roy, 2025). These statistics demonstrate that clinical

guidance cannot work without solid investment and political dedication. Evidence-based suggestions are thus to enhance the implementation feat to the WHO Module 4 criteria by training the workforce and monitoring frameworks, securing domestic and foreign TB funds to cushion the drug supply chains, diagnosis, and patient support, and incorporating tobacco management and mitigation interventions into TB programmes, considering tobacco as a significant driver of epidemics (Santhosh and Roy, 2025). Although WHO recommendations also have a high level of methodological rigour, Reuters does not report primary data but primarily policy-level forecasts, which limits the accuracy of causation. However, the concurrent synthesis of the two sources elucidates that the results of treatment are driven more by governance, financing, and prevention, rather than biomedical measures (Parvin et al. 2025). This evidence most appropriately fits the Health Systems Strengthening framework, which focuses on leadership, financing, service provision, and workforce capacity as all pillars that must interrelate and be interdependent to ensure successful, sustained TB treatment.

2.2.5 Literature Gap

Although a broad body of literature has been done regarding the control of tuberculosis globally and nationally, there are still some significant literature gaps. Most of the available evidence, such as reports of the World Health Organisation are characterised by programmatic indicators and aggregate surveillance data, which are able to give trends, but little understanding about patient experience, contextual barriers, and implementation realities in health systems. Qualitative and mixed-methods research examining the extent to which patients, health professionals, and programme managers are pursuing or managing TB treatment plans, especially in a high-burden country like India, is somewhat under-researched. Also, although recent research emphasises the usefulness of shorter all-oral regimens of MDR-TB and digital adherence solutions, most evidence emphasises the cost-effectiveness and short-term results. The socio-demographic and structural factors of migration, gender relations, informal and unstable employment, stigma and financing are usually discussed independently despite the system approach and lack of analyses at the systems level. Additionally, policy-focused reports often have identical implementation potentials and ignore variations in infrastructure in regions, workforce supply and governance. This restricts the application of results in different environments.

2.2.6 Conceptual Framework



CHAPTER 3: METHODOLOGY

3.1 Introduction to Chapter

In this chapter, the methodological approach used in implementing this systematic literature review will be explained on the topic of tuberculosis treatment strategies in India. It provides information on how the relevant studies were identified, selected and analysed in an organised and transparent way. The chapter also relates how the PICO framework, search strategy, inclusion and exclusion criteria and data analysis process were used. All in all, it will seek to make sure that the research is rigorous, reliable and has the potential to produce meaningful insights to enhance better TB treatment outcomes.

3.2 Systematic Literature Review (SLR)

A Systematic Literature Review (SLR) can be defined as a transparent search through previous research on a particular topic (Cabrera and Cabrera, 2023). Contrary to conventional reviews, an SLR implements an explicitly detailed procedure in order to reduce bias and guarantee the findings are trustworthy and exhaustive (Ofem et al. 2022). The overall aim of carrying out an SLR in the study is to obtain and critically examine available evidence about treatment measures of tuberculosis in India to aid in establishing what works, what does not work and areas that remain uncovered.

In order to have a full-fledged SLR, there are a number of main steps involved. The review is first guided by a clear research question and objectives. A systematic search strategy is then created based on frameworks like PICO to select the keywords and databases of interest (Fundoniet al. 2023). Subsequently, the inclusion and exclusion criteria are used to filter the studies in terms of relevance and quality. The studies are then on the valuation of the validity and contribution of the selected studies, which are critically appraised. Last but not least, synthesising and analysing are carried out to have meaningful conclusions. These steps allow the SLR to achieve comprehensive knowledge of the topic and give a robust evidence base to implement recommendations and further studies.

3.3 Search Strategy

To guarantee that the useful, high-quality evidence was found to include in this qualitative systematic review, a structured and systematic search strategy was elaborated. The review

used the PICO framework to adjust the focus of the research according to the recommendation of Nishikawa-Pacher (2022). The Population in this study consisted of patients with tuberculosis in India. The intervention thus consisted of Directly Observed Therapy (DOT), Video Observed Therapy (VOT), case management, and MDR-TB regimens, the Outcomes being treatment success rates and factors influencing this success. There are different types of databases were considered, like MEDLINE, Scopus, CINAHL Plus, Web of Science Core Collection, Cochrane Library, Embase, Google Scholar and PubMed. In between these PubMed, Scopus and Google Scholar databases were chosen as they consist of a wide range of peer-reviewed journals (Gusenbauer, 2022). Refining search results was done through the combination of keywords and Boolean operators like AND; and OR, such as tuberculosis, treatment outcomes, adherence and India. The search was restricted to English-language, peer-reviewed articles that had been published in 2015 and 2025 to be up to date. Also, the reference lists and grey literature were examined manually to further increase the completeness of the evidence through the use of commentaries.

3.4 Search terms

The formulation of search terms that were clear and exhaustive was a key measure towards making sure that this systematic review retrieved only the relevant research and not irrelevant evidence. Quality keywords and concepts were identified based on the PICO framework as discussed by Hosseini et al. (2024). This was used in order to organise the search logically and transparently, so it is easier to repeat and be justified. Individuals diagnosed with tuberculosis in India were the subject of the Population component. Several related terms, including Tuberculosis, TB and pulmonary tuberculosis, drug-resistant TB and multidrug-resistant tuberculosis, were incorporated to provide extensive coverage. Such differences were noteworthy since various studies tend to adopt slightly different words based on the clinical orientation or geographical bias in the report.

In the case of the Intervention component, the keywords were based on the spectrum of treatment and adherence-support methods that are already present in the Indian public healthcare system (Covvey et al. 2024). The keywords were Directly Observed Therapy, DOT, Video Observed Therapy, VOT, case management, treatment adherence, TB treatment regimens, and MDR-TB treatment. The use of full terms, as well as abbreviations, made sure that the relevant studies were not missed. The Context element emphasised the healthcare

setting in India. Thus, the terms included India, the Indian healthcare system, public health, the National Tuberculosis Elimination Programme and NTEP. This assisted in narrowing the search to studies that are more relevant to the Indian context, yet a broad sample of healthcare delivery settings is captured.

The outcome component was about the effectiveness of the treatment and factors affecting it. The following keywords were used: treatment success, treatment outcomes, treatment completion, adherence, default rates, mortality, and treatment failure. Moreover, concepts associated with influencing factors like socio-demographic factors, clinical factors and structural barriers were also introduced to enable a more detailed study. These terms were successfully combined with the help of the Boolean operators. Similar keywords in each of the PICO categories were interrelated with the use of OR, and different categories were interconnected with the use of AND to narrow the search results (Costa et al. 2025). MeSH terms, used in databases like PubMed and Google Scholar, were also viewed as controlled vocabulary, which enhances the accuracy of search with free-text keywords.

Table 1PICO Framework with Mapped Terms

PICO Component	Search Terms
Population (P)	Tuberculosis, TB, pulmonary tuberculosis, drug-resistant TB, multidrug-resistant tuberculosis
Intervention (I)	Directly Observed Therapy, DOT, Video Observed Therapy, VOT, case management, treatment adherence, MDR-TB regimens
Context (C)	India, Indian healthcare system, public health, National Tuberculosis Elimination Programme, NTEP
Outcome (O)	Treatment success, treatment outcomes, adherence, default rates, mortality, treatment failure, socio-demographic factors, clinical factors, structural barriers

3.5 Key Words

Keywords are very specific words that aid in the identification of useful studies in the academic databases by revealing the main ideas of the study topic (Chigbu et al. 2023). Based on this, it is worthwhile to use relevant keywords since it enhances precision in the search, minimises irrelevant findings, and has an overall coverage of evidence. Keywords added to this review are the words: tuberculosis, treatment outcomes, adherence, India, and MDR-TB because they directly represent the study focus.

3.6 Databases

This research study relied on various academic databases to identify the appropriate literature in the field of developing appropriate treatment strategies in the context of TB in India to get a wide and sound evidence base. The importance of searching multiple databases is that no single database would contain all the available research and using a single source might result in incomplete or prejudiced results. Haby et al. (2024) state that studies that combine databases enhance the depth and breadth of evidence and minimise the possibility of skipped important studies. Peer-reviewed journal articles, reports, and other relevant grey literature were identified in databases such as Google Scholar, Scopus and PubMed in this review. PubMed specifically proved very effective in terms of finding medical and clinical research, and in general, multidisciplinary research was found in Google Scholar, which assisted in taking more sources, such as conference papers and institutional reports (Tadesse Bogale and Debela, 2024). Therefore, cross-checking of findings by multiple databases enabled the study to increase the validity and to ensure that various views on the effectiveness of TB treatment in India were included to improve the overall quality and validity of the review.

3.7 Inclusion/Exclusion Criteria

Inclusion and exclusion criteria are crucial in a systematic literature review as they include the types of studies that would be included and make sure that the inclusion process is transparent, consistent, and not biased. Paul and Barari (2022) emphasise that research guidelines and clear-cut criteria enhance the reliability and validity of research findings by avoiding irrelevant and low-quality studies. The inclusion criteria in this review were that the studies should be about the tuberculosis treatment strategies in India, peer-reviewed, written in English, published between 2015 and 2025, and provide either the outcomes of the treatment or the factors

influencing it. Conversely, exclusion criteria were studies that were not based on Indian situations, were not accessible in full text, were not peer-reviewed, or did not directly deal with treatment effectiveness. The use of these criteria served to sustain the quality of the evidence and also made sure that the findings were focused, credible and in line with the research objectives.

3.7.1 Inclusion and exclusion Criteria

Inclusion and exclusion criteria at the most aspects in systematic literature review aids to define the basic parameters for selecting the papers. Hence clear indication of inclusion criteria helps in selecting the papers for the particular study where as the exclusion criteria helps in rejecting the papers based on the requirements of the particular study.

Table 2inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
Concentrate on TB	Studies outside Indian context.
Only peer-reviewed qualitative journal publications.	Quantitative and mixed-method journals
Published between 2015 and 2026	Non-tuberculosis-related research.
In the English written language.	Lack of data on treatment outcomes.
Reports treatment outcomes or effectiveness.	Non-peer-reviewed publications only.
Incorporates qualitative	Articles not in full text. Studies published before 2015.

3.8 Search Results

This SR has undertaken the study selection process in a systematic and transparent manner based on the PRISMA framework. PRISMA aids in providing clear monitoring of the identification, screening, and inclusion of studies (Zarate et al. 2022). In accordance with the analysis, to begin with, 410 studies were located using title and abstract search in selected databases. Accordingly, during the selection at this initial stage, 170 studies were eliminated because of their irrelevance. This filtering resulted in only potentially useful studies proceeding. Next, 240 full-text articles were evaluated as to eligibility. Other studies were also found using the manual search (Wubinehet al. 2024). 150 studies were eliminated due to certain reasons, such as inappropriate study design background-only data, and irrelevance. In addition, 90 studies were left out because they were not in English. Following these criteria, 65 studies were eligible based on the basic inclusion criteria. However, another quality screening measure was implemented to guarantee strength (De Cassai et al. 2025). At this point, total 55 articles were excluded in due to wrong population setting (20), wrong study design and irrelevant results. Finally, 10 studies were incorporated in the end synthesis of qualitative analysis. This sequential elimination procedure is presented in a PRISMA flow diagram, which is easier to comprehend and shows the process of eliminating irrelevant and low-quality studies systematically (Liu et al. 2025). This process of rigour made sure that the final selection was not only focused but also credible and directly oriented in reaching the research purpose of assessing TB treatment strategies in India.

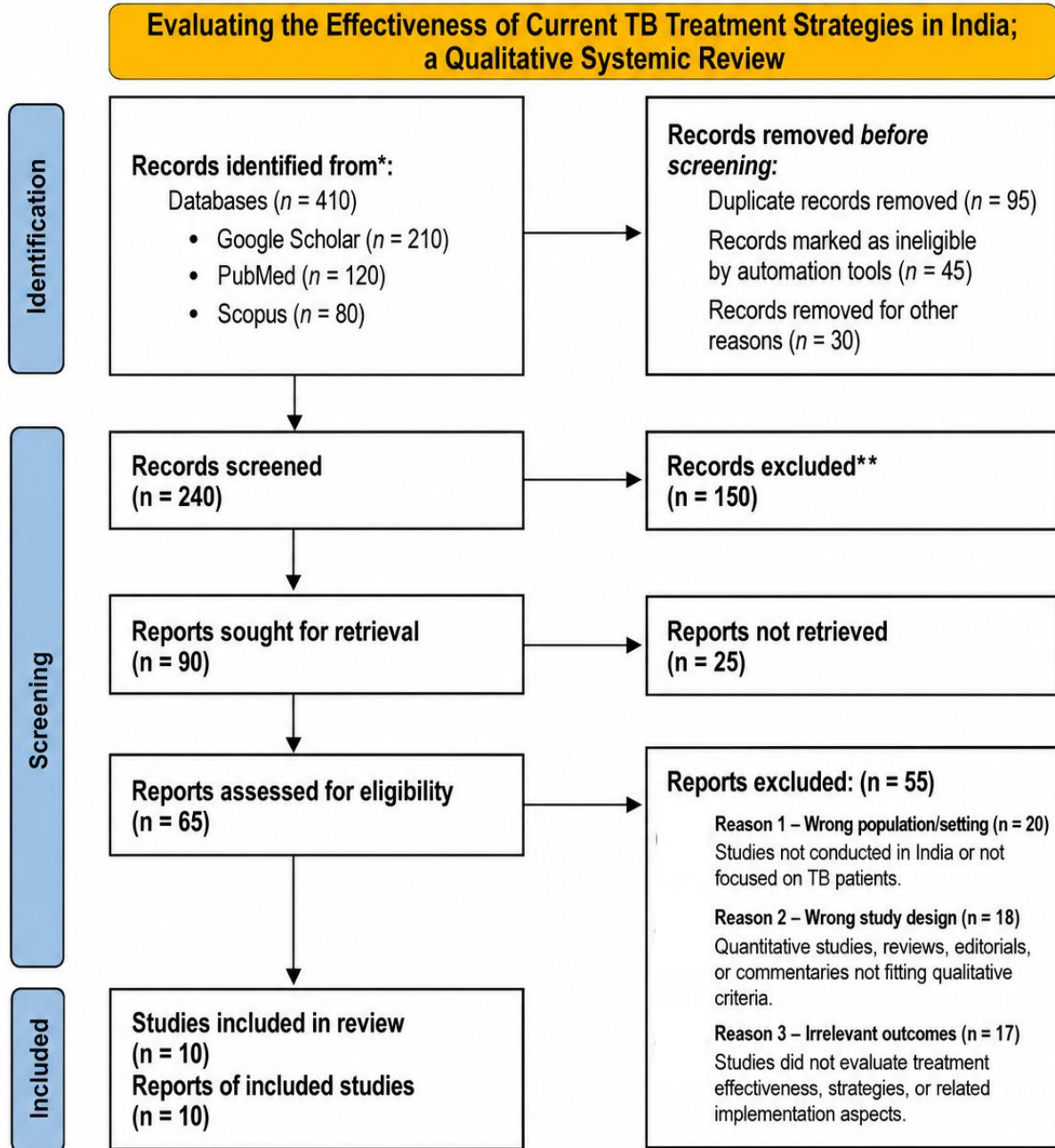


Figure 3PRISMA flow chart

3.9 Ethical Considerations

Ethical concerns are also very significant in determining the responsible and integrity conduct of research. The ethics of research, as noted by Alhabsi (2024), are oriented at safeguarding the rights, privacy and dignity of the participants. In spite of the fact that the current research is a SR and does not imply direct human involvement, ethical norms were also taken into consideration during the implementation of the research. All studies that were chosen have been reviewed to guarantee that they were given pertinent ethical approval through recognised institutions. The lack of a clear report on ethical considerations or consent of the participants excluded other studies in order to retain the integrity of the review (Nii Laryeafio and Ogbewe, 2023). Besides, it was also important to consider whether the initial research was appropriately made confidential and informed. The review was also based on peer-reviewed sources so as to make sure that it was accurate and reliable. Adequate citation and credit of original writers were ensured to prevent plagiarism. These ethical principles will help the study to be transparent and responsibly add to the current body of knowledge on the outcomes of tuberculosis treatment.

CHAPTER 4: DATA EXTRACTION AND EVALUATION

This chapter deals with systematic extraction and critical appraisal of the information of the literature included in this qualitative review of tuberculosis treatment strategies in India. It starts with the description of data extraction, the application of a developed data extraction form that is structured and predesigned in order to provide consistency and transparency.

4.1 Data Extraction

Data extraction refers to an organised approach of locating, retrieving and documenting pertinent information of chosen studies in a systematic way that would facilitate analysis and synthesis. It creates consistency in the major information represented in all the studies involved, hence contributing to transparency and fewer biases in systematic reviews (Afifi et al. 2023). The data extraction process, in this qualitative systematic review, was carried out by a preconceived data extraction form to ensure consistency and accuracy in the entire process.

The data extraction form was created particularly taking into consideration the objectives of the research and the PICO framework presented in the methodology. It allowed organising the study characteristics into a well-structured table that allows making comparisons and synthesising them into a theme. The most important information that was obtained was authors, year of publication, study location, research design, sample size and the characteristics of the participants. These components gave a summary of the setting and methodology of each research.

Moreover, specific data about the approach to tuberculosis treatment (e.g., type of intervention, e.g., the Directly Observed Therapy (DOT) and Video Observed Therapy (VOT), places of usage, and the length of treatment), were also taken out (Du Thinh et al. 2024). There was also systematic recording of outcome-related data such as success rates of treatment, adherence rates and perceived obstacles or supports to treatment effectiveness.

Since the review was qualitative, special attention was paid to pinpointing themes based on patient experiences, challenges in the health system, socio-demographic factors, and structural barriers on the final outcomes of treatment. Besides, the most important findings, the author's conclusions and any limitations reported were recorded in order to facilitate critical appraisal and synthesis.

This systematised data extraction methodology guaranteed coherence, reduced the potential risk of omitting valuable information, and included a strong preparation for the follow-up rating and thematic analysis of the encompassed research. Also, a standardised method of extraction increased the consistency of results on studies and the reliability of the review in general. It also made sure that all the variables of interest were always captured, which would help in a stronger and systematic synthesis of qualitative evidence on the approaches to tuberculosis treatment.

4.2 Brief introduction to critical appraisal and paper quality assessment

Critical appraisal is a scientific approach to evaluating research evidence, in order to determine its validity, reliability and relevance before it can be utilised in any conclusion or decision-making. It entails assessing the study methodological quality, the suitability of the research design, data collection and analysis rigour, as well as credibility of the findings (Tod et al. 2022). Critical appraisal is an essential procedure of systematic reviews, which assures that the used studies are of acceptable quality scientifically.

Critical appraisal is important because it is used to determine strong and low-quality evidence (Bezerra et al. 2022). Not every study that has been published is methodologically good; some studies can be biased, poorly designed, or badly reported, resulting in incorrect conclusions. Through the critical evaluation of the research papers, the reviewer is able to trace possible sources of bias (selection bias, measurement bias, and researcher subjectivity), especially in qualitative studies. This can be particularly applied to the field of research in public health, where the power or quality of evidence is instrumental in determining a policy and practice decision.

In addition, a critical appraisal increases the validity and trustworthiness of a systematic review (Shaheen et al. 2023). The validity of the results can be undermined by the inclusion of poorly conducted studies without assessment. Appraisal is used to evaluate the transparency, ethical considerations and procedure of the analysis of studies and their strength. This way, the conclusive results of the review are informed by reliable and quality research.

Critical appraisal in the context of the current study (tuberculosis treatment strategies in India) is necessary so that the qualitative evidence is relevant and gives a true picture of the patient experiences, health system issues and treatment results. It can also aid in detecting the gaps and inconsistencies in the literature. Critical appraisal, therefore, not only enhances the quality

of the review, but also guarantees that the results obtained would be meaningful, reliable and relevant to the actual practice of public health.

4.3 Critical Appraisal Tools

Critical appraisal instruments are pre-constructed rubrics or checklists that are designed to assess the quality, credibility, and applicability of research studies systematically. These instruments give a list of a set of standardised criteria that the reviewers use to evaluate various parts of a study, such as its design, methodology, data collection, analysis and interpretation of results. Researchers can be able to achieve this through these tools to have a consistent and transparent method of assessment of evidence across several studies.

It is essential to figure out which CASP checklist to use since various research designs may have various evaluation criteria [Appendix 4]. To illustrate, in qualitative studies, depth, context and interpretation are the primary areas of concern, whereas in quantitative studies of interest are measurement, statistical validity and generalisability (Lim, 2025). The wrong choice of the appraisal tool can result in wrong estimates of study quality or loss of significant proponents and flaws in the methods used. So, the choice of the tool that would be used should be made according to the research objectives and study design in order to improve the validity and precision of the appraisal. Where qualitative evidence is central, as in this case, a tool that is specifically selected to be present in qualitative research guarantees that issues like credibility, reflexivity, and thematic analysis are adequately evaluated.

The critical appraisal tools would be used to evaluate a number of important aspects of research papers. Firstly, they check whether the research aims are clear and whether the research methodology chosen fits in meeting the research question (Kolaski et al. 2023). Secondly, they review the sampling procedure and approach to examine the suitability of the participants, who are needed in the study setting and their representativeness. Thirdly, they evaluate data collection procedures, making sure that they are rigorous, ethical and well-described.

Moreover, such tools would assess the process of data analysis such as the analysis of appropriate analytical techniques and the findings that persist with adequate evidence (Kakar et al. 2023). They also take into consideration such issues as bias, researcher reflexivity and reporting transparency. The other significant factor evaluated by appraisal instruments is ethical

considerations, e.g., informed consent and confidentiality. Lastly, they discuss the general value and contribution to what is already known by the study.

In general, critical appraisal tools are important in the selection of evidence in a systematic review, as it is only reliable and high-quality information to be added, thus enhancing the validity and reliability of the research results.

4.4 Evaluation of Qualitative Studies using CASP tool

4.4.1 Justification and Overview of the Appraisal Tool

Critical Appraisal Skills Programme (CASP) was chosen to review the qualitative studies of this systematic review because it is quite consistent with the qualitative research methodology and is used extensively in health and public health-related research (Campbell et al. 2024). The particular feature of CASP is that it aims to evaluate qualitative evidence and uses a specifically designed checklist that is structured and transparent, which explains its specific suitability in the context of studies about intricate issues, like patient experiences, adherence to treatment plans, and health system challenges related to the work with tuberculosis. The fact that it puts more emphasis on the important concepts of credibility, rigour, and relevance ensures that the appraisal procedure has the ability to measure the quality of methodology and the richness of information brought about by the studies.

The simplicity and clarity are one of the main factors why the CASP tool has been picked (Metsiset al. 2024). This instrument comprises ten clear questions that would lead the reviewer through key areas of qualitative research that encompass clarity of research objectives, suitability of methodology, recruitment approach, data gathering, reflexivity, ethics as well as data analysis. Such a systematic manner enables consistency in reviewing several studies, which makes the whole appraisal less subjective and increases the review transparency.

Also, CASP is a well-known and commonly used tool in systematic reviews in healthcare settings, which enhances the validity of this study. CASP is practical in synthesising qualitative evidence due to its balance in comparison to other appraisal tools, neither too complicated nor simplistic. Its focus on interpretive validity and credibility is especially applicable to this study, wherein it is essential that the contextual and experience variables which affect the TB treatment are observed. Consequently, the application of CASP can be considered to ensure that the results of this review are informed by the high-quality and reliable qualitative evidence.

4.5.2 Strengths and Limitations of the Chosen Appraisal Tool

Strength

The Critical Appraisal Skills Programme (CASP) instrument has a number of strengths that render the tool one of the most appropriate tools to apply in the assessment of qualitative research, especially the systematic review of studies related to the field of public health (Smith et al. 2025). This is also one of its biggest advantages as its structured but flexible structure enables researchers to critically evaluate critical areas of qualitative research design, data collection, analysis and ethical issues. The ten questions, or checklist, are succinct, simple to use and understand, allowing similarity in the checklist in more than one study and transparency in the appraisal process. This is particularly advantageous when working with many studies since the number could be very large, and thus any ambiguity is minimized and reproducibility is achieved.

Qualitative rigour and trustworthiness are another key strength of CASP. Contrary to a large number of quantitative appraisal instruments, CASP lays stress on issues like credibility, reflexivity, and the connection between the researcher and the participants. This is especially applicable to research investigating intrinsically complicated phenomena, such as patient experience, treatment adherence and health system barriers to tuberculosis treatment. Furthermore, CASP is commonly known and widely implemented in medical research, boosting the methodological validity of the review and bringing it to the accepted academic standards.

Also, CASP encourages critical thinking, as opposed to a strictly checklist-based assessment, which involves more in-depth discussion of the research setting and results. Through this interpretive approach, the researcher is better placed to understand nuances in qualitative data and therefore, it can be used effectively when examining complex issues related to the field of public health, as contextual and experience factors are important in that context.

Limitations

Nonetheless, these strengths are accompanied by some limitations of the CASP tool in comparison to the other appraisal instruments, like the Joanna Briggs Institute (JBI) checklist and Mixed Methods Appraisal Tool (MMAT). A key weakness is that there is no formal scoring system. CASP is based on qualitative judgments (e.g., yes, no, or unclear), subjectivity may be a factor in it, and thus, quantitative comparison is challenging to measure study quality.

Conversely, the use of instruments such as MMAT offers more organised scoring systems that can be used to compare the results across the studies.

Moreover, CASP might not require depth in some aspects of methodological evaluation (Ansar et al. 2025). As an example, it deals with data analysis but does not give specific guidelines to assess sophisticated qualitative methods or theories. Though the JBI checklist, on its part, provides more detailed advice on methodological consistency and philosophical peculiarities that may be beneficial when carrying out meticulous qualitative assessments.

Summing up, CASP is the most effective because of its clarity, ease of use, or orientation on qualitative rigour, but might not be as detailed or objective as other tools. However, it is a suitable option in this review due to its practicality and good fit with qualitative research.

4.5.3 Critical Appraisal of Included Qualitative Studies

Critical appraisal of the qualitative studies involved in this review was done using the CASP tool in order to determine the methodological rigour, credibility and relevance of the studies. In general, the quality of the studies was moderate to high, with the majority of them having clear research objectives and suitable qualitative designs. Nevertheless, they exhibited differences in the methodological transparency, sampling plan, and their reflexivity reporting. To assess the methods' rigour, credibility and relevance of the qualitative and relevant studies incorporated in this review, their critical appraisal was conducted with the aid of the CASP tool. The appraisal discussed the following studies.

Table 3included studies

Author name	Year of Publication	Methods	Country	Analysis
Atre et al.	2023	Qualitative	India	Thematic analysis
Anand et al.	2024	Qualitative	India	Content and thematic analysis
George et al.	2022	Qualitative	India	Thematic analysis
Khaitan et al.	2022	Community-based qualitative study	India	Thematic analysis
Fargnoli et al.	2025	Qualitative	India	Qualitative thematic analysis
Poddar et al.	2026	Formative qualitative study	India	Thematic analysis
Rakesh et al.	2017	Qualitative	India	Thematic analysis
Pavithra et al.	2022	Qualitative assessment	India	Content analysis
Soman et al.	2024	Qualitative	India	Thematic analysis
Yellappa et al.	2016	Qualitative	India	Thematic analysis

Regarding research design and research methodology, the research studies like Atre et al. (2023), George et al. (2022), Poddar et al. (2026), and Yellappa et al. (2016), had effective designs and research methods, like well-structured qualitative research methods that included interviews and stakeholder involvement that were appropriate to investigate such complicated issues as patient experiences and diagnostic acceptability. Through these studies, it was evident that qualitative methods would be appropriate in order to have the contextual and behavioural factors that would affect an appropriate treatment of tuberculosis. However, by contrast, a few studies used as a part of the review, e.g., narrative and systematic reviews, did not have primary qualitative data, which restricted their ability to cover lived experiences.

Different studies had different sampling and participant selection. Yet, the background and experiences of patients, caregivers, and healthcare providers were highly diverse because the

purposive sampling methodology was used by Poddar et al. (2026). In the same way, the number of participants in the interview and the large population of the survey provided by Atre et al. (2023) reinforced the depth of insights. Small sample sizes in certain qualitative studies, however, diminished generalisability and lack of specifics on the recruitment strategies in some studies cast doubt, therefore, on the potential of selection bias.

In the aspect of gathering data, the majority of the qualitative analyses made the right choice of data collection methods, such as semi-structured interviews and consultations of stakeholders. These techniques are suitable for investigating perceptions, obstacles and facilitators in TB care. However, not all the studies gave adequate information on the development of data collection tools or on whether they were pilot-tested or not, and this could compromise the reliability of the results. Generally, there was satisfactory data analysis and rigour, and the studies showed either thematic or content analysis methods. The analytical depth of Poddar et al. (2026) was high as results were correlated with mental health and frameworks. A typical shortcoming of the various studies, however, was the fact that many of the researchers had not discussed reflexivity in depth; indeed, most of them did not even take into consideration the fact that they could have influenced the data interpretation. The lack of this can influence the authenticity and honesty of the qualitative results.

Most primary qualitative studies had ethical issues, especially regarding informed consent and confidentiality. Nonetheless, not all of the studies offered much information on ethical approval, as this decreases transparency. Moreover, various perspectives (e.g., of patients and providers) were used to support the credibility of findings in various studies, though such techniques as triangulation and member checking are not necessarily mentioned. In general, the qualitative studies used are insightful in their contribution to the understanding of behavioural, social and health system factors shaping TB treatment. Although the majority of the studies were methodologically sound and relevant, other common shortcomings were small or context-specific samples, low levels of reflexivity, and inconsistent levels of reporting quality. Although there are such weaknesses, the evidence is very strong enough to inform the thematic synthesis of such a review, especially in deriving the patient-centred and system-based challenges of treatment strategies of TB.

This section critically analysed the data extraction and critical evaluation process of the studies that were selected in this review. It started by describing how the designed method of extraction

of relevant data would be achieved on the basis of a pre-structured data extraction form with the aim of uniformity, transparency and comparability of studies. Particular study attributes such as methodology, sample, interventions, outcomes, and determinants were structured in a way that was to aid in further analysis. The following chapter would expand the findings with a thematic analysis and synthesis of the extracted data, illustrating important patterns, themes and insights concerning tuberculosis treatment strategies in India.

CHAPTER 5: DATA ANALYSIS AND SYNTHESIS

5.1 Thematic Analysis

Thematic analysis is a qualitative approach that is flexible and can be used to discover, categorise, and make sense of patterns or themes in data. It aids researchers in getting a sense of the intricate information, emphasising common ideas and meanings (Trombeta and Cox, 2022). Accordingly, when used on secondary data in a systematic literature review, it is sometimes known as thematic synthesis, wherein the results of many studies are combined to create more general insights.

5.2 Data analysis tool

This research used the thematic framework developed by Braun and Clarke (Braun and Clarke, 2024). The method assists in organising, interpreting, and recognising any significant patterns in qualitative data. It has value as it provides a flexible but systematic approach to analysis of complex results, it ensures transparency and also provides a greater insight into recurring themes when using the sampled studies.

5.3 Characteristics of the identified studies

The ten articles incorporated in this review give a wide spectrum of geographical settings and the methods of the research, with an interest in the study of tuberculosis care.

India 10 studies: The ten studies included in this review with focused on the TB treatment experiences, healthcare challenges and adherence barriers within Indian context. Most of the selected articles used in this study is based on the qualitative research methods to explore and evaluate healthcare accessibility, patient experiences, stigma, mental healthcare and treatment management. The studies showed diverse setting across India including rural, urban and marginalised communities. Atre et al. (2023) and Poddar et al. (2026) examined psychological and social needs of MDR-TB and TB patients in Pune, mainly the significance of mental health support and patients centred care. Anand et al. (2024) and Soman et al. (2024) focused upon tribal and indigenous population showing cultural barriers, gap between TB policies and local practices and poor healthcare access. George et al. (2022), Pavithra et al. (2022), and Khaitan et al. (2022) explored treatment adherence barriers including medication side effects, stigma and weak healthcare follow up system. Rakesh et al. (2017) and Yellappa et al. (2016)

investigated patients perception toward DOT and determining problem related with confidently, rigid treatment system and transport burden. Fargnoli et al. (2025) evaluated patient's preferences about non-sputum diagnostic methods.

A variety of techniques, such as cross-sectional, qualitative, systematic and narrative reviews, and meta-analysis, were used in the investigations. The sizes ranged from enormous, pooled data on numerous studies of the research, to small qualitative samples. The interventions included digital adherence technology, alternative diagnostics, mental health integration and health literacy. Obstacles to access, efficacy of treatment and adherence were frequently measured. Overall, the study demonstrates that the social, behavioural, and structural factors have a significant impact on the outcome of treatment for TB in most scenarios.

5.4 Emerging Themes from included studies

Table 4 Theme generation based on Codes and Nodes

Themes	Code	Nodes	Example	Articles where it was extracted
Theme 1: Patient-Centred Determinants Influencing TB Treatment Adherence	Patient Factors	Fear of stigma and disclosure	"Some of them preferred to take DOT from a distant place for fear of losing confidentiality."	Rakesh et al. (2017)
		Mental health	"Patients described depression, anxiety, stigma, and emotional exhaustion, which reduced motivation to continue treatment."	Poddar et al. (2026); George et al., (2022)
		Unmet patient need	"Patients expressed the need for nutritional, psychological, and social support during MDR-TB treatment."	Atre et al. (2023); Anand et al., (2024)

Theme 2: Systemic and Contextual Challenges in TB Treatment Outcomes	System Factors	Disease management	"I kept on telling them that it is difficult for me to come here [TB hospital] every day"	Yellappa et al. (2016); Soman et al., (2024)
		Tribal healthcare accessibility	"Remote tribal communities faced poor transport, lack of awareness, and delayed diagnosis."	Anand et al. (2024)
		Policy-practice gap	"Although services existed on paper, indigenous communities still depended on traditional healers and had limited access."	Soman et al. (2024); Pavithra et al. (2022)
Theme 3: Innovations and Social Determinants Shaping TB Treatment Effectiveness	Treatment Approaches	TB diagnosis	"End-users preferred non-sputum tests because sputum collection was difficult, uncomfortable, and socially embarrassing."	Fagnoli et al. (2025) Atre et al. (2023); Khaitan et al. (2022)
		Integrated mental health care	"Participants supported integrating mental health services within TB care programmes."	Poddar et al. (2026)
		Patient-centred care strategies	"Participants highlighted the importance of counselling, nutritional support, and community-based care."	Atre et al. (2023); Pavithra et al. (2022)

5.4.1 Theme 1: Patient-Centred Determinants Influencing TB Treatment Adherence

The adherence to TB treatment is affected by a complicated combination of individual cognition, emotional stability, and daily difficulties patients encounter during their treatment. Treatment programs in India have been extended, and national outcomes have been good on paper, but patient experience frequently dictates whether the treatment is achieved. The patient issues continue to be at the centre of this, with personal beliefs, behaviours, and situations defining the way in which patients interact with the rigorous and prolonged treatment therapies. This implies that compliance cannot be disassociated with the lives that patients are going through in their everyday lives.

One of the most important factors impacting the level of adherence is health literacy, which addresses the degree of understanding of patients about their illness and treatment needs. Rakesh et al. (2017) identify that a lot of TB patients suffer from severe emotional and practical problems during Directly Observed Therapy (DOTS) in India. The DOT regime was often cited as a distraction because frequent visits to treatment centres impacted employment, transportation and involvement in family or social events. Confidentiality issues were paramount, as some patients feared they would be diagnosed with their illness and that this would bring increased social and psychological pressure as a result of the treatment being received in a community setting. Similarly, George et al. (2022) highlighted that individuals even preferred travelling to distant treatment centres to maintain privacy. The study also showed the importance of having a caring healthcare provider that provided flexibility in treatment, counsellor, and emotional support throughout treatment. The study, however, noted that family supervision might not work for everyone with alcoholism or weak family supports. The results found here contradict the notion that external supervision alone would ensure adherence to the treatment, and instead the importance of patient-centred flexibility, trust, and psychosocial support for long-term adherence and success in therapy is emphasized. This brings to fore that health literacy is not a matter of adherence but also timely access to healthcare systems. The commitment of the patients towards treatment is greatly compromised when they have low levels of knowledge.

Emotional well-being is also very important in determining adherence. Anxiety, depression, and stigma are the mental health issues that are common among TB patients. According to Poddar et al. (2026), such emotional difficulties frequently decrease the motivation of patients to treat

themselves, particularly in combination with social isolation. Follow-up visits, or even withdrawal of care, may be caused by patient feelings of shame or hopelessness. The significance of mental health is especially clear given the fact that the treatment process will take months of regular work, which cannot be achieved without being emotionally fit. Pavithra et al. (2022) reported that many active TB patients face with understanding medication schedules, importance of completing treatment and side effect. Most patients do not report their condition because of fear of being discriminated against, and this may result in a failure to start treatment or cause a patient to stop treatment. It has been proven that stigma has a strong connection with treatment loss and poor outcomes (Pavithra et al., 2022). It shows that patient factors are closely related to social settings and are more of a collective choice than an individual choice. Moreover, structural issues are also crucial in adherence. Patients might find it challenging to undergo treatment due to management barriers that include the lack of access to healthcare facilities, delays in diagnosis, and disjointed service delivery. Khaitan et al. (2022) reported that point out several respondents showed hopelessness and frustration as of severe medication side effect as well as lengthy treatment regimes. Compliance, in these cases, is reliant not just on the child but on the family sensitisation and access to healthcare. This compares to adult cases where health literacy is directly associated with individual responsibility. The existence of management barriers demonstrates the fact that compliance is usually affected by the systemic problems that a patient cannot change.

Yellappa et al. (2016) and George et al. (2022) both demonstrated that there are still management barriers that are impacting vulnerable populations, although the entire programme is successful. The socio-economic conditions also influence compliance by creating an effect on the patient factors. Patients may find it challenging to focus on treatment due to poverty, food insecurity, and unstable employment. People in informal jobs might not attend clinics because of missing earnings, and this interferes with the treatment. It has been demonstrated that these vulnerabilities greatly contribute to a high probability of poor treatment outcomes (Atre et al. 2023). These facts reveal that patient factors are not limited to personal behaviour, but on a larger scale, living standards that affect health choices.

The interconnection of health literacy, mental health, and barriers to management is important, especially when treatment is over an extended period. Patients must adhere to rigorous plans over a few months of time, which may be complicated in case of emotional distress or logistical problems. Conversely, in low-resource areas, adherence faces complications due to structural

and financial limitations (Soman et al., 2024). These intersecting problems underscore the fact that there are numerous interacting factors that determine compliance and not just one factor. A more effective approach to handling these problems is through integrated approaches to care. The study by Poddar et al. (2026) shows that mental health support, in conjunction with TB treatment, increases patient engagement and adherence. This method enhances mental health and other patient aspects like motivation and resilience. Contrastingly, conventional approaches that consider medication alone are ineffective because they do not consider the larger issues that patients have. This analogy emphasises the need to deal with both management barriers and individual needs.

In conclusion, personal, emotional, and structural factors interact to determine TB treatment adherence in India. Hence, this theme is correct as the way people interact with treatment is dictated by the patient factors, and the understanding and choices they make are influenced by their health literacy. Despite treatment strategies being clinically effective, their performance in response to these interlinked realities ultimately depends on their success. Thus, more emphasis on patient-centred care, to incorporate education, emotional support, and enhanced access to healthcare, is crucial to attain sustained adherence and improved outcomes.

5.4.2 Theme 2: Systemic and Contextual Challenges in TB Treatment Outcomes

The effectiveness of TB treatment strategies in India is strongly impacted by systematic and contextual challenges which extend beyond clinical treatment. The chosen studies showed that healthcare infrastructure limitations, cultural barriers, socioeconomic inequality and weak policies problem continue to impact treatment results across different regions in India.

Yellappa et al. (2016) highlighted that numerous patients treated for MDR-TB were experiencing malnutrition, weakness, psychological stress and financial insecurity, all of which hindered their successful completion of treatment. The lack of easy availability of the device, together with the duration of the treatment and strong side effects of the drugs, further exacerbated the experience of patients, increasing felt emotional exhaustion. Treatment disenlistment was reported based on feelings of hopelessness, social isolation and fear of stigma by several of the participants (Yellappa et al. 2016). These results suggest that treatment with medicines is not a necessary and sufficient contribution to achieving the success in life of TB patients rather the economic status, emotional strength and social support are equally contributing factors. Accordingly, the complicated treatment regimens predispose the non-adherence and poor

outcomes (Anand et al., 2024). However, these clinical benefits do not completely address efficiencies within disease management systems. This implies that a treatment design innovation alone cannot penetrate ingrained system factors.

System factors are further reinforced during complex emergencies when the health systems are disrupted. Atre et al. (2023) reported MDR-TB patients in Pune experienced that displacement, instability, and conflict disrupt the delivery of TB care, resulting in discontinuation of treatments and poor outcomes. This kind of view adds a structural aspect to the situation, which is in contrast with much more stable environments where adherence interventions can become effective. Similarly, Khaitan et al. (2022) identified that resource-consuming and challenging to apply across the board, supervised treatment options like DOT are still resource-consuming and have their limitations. Thus, complex emergencies not only interfere with disease management but also reveal the vulnerability of the current TB control systems.

The policy-practice gap that is persistent is another important dimension of system factors and has a great influence on the outcomes of treatment in India. George et al. (2022) demonstrated allege that in spite of powerful national TB policies, their implementation frequently does not correspond to local cultural beliefs and health beliefs. This detachment puts obstacles to compliance and restricts the practical efficacy of interventions. Similarly, Yellappa et al. (2016) found that, patient perceptions, and financial constraints as significant factors contributing to low adherence, justifying the ways the policy-practice gap is active at both systemic and community levels. These conclusions imply that the success of policy cannot be quantified based just on design, but it has to be contextually flexible.

The disease management and the policy-practice gap also bring to the fore systemic weaknesses. The effectiveness of social and behavioural realities dictates the effectiveness of the structures' adherence support mechanisms, even when they are introduced. The study by Soman et al. (2024) argued that patient beliefs, regimen complexity, and health system support are a combination that can lead to adherence because of the multidimensional nature of system factors. However, the fact that the gaps between policy frameworks and patient experiences still exist implies that disease management strategies lack tailoring towards real-life settings.

Moreover, system factors associated with Complex emergencies indirectly support the policy-practice gap through undermining institutional capacity. As indicated by Anand et al. (2024), health systems in unstable environments will find it challenging to sustain a stable policy

implementation, which exacerbates the existing differences in treatment results. This leads to the cycle of disease management being disrupted and contributes to poor adherence, which is, in turn, worsened by poor execution of policy. On the same note, Atre et al. (2023) show that the marginalised populations face ongoing inequities, regardless of the emergency setting, because of the cultural and structural mismatch within the healthcare systems.

Yellappa et al. (2016) looked at the clinical, behavioural and socio-economic aspects of disease management within TB services. The study identified that the diagnosis and treatment of MDR-TB puts tremendous strain on patients due to long and expensive treatment, side-effects of the drugs, numerous visits to healthcare facilities, and loss of employment or family duties. Adverse effects of treatment were reported, such as nausea, weakness, hearing loss, and mental discomfort, which adversely affected adherence. Furthermore, stigma and discrimination were found to be significant obstacles to patient wellbeing and the affinity to treatment. A lack of acceptance by the community choices to isolate from activities or conceal their condition was also mentioned by many people (Yellappa et al. 2016). This study, then, recommended interventions for effective TB management that are patient-centred, incorporating the clinical symptoms and the broader social impact of chronic illness. Consequently, George et al. (2022), pay attention to macro-level problems of complex emergencies. Atre et al. (2023) and Poddar et al. (2026) further demonstrated that socio-cultural barriers that are inherent in the Policy-practice gap. Thus, a combination of these outlooks shows that the results of TB treatment are determined by a set of System Factors overlapping and not by one dominant concern.

Overall, the analysis indicates that enhancing the effectiveness of TB treatment cannot solely be achieved through improvements in medical regimens. This theme is correct as the continuous disease management difficulties, the destabilising influence of complex emergencies, and the persistent policy-practice gap all contribute to the limitation of the success of the current strategies. Hence, dealing with these mutually reinforcing system factors requires a more integrated and locally sensitive way to bridge clinical innovation with systemic reform and local realities.

5.4.3 Theme 3: Innovations and Social Determinants Shaping TB Treatment Effectiveness

Attempts to enhance the effects of treating tuberculosis are more relying on the successful incorporation of innovations, coupled with the comprehension of social reality in health systems.

Correlation between treatment approaches, TB diagnosis, social determinants, and digital adherence shows that technological and clinical solutions are not sufficient to guarantee long-term success unless supported by the favourable socio-economic and policy conditions.

Accordingly, the role of innovation in TB diagnosis is in transforming the diagnostic tracks at the early stages of diagnosis. Fargnoli et al. (2025) found that the ways non-sputum-based diagnostic approaches can greatly improve access and patient acceptability, especially targeting those populations that find it challenging to use traditional sputum collection. This step in treatment approaches implies a change to more patient-friendly systems. However, even though the research highlights the potential of alternative diagnostics, it also raises the question of the scalability and generalisability aspects of the study in the context of different healthcare environments, and especially in the resource-limited ones. Simultaneously, the impact of social determinants remains influential in treating efficiency in unimaginable ways. Atre et al. (2023) emphasised MDR-TB patients advantage from counselling support, coordinated healthcare services and enhanced communication during prolonged treatment. The results showed that despite high levels of adherence technologies, they will not be as effective if patients still grieve poverty, live in unstable situations, endorse stigma, or have poor technological accessibility. In particular, the study pointed out that digital adherence logistical might exclude certain patient populations due to economic disparities and differences in access to smart phones. Furthermore, the issues of privacy and the recording of video images were identified as culture-specific barrier to VOT acceptance in some communities. The results suggest that a predominantly biomedical approach to TB care and management should be rejected in favour of a holistic approach that considers multiple factors that might affect TB treatment outcomes and access to services. Conversely, the premise of success in treatment lies inherently in the ability of the health system and socio-economic security instead of clinical treatments alone (George et al. 2022).

The advent of digital adherence technologies brings on further complexity in the assessment of the effectiveness of the treatment. Yellappa et al. (2016) and Rakesh et al. (2017) further demonstrated that effectiveness of digital technology in enhancing adherence rate and patient-reported outcomes, including SMS reminders and electronic medication monitor usage. These advancements in the treatment approaches are a great stride towards addressing behavioural issues in the long-term treatment of TB. Their success, however, is directly related to technological access and digital literacy, which are also influenced by social determinants.

Additionally, Pavithra et al. (2022) identified that tackle the obstacles during the early stages by enhancing the detection of TB. Conversely, digital adherence is one of the important factors to ensure treatment outcomes. Therefore, social determinants and factors affecting the healthcare system are still important factors in tuberculosis treatment programme. The authors emphasized that digital adherence tools should be integrated within the healthcare systems, systems need to be coordinated, and they must be patient centred. The authors Khaitan et al. (2022) found that interventions that involve patient education, emotional support, counselling and quick response from providers when adherence drops are most effective when paired with VOT. The research also highlighted the need to combine various methods to monitor adherence to treat patients' evolving needs over the duration of treatment. These results suggest that technological interventions can improve treatment adherence in the short term but may not be effective in the long-term without a broader initiative to address social, behavioural, and economic barriers that impact adherence.

Moreover, constraints at the system level remain as a problem to the effectiveness of innovative treatment approaches. A decrease in donor support and financial instability can disrupt diagnostic services and adherence programmes, which, in turn, can undermine the treatment outcomes (Soman et al. 2024). This creates the interdependence between TB diagnosis, Digital adherence, and the system capacity capabilities, in general. Even well-designed interventions can be hampered without sustained investment, even though they might not have as long-term an impact. Further evidence that supports this argument is the fact that translating innovation into practice depends on strong governance, financing and the capacity of the workforce (WHO, 2025). Critical synthesis of the evidence indicates that although there is a need to innovate in Treatment Approaches, it is not enough. Fagnoli et al. (2025) offer encouraging opportunities related to the enhancement of TB diagnosis, but due to contextual variability, their results are limited. Digital adherence benefits can be measured by George et al. (2022). Despite this, the benefits are not equal because of the differences that correlate with social determinants. George et al. (2022), pointed out, however, that numerous challenges reported throughout the treatment process are remain linked to structural inequities and constraints within health systems. This reinforces the importance of a systems-based strategy where TB diagnosis, patient-centred communication, digital adherence support, and social support are all a part of a single systems framework of care. Results showed that video observed therapy resulted in a significantly lower inconvenience, travel expenses, and exposure risks than traditional directly

observed therapy approaches. However, the authors identified that technology on its own is not enough without healthcare service providers giving continuous encouragement, education, adverse event management and adherence support. The overall evidence pointed to the need for aspects beyond technical and medical solutions such as the generalisation of structural change to enhance patient experiences and access to care in the context of TB treatment and care.

It shows patient-related issues, systemic challenges, and innovations by structuring information into significant themes with thematic analysis. This chapter is able to illustrate that during therapy; the outcomes are influenced by social and structural factors besides medical treatments. Weighing everything up, it gives a balanced evaluation of its pluses, minuses and valuable implications of improving TB treatment in India.

CHAPTER 6: DISCUSSION

6.1 Introduction

This chapter discussed the finding associated with the effectiveness of current TB treatment strategies in India based on selected qualitative studies. It critically evaluates and assesses how patient's centric factors, treatment innovation and healthcare system challenges impact outcomes. The chapter examine issues including mental health, socioeconomic barriers, stigma and healthcare accessibility gaps impacting TB care. It also analysed the role of innovation including patients care support, integrated mental healthcare and alternative diagnostic methods in improving effectiveness.

6.2 Discussion of Key Findings

The outcome of ten studies evaluating current TB treatment strategies in India were systemised in review. The studies examined patients experiences, healthcare accessibility, treatment and mental health challenges in TB diagnosis and management. The selected articles included qualities studies focused on different healthcare and social context across India.

Three major themes emerged from the analysis:

- Patient-centred determinants influencing TB treatment adherence,
- Systemic and contextual challenges in TB treatment outcomes, and
- Innovations and social determinants shaping TB treatment effectiveness

This section critically discussed these finding in context to previous literature, behavioural theories, and healthcare challenges and patients centric methods. The discussion shows that impact of mental health, healthcare accessibility and socioeconomic barriers on treatment results. it further evaluates the significance of innovation including integrated mental health, flexible treatment system and alternative diagnostic methods in improving adherence and overall TB treatment.

Theme 1: Patient-Centred Determinants Influencing TB Treatment Adherence

The findings from Rakesh et al. (2017) suggest that low levels of treatment adherence are commonly linked to other important social and structural issues reported in global TB literature around stigma, patient autonomy and health service access. The results of the study verified

that inadequacies in knowledge of the health consequences of alcohol and substances use are not the only reasons for adherence problems, but also a number of factors such as fear of social discrimination, rigidity of treatment systems, emotional distress, and a lack of support networks. Patients noted that building supportive relationship with health care workers and relatives fosters more motivation and confidence to successfully complete treatment. The results are consistent with broader global research indicating that patient-centred interventions incorporating emotional support, counselling and treatment supervision that is flexible, enhance TB programmes (George et al., 2022). In this light, Anand et al., (2024) reaffirm the call to shift TB control from provider-centred approach towards acknowledging social, behavioural and psychological factors which impact treatment adherence. This also supports the notion that knowledge gaps are a chronic barrier, irrespective of the increase in treatment approaches.

The results, however, also go against the loud-voiced optimism of high national success rates, holding that there might be an unaccounted adherence problem at the patient level. The node of patient factors, which comes out as an important determinant but is hardly noticed, is mental health. The authors emphasise the way stigma and emotional distress decrease treatment uptake by Poddar et al. (2026), which is consistent with the evidence internationally on psychological vulnerability being a poor predictor of TB results. Simultaneously, the mental health care incorporated into TB programmes, as seen in the findings, is a rather progressive solution that is yet to be applied in many contexts. This implies a dichotomy between the emergent best practices and the standard programme design. The structural conditions argumentative value is enhanced by the role of management barriers, especially the problem of access and the difficulty of navigation in the healthcare system. Rakesh et al., (2017) show that the barriers are more acute in paediatric TB, where caregivers are at the core of care. This result aligns with the existing literature on travel and access disparities, and logistical limits as the main predictors of treatment discontinuation (Nidoi et al. 2021). But the fact that these barriers remain consistent even with high national programmes suggests that changes at the system level have not been completely converted to patient-level experiences. This brings about a given contradiction between policy success and lived realities, which implies that existing strategies are not always effective when implemented.

The results showed Soman et al., (2024) that while treatment strategies to control TB are successful at the clinic level, they are largely dependent on patients' compliance. National programmes frequently have high treatment completion rates, but these underestimate

significant variation in patient engagement and continuity of care. The evidence conflicts with the notion that it's enough for medication to be available to achieve success (Myburgh et al., 2023).

Rather, health literacy, mental health status and socio-economic status of patients have a significant influence on adherence in the opposite direction. Patient-related barriers are present as well as communication gaps within healthcare systems are reflected in the limited understanding of the treatment duration, adverse effects and medication importance. Furthermore, literature by Nidoi et al., (2021), patient's motivation for treatment is greatly diminished because of other factors including stigma, fear of disclosure, and emotional distress. Results show that there is a lack of attention given psychosocial aspects of TB care in our interventions. Patients are also constrained in their ability to stick to treatment due to the demands of a day-to-day existence and transportation expenses, as well as unstable jobs, and the financial strain that comes with living on these less than stable incomes. However, there are social and institutional factors which limit the treatment behaviour that cannot be interpreted solely as a failure in the responsibility of the patients.

This study indicates that while completion rates are important, the effectiveness of health care interventions needs to be gauged by how well they meet the actual needs of patients, as well as their psychosocial needs and socio-economic context. If patient-centred barriers are not addressed and tackled, non-adherence, resistance to TB treatment, the transmission of TB and poor programme outcomes will continue. Thus, alone the better provision of treatment will not lead to sustainable TB control unless combined with a comprehensive adherence support system.

Theme 2: Systemic and Contextual Challenges in TB Treatment Outcomes

The second theme, Systemic and Contextual Challenges in TB Treatment Outcomes, turns attention to the system issues, such as the management of a disease, complex emergencies, and the policy-practice gap. These findings have clearly endorsed the existing literature that stresses the health system's strength as a determinant of treatment success. The limitations of the models of standard treatment are pointed out by disease management problems, especially when dealing with TB-diabetes comorbidity. This is in line with the broader global evidence that demonstrates that the complexity of the treatment of MDR-TB is associated with poor treatment adherence and poor treatment outcomes (Yellappaet al., 2016). The study showed that multiple

medications, serious side effects to medicines, lack of economic security and social stigma all together diminished patients' willingness and capacity to sustain therapy. Patients with unstable income and without family support were particularly likely to discontinue treatment (Yellappa et al. 2016).

This homogeneity indicates that multi-morbidity is not adequately treated using any of the existing treatment strategies, yet it is becoming a problem in high-burden locations. The node of complex emergencies will bring in a more structural and contextual touch to the debate. Monedero-Recuer et al. (2026) show that conflict and instability are some of the disruptions that undermine TB care systems and are in line with the world research findings that indicate that health systems are vulnerable to crisis settings. Atre et al., (2023) demonstrates a weakness of the current literature, where most TB plans are characterised by the features of rather stable conditions and fail to consider the particularities of an emergency. This creates a disconnection between theoretical frameworks of care and actual circumstances, especially in low-resource environments. Another node of critical interest that is the reflection of systemic inefficiencies is the policy-practice gap. As noticed by Anand et al., (2024) and Khaitan et al., (2022), sound policy frameworks are not always associated with implementation, especially in cases where cultural and socio-economic aspects are not taken into consideration. This observation is in line with other literature, which has stressed the significance of the customisation of context in social health interventions. This supports the framework of Improving Health Systems Strengthening that argues the alignment of governance, financing, and delivery of services is required to lead to sustainable results (Nidoi et al., 2021). Comparing the findings in a critical fashion across the systemic findings shows that although clinical innovations have enhanced treatment outcomes, the system still has weaknesses that restrain their effectiveness (Parvin et al., 2025). As an example, MDR-TB shorter regimens have demonstrated excellent adherence, but the outcomes of such interventions are limited due to more significant problems, including funding uncertainty and inadequate infrastructure coverage (Rai et al., 2026). This implies that systemic challenges cannot be addressed by technological and clinical innovations only, which means that a more holistic approach has to be developed towards the control of TB.

The results show Fagnoli et al., (2025) that there are significant systemic and contextual determinants to the treatment outcome of TB. Lack of appropriate links in the delivery system led to inefficiency of care delivery and lack of care continuity, especially as it pertains to the management of co-morbidities and follow-up services. Poddar et al., (2026) points to the gap in

the healthcare systems and in the unmet and complex needs of patients, particularly in resource-limited and marginalised communities. There is often good policy level (national) design of TB strategies, but this will rely on consistent implementation at local healthcare settings. Socio-economic inequalities with regards to poverty, insecure job, low income, overcrowding and access to healthcare still hinder patient attendance at treatment programmes. There are also elements that are vulnerable in healthcare systems such as service disruptions, human resource shortages and lack of institutional coordination that undermine healthcare system resiliency during crises (Parvin et al., 2025). The results, therefore, show that treatment outcomes are influenced by the structural inequalities and institutional capacity as well as treatment interventions.

Theme 3: Innovations and Social Determinants Shaping TB Treatment Effectiveness

Innovations and Social Determinants Shaping TB Treatment Effectiveness is the third theme that deals with treatment methods and their relationship with TB diagnosis, social determinants, and digital adherence. The results show that innovation is important in enhancing treatment outcomes, but this effect varies greatly depending on the situation. The TB diagnosis node, especially the use of non-sputum-based methods, evidences a patient-friendly tendency. These innovations provide better access and early diagnosis, as shown by Yellappa et al., (2016), which is aligned with the worldwide evidence supportive of better diagnostic technologies (Tadesse Bogale et al., 2024). A desired limitation, however, regarding scalability and implementation can be found in the fact that despite some promising innovations currently in the literature, their viability in resource-constrained environments often remains unfeasible. Throughout literature and thematic analysis, the role of social determinants was an important finding. The accessibility of care, stigma, costs, and privacy concerns significantly affect treatment outcomes, which was effectively echoed in the broader domain of Social Determinants of Health as mentioned by Pavithra et al., (2022). The study continually brought into focus the notion that TB cannot simply be considered a biotic illness, but also as a social-economic and structural public health problem. Moreover, the results showed that VOT and other patient-centred practices would have a positive effect on adherence only in the presence of a responsive health-care system that demonstrates responsiveness to social vulnerability and behavioural issues. This uniformity across the literature supports the conclusion that sustainability of TB treatment responses can be achieved only with a combination of biomedical, technological and socio-economic considerations in integrated healthcare improvements.

Nonetheless, the reluctance to stop focusing on social determinants in the studies indicates that these factors have become well-known but under-applied in practice. The node of digital adherence truly points out the increased presence of technology in TB care. The evidence presented by Khaitan et al., (2022) that digital tools enhance adherence is strong, and it correlates well with existing evidence regarding the effectiveness of remote monitoring and patient engagement strategies. However, the findings also show that there is one major weakness: access to technology is not even and is especially dependent on socio-economic conditions. This poses a paradox: the most vulnerable populations, which may benefit the most by such interventions, may lack access to these interventions.

Critical analysis of this theme reveals that such advancements in treatment approach have been promising, but they are not adopted as a system but as an isolated treatment, which is what is commonly applied. The results, thus, complement and expand previous studies by showing the way these factors interplay. Besides thematic insights, the findings need to be critically assessed concerning the research approach and methodological limitations (Rai et al., 2026). A qualitative systematic review enabled the use of a rich, contextual comprehension of TB treatment strategies, especially in reflecting the life experience of patients and their challenges with the system (Shah et al., 2025). The use of the CASP tool has promoted the inclusion of moderate and high-quality studies, which increases the validity of the results (Campbell et al. 2024). Nevertheless, there are several shortcomings. First, the majority of studies included were qualitative or review-type studies, which would be less generalisable and not enable robust conclusions of causation. This constraint is also apparent: the qualitative design created rich experiences from the patients, provided context and captured the lived experience of patients in a limited regional context (Yellappa et al. 2016). While the socio-economic and behavioural barriers to adherence to MDR-TB treatment was an important finding from the study, results may not necessarily be applicable to all populations or health systems in India or other LMIC countries. Secondly, qualitative research, including Poddar et al. (2026), may not be able to generalise results because the sample sizes are limited. Thirdly, the discrepancies between reporting, especially on the issue of reflexivity and recruitment strategies, bring on board the possibility of biases when interpreting the data. The other significant limitation relates to the heterogeneity of the included studies. This is because the study designs, populations and contexts used fluctuate, thus it is not easy to make direct comparisons or to come up with the

same conclusion. Although this variety enhances the discussion, it also makes it difficult to generalise the results. Moreover, the use of secondary data implies that the review would rely on the quality and extent of available research, which might not be comprehensive and suitable to reflect on the emerging problems or regional differences.

A small number of good-quality qualitative studies in this field is also indicative of larger issues in TB research. The available literature is largely based on quantitative results and programme indicators, and places minimal emphasis on patients' experiences and contextual aspects. Such an imbalance can be one of the reasons why some of their aspects (e.g., mental health integration or digital adherence) have not been researched as fully as they become increasingly important. The results of this research are much aligned with the available literature, especially in terms of identifying the significance of patient factors, system factors, and social determinants (Shah et al., 2025). Nevertheless, they also give insight into significant gaps and inconsistencies, including the lack of alignment of success with the policy and patient experience, as well as the limited scalability of innovative interventions. These lessons can help create a deeper picture of the effectiveness of TB treatment and clarify that complex, context-specific strategies are necessary and that they should target both clinical and non-clinical determinants.

The results suggest that innovative and evidence-informed interventions such as short-course treatment and DAT could enhance TB treatment success. Digital monitoring tools can enhance treatment supervision and patient engagement, but this is dependent on patient digital literacy, technology, and infrastructure for digital access (Shaheen et al., 2023). These technologies do not necessarily aim to systematically break down barriers but can also contribute to further reinforcing inequalities between vulnerable groups with less access to these technologies. Likewise, the shorter treatment duration decreases medication burden and the convenience for patients, but it does not completely address underlying social determinants of stigma, malnutrition, poverty and overcrowded home environments (Tadesse Bogale et al., 2024). These over-arching socio-economic issues remain to shape the occurrence, compliance and recovery from disease. The results therefore indicate that a parallel structural approach and social action are necessary to bring about sustainable changes in TB control which are lacking from technological and medical innovations.

6.3 Strengths and Limitations

The results of the systematic literature review (SLR) show several strengths in the methodology adopted, thus increasing the credibility and reliability. The systematic and transparent process of data identification and screening and extraction ensured consistency across all included studies, which is considered a major strength. The application of the structured extraction framework allowed for crucial information to be gathered regarding methodology, treatment outcomes, obstacles, and the effectiveness of the intervention which helped with both meaningful comparisons and synthesizing across similar study designs (Taylor et al., 2023). In addition, using the CASP appraisal tool added methodological rigour by critically evaluating the content of the literature submitted in terms of quality, reliability and relevance. The diversity of study design and studies contexts also enriched the type of analysis carried out, as it resulted in both overall and context-specific understandings of the effectiveness of TB treatment (Tod et al., 2022).

Several constraints and also should be noted, however. The study was based on secondary research only, and the conclusion of the study was heavily dependent on the former published work in terms of quality, transparency and consistency in methods applied in the research (Unanah, and Aidoo, 2025). Some of the studies included found their results limited to broad generalisation to other populations as the samples were either relatively small or included a restricted number of studies that were specific to their context. A potential bias can also be found within some studies due to inconsistencies in reporting recruitment strategies, reflexivity of the researchers and data collection procedures. Furthermore, distinct methodological approaches, treatment settings and outcome measures in the literature posed difficulty in respect to achieving complete comparability between studies (Parvin et al., 2025). While the review is informative on the effectiveness of TB treatments, more robust primary studies conducted on a larger scale and using an identical study methodology need to be done to build momentum to the evidence base.

CHAPTER 7: RECOMMENDATIONS AND CONCLUSION

7.1 Introduction to Chapter

This chapter describes the final stage of the research, summarising the key findings of the discussion and transforming them into practical and proactive implications. It evaluates the importance of the results to TB control in India and highlights how the findings could be used to impact practice and policy.

7.2 Implications of findings

The findings of this paper have profound implications for TB research and the management of health for the general population, particularly in the high burdens such as India. They indicate that a more complete system-based perspective is required to understand therapeutic efficacy as opposed to clinical success rates only. TB programs should include behavioural and psychological support as per patient-centred criteria, such as mental health and health literacy. Nonetheless, the issues of policy-practice disconnect, and weak disease management systems are structural and suggest that to retain results, it is necessary to enhance health systems. The findings also point to the necessity to collectively address the issues of alleviating social inequality through technologies, such as enhancing diagnostics and digital aids to adherence. In general, the study confirms the idea that TB control can and should be based on the combination of clinical, social, and structural interventions instead of using discrete tactics only.

7.3 Recommendations for Practice

According to the findings, there are a number of viable recommendations that can be given to enhance TB treatment outcomes in India. To begin with, healthcare programmes must be more patient-centred by incorporating health education and mental health support into the routine TB care (Myburgh et al. 2023). This would assist the patients in comprehending the process they need to get through and keep them motivated during the treatment. Second, the health system capacity needs to be empowered through enhanced policy-ground-level coordination. Gaps in care can be reduced through training of the healthcare workers and maintaining uniform service delivery. Third, digital adherence intervention (like mobile reminders and remote monitoring) should be broadened, especially in underserved regions, but not without patients possessing the means of digital access and literacy. Moreover, programmes such as the social support

systems (financial aid and nutritional programmes) should be strengthened to deal with the socio-economic impediments. An integration of these strategies can result in a more welcoming environment, which enhances adherence and effectiveness of treatments.

7.4 Recommendations for Future Research

Further studies need to be done on how to fill these gaps that have been identified in the study to enhance the evidence base on the treatment of TB. More primary qualitative and mixed methods research has a definite gap and is needed to explore the experiences of patients across various parts of India since existing evidence is context-specific and limited. Longitudinal studies would also be welcome to comprehend the changes in treatment adherence and outcomes, especially in association with socio-economic changes (Audulvet al. 2022). Also, more studies are needed to determine the effectiveness and scalability of digital adherence technologies long-term, particularly in rural and low-resource regions. Best practices could be better understood through comparative studies of various intervention models, e.g., integrated care approaches and standard treatment programmes. Lastly, research ought to take a systems approach of reviewing the interaction between clinical, social, and policy factors and their individual investigation. This would help in formulating more elaborate and effective TB control policies.

7.5 Conclusion

The aim of this study was to establish whether the existing TB treatment regimens used in India were effective based on a qualitative systematic review, which focused on treatment effects, influencing factors and measures to facilitate adherence. The results show that while treatment success rates and healthcare coverage have increased significantly, there are still major obstacles that restrict these tactics' overall efficacy. This analysis shows that patient-centred, systemic and structural factors interplay to determine the TB treatment outcomes, not just treatments. Patient factors such as mental health and health literacy have a significant impact on treatment adherence. Even with the alternative of effective regimens, individuals who lack understanding of their body condition or have emotional and social challenges tend to quit therapy. This emphasises how crucial it is to treat behavioural and psychosocial issues in addition to clinical therapy. Treatment results are still impacted by contextual and systemic issues. The inefficiency of the national TB programs is undermined by the flaws in the disease management, interference of more general socio-political conditions and the disconnect

between the policy formulation and its implementation. Such findings suggest that the policies of good quality might end up being ineffective due to the lack of appropriate health system capacity and localised to the reality.

The role of the introduction of innovation in enhancing the efficacy of TB therapies is another issue that is raised by the investigation. The innovations of the testing procedures and computer-based strategies of adherence offer good perspectives in improving the opportunities to diagnose diseases in their early stage and offer care to patients in the course of their treatment. However, how well they are incorporated into current health systems and made available to all people will determine how successful they are. The technological solutions are not sufficient, as social factors of poverty, shame, and unavailability of resources are still involved in the results. On the whole, the study concludes that TB treatment and treatment strategies in India work, but their practical application is inconsistent. In an effort to deliver long-term benefits, a more integrated approach that involves patient-centred care, better health systems, as well as context-sensitive innovation is required. The following interrelated variables can assist in the enhancement of compliance with treatment, eliminate disparities, and eventually lead to the objective of TB elimination.

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APPENDICES

Appendix 1: Data extraction tables

Author(s), Year, Location	Study Design & Methodology	Sample Size & Population	TB Type	Treatment Strategy / Intervention	Treatment Outcomes	Determinants Influencing Outcomes	Key Findings	Study Limitations	Quality (1–5)	Country
Atre et al. (2023), Pune	Qualitative study using in-depth interviews	MDR-TB patients and healthcare stakeholders	MDR-TB	Patient-centred MDR-TB care and support services	Improved understanding of unmet patient needs	Mental health, stigma, nutritional and financial burden	Psychological and social support improved treatment engagement	Small qualitative sample	4	India
Anand et al. (2024), Rajasthan	Qualitative analysis using interviews and discussions	Tribal populations and healthcare workers	Drug-sensitive TB	TB management in tribal healthcare settings	Delayed diagnosis and weak treatment access	Poor transport, low awareness, cultural beliefs	Tribal communities faced major health care accessibility barriers	Limited regional focus	4	India

George et al. (2022), Bengaluru	Qualitative study using interviews	Female TB patients and frontline workers	Drug-sensitive TB	Frontline TB intervention support during COVID-19	Reduced adherence during pandemic	Gender barriers, stigma, mobility restrictions	Female patients experienced treatment interruption and emotional stress	Small sample size	4	India
Khaitan et al. (2022), Haryana	Community-based qualitative study	TB patients with treatment loss-to-follow-up	Drug-sensitive TB	Community TB treatment follow-up systems	High treatment discontinuation risk	Medication side effects, hopelessness, poor support	Long treatment duration increased treatment fatigue	Context-specific findings	4	India
Fargnoli et al. (2025)	Qualitative study among end-users	TB end-users and healthcare participants	Mixed TB	Non-sputum diagnostic methods	Improved diagnostic acceptability	Social embarrassment, discomfort with sputum testing	Patients preferred patient-friendly diagnostic approaches	Generalisability concerns	5	India
Poddar et al.	Formative qualitative	Patients, caregivers,	Mixed TB	Integrated mental	Better emotional support	Depression, anxiety,	Mental health integr	Limited implementation	5	India

(2026), Pune	study	and providers		health and TB care	t and treatment engagement	stigma	ation improved patient-centred care	ion evidence		
Rakesh et al. (2017), Kerala	Qualitative study using Focus Group Discussions	29 TB patients and 8 health workers	Drug-sensitive TB	Directly Observed Therapy (DOT), family DOT	Improved adherence when treatment was flexible	Health fear, stigma, confidentiality	Confidentiality concerns affected treatment participation	Qualitative limitations	4	India
Pavithra et al. (2022)	Qualitative assessment study	Active TB patients	Drug-sensitive TB	Anti-tuberculosis medication adherence support	Variable medication adherence	Poor awareness, side effects, family support	Counselling and awareness improved adherence	Small sample size	4	India
Soman et al. (2024)	Narrative review	Indigenous and tribal populations	Mixed TB	Healthcare policy and community health systems	Weak policy implementation outcomes	Cultural beliefs, policy-practice gap	Indigenous groups continued relying on traditional healers	Not a primary qualitative study	3	India

Yellappa et al. (2016), South India	Qualitative study using interviews	TB patients receiving DOT	Drug-sensitive TB	Directly Observed Treatment (DOT)	Difficulty maintaining long-term adherence	Financial burden, travel, stigma	Daily treatment visits created emotional and economic stress	Limited sample scope	4	India
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Appendix 2: selected articles

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Poddar, M., Nalavade, M.T., Suryavanshi, N., Golub, J.E., Bass, J., Kemp, C.G. and TB Aftermath Study Team, 2026. Designing Integrated Care Models for Mental Health and Tuberculosis in Pune, India: A Formative Qualitative Study of Patient, Caregiver, and Provider

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[core/content/view/B874B80E3411F868287CDDE241AE9E97/S2054425125101234a.pdf/designing integrated care models for mental health and tuberculosis in pune india a formative qualitative study of patient caregiver and provider perspectives.pdf](https://www.cambridge.org/core/content/view/B874B80E3411F868287CDDE241AE9E97/S2054425125101234a.pdf/designing-integrated-care-models-for-mental-health-and-tuberculosis-in-pune-india-a-formative-qualitative-study-of-patient-caregiver-and-provider-perspectives.pdf)

Rakesh, P.S., Balakrishnan, S., Krishnaveni, V., Narayanan, V., Pillai, S. and Thomas, S.M., 2017. Patients' perception towards directly observed treatment—a qualitative study from Kollam district, Kerala, southern India. *Indian Journal of Tuberculosis*, 64(2), pp.93-98.
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Appendix 3: Quality assessment/Evaluation

Study	Cle ar Ai ms	Appr o p r i a t e M e t h o d o l o g y	Rese a r c h D e s i g n	Recruit ment Strateg y	Data Colle ction	Ref lexi vity	Ethi cal Issu es	Data Anal ysis	Clea r Findi ngs	Value of Resea rch
Atre et al. 2023	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Anand et al. 2024	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Georg e et al. 2022	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Khaita n et al. 2022	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Fargn oli et al. 2025	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Podda r et al. 2026	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rakes h et al. 2017	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Pavith ra et al. 2022	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Soma n et al. 2024	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes
Yellap pa et al. 2016	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Appendix 4: CASP Qualitative Checklist

1. Was there a clear statement of the aims of the research?
2. Is a qualitative methodology appropriate?
3. Was the research design appropriate to address the aims of the research?
4. Was the recruitment strategy appropriate to the aims of the research?
5. Was the data collected in a way that addressed the research issue?
6. Has the relationship between researcher and participants been adequately considered (reflexivity)?
7. Have ethical issues been taken into consideration?
8. Was the data analysis sufficiently rigorous?
9. Is there a clear statement of findings?
10. Does the research provide valuable and applicable insights for practice, policy, or further research?

Appendix 5: CASP quality check table

No.	Citation (short)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
1	Atre et al., (2023)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
2	Anand et al., (2024)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
3	George et al., (2022)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
4	Khaitan et al., (2022)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
5	Fargnoli et al., (2025)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	Poddar et al., (2026)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	Rakesh et al., (2017)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
8	Pavithra et al., (2022)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
9	Soman et al., (2024)	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes
10	Yellappa et al., (2016)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes