2026 Volume: 02 Issue: 06 www.ijrpa.com ISSN 2456-9995 Review Article

International Journal Research Publication Analysis

Page: 01-13

CLINICAL PRESENTATION, DIAGNOSTIC APPROACHES, AND TREATMENT OUTCOMES OF PULMONARY TUBERCULOSIS IN HOSPITALIZED PATIENTS

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Article Received: 3 May 2026
Article Revised: 23 May 2026
Published on: 13 June 2026

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DOI: https://doi-doi.org/101555/ijrpa.6074

ABSTRACT

Background: Pulmonary Tuberculosis (PTB) remains one of the world's deadliest infectious diseases, caused by Mycobacterium tuberculosis. Despite effective treatments being available for decades, delayed diagnosis and poor treatment adherence continue to fuel transmission — particularly in developing countries where healthcare access is limited.

Objective: To synthesize and critically appraise available evidence on the clinical manifestations, diagnostic approaches, and treatment outcomes associated with pulmonary tuberculosis, with the aim of providing evidence-based guidance for hospital clinical practice.

Methods: A narrative review was conducted through a systematic search of PubMed, Google Scholar, and Scopus (2010–2025), supplemented by WHO global TB reports and national treatment guidelines. Articles were selected based on relevance to PTB epidemiology, diagnosis, and treatment.

Results: Reviewed literature consistently identifies persistent cough (>2 weeks), fever, night sweats, and weight loss as the cardinal symptoms of PTB. WHO global data report approximately 10 million new cases and 1.3 million deaths annually. GeneXpert MTB/RIF demonstrates sensitivity exceeding 95% and delivers results in ~2 hours. Standard first-line therapy (2HRZE/4HR) achieves treatment success in 80–90% of cases when adhered to fully.

Conclusion: Early diagnosis using modern molecular tools and strict adherence to standardized anti-TB regimens significantly improve patient outcomes and reduce community transmission.

KEYWORDS: *Pulmonary Tuberculosis • Mycobacterium Tuberculosis • Sputum Microscopy • Genexpert • Narrative Review • Anti-Tuberculosis Therapy*

1. INTRODUCTION

Pulmonary Tuberculosis (PTB) is a chronic, airborne infectious disease caused by Mycobacterium tuberculosis that has plagued humanity for centuries. While much of the modern world has seen declining rates of the disease, it remains a formidable public health challenge in low- and middle-income countries. Every time an infected person coughs, sneezes, or simply speaks, tiny infectious droplets are released into the air — putting those nearby at risk.

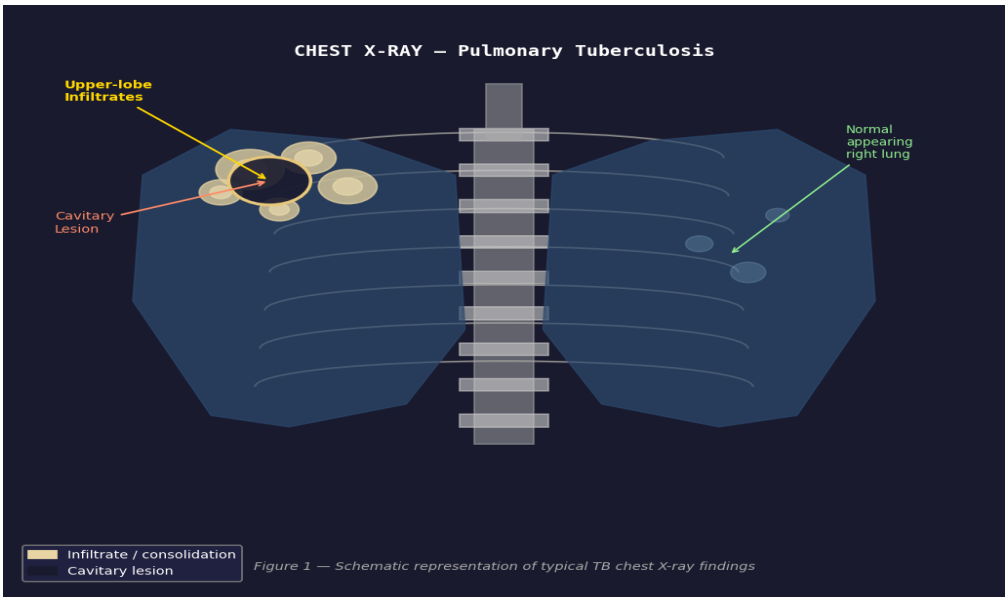

Figure 1: Schematic chest X-ray showing typical pulmonary TB findings — upper-lobe infiltrates (yellow) and cavitary lesion (outlined circle, left upper lobe).

Globally, tuberculosis is one of the top ten causes of death from a single infectious agent. According to WHO estimates, over 10 million new TB cases occur annually, resulting in approximately 1.3 million deaths, with South-East Asia and sub-Saharan Africa carrying the greatest burden [1]. Compounding this challenge is the emergence of drug-resistant strains — Multidrug-Resistant TB (MDR-TB) and Extensively Drug-Resistant TB (XDR-TB) — that demand more complex and costly treatments [4].

Co-infection with HIV further complicates the clinical picture. An HIV-positive individual has a dramatically higher risk of progressing from latent TB infection to active disease, and clinical outcomes tend to be significantly worse [12]. Poverty, malnutrition, overcrowding, and limited access to healthcare create a cycle that sustains transmission in vulnerable communities [14].

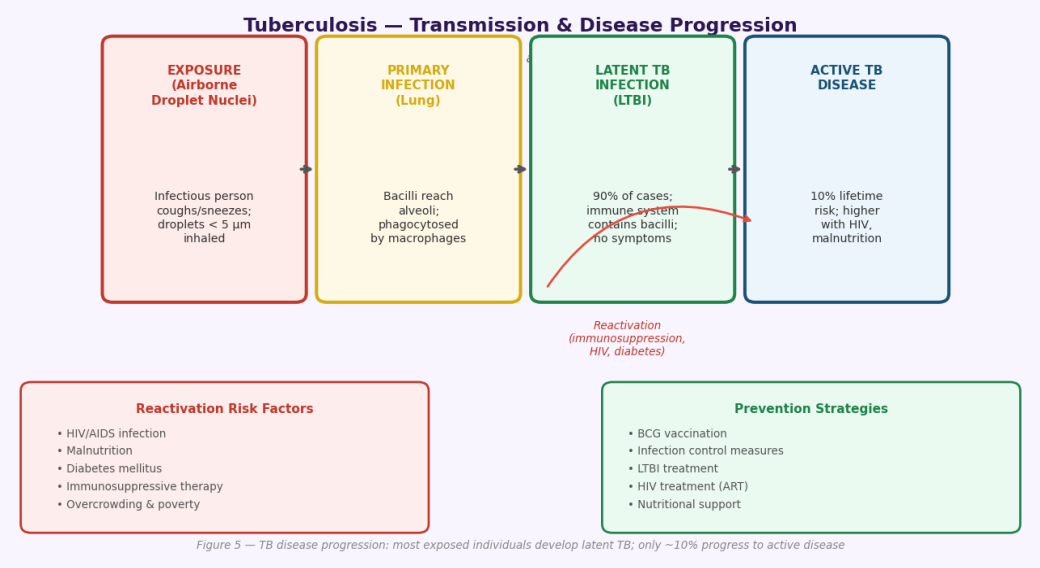

Figure 2: TB disease progression — from initial airborne exposure through latent infection to active pulmonary disease, with key reactivation risk factors.

The clinical presentation of PTB is not always straightforward. Patients often arrive with a gradual constellation of symptoms — a persistent cough, unexplained weight loss, drenching night sweats — that can be mistaken for other respiratory illnesses. This diagnostic ambiguity frequently leads to delays that worsen outcomes and prolong community spread [15]. This review synthesizes current evidence to provide a practical, evidence-based resource for clinicians managing pulmonary tuberculosis.

2. METHODS

2.1 Study Design

This study was conducted as a narrative review and descriptive synthesis of published literature. No original patient data were collected, and no clinical research ethics approval was required. The review aimed to provide clinically relevant, evidence-based guidance on the epidemiology, diagnosis, and management of pulmonary tuberculosis, applicable to hospital therapy practice.

2.2 Literature Search Strategy

A comprehensive, structured literature search was conducted in February–March 2025 across three electronic databases: PubMed/MEDLINE, Google Scholar, and Scopus. The following search terms were used in combination:

- "Pulmonary tuberculosis" OR "TB" OR "Mycobacterium tuberculosis"
- "Diagnosis" OR "GeneXpert" OR "sputum microscopy" OR "chest X-ray"
- "Treatment" OR "DOTS" OR "anti-tuberculosis therapy" OR "MDR-TB"

- "Clinical presentation" OR "symptoms" OR "epidemiology"

Boolean operators (AND, OR) were used to combine terms. Searches were limited to English-language publications. Reference lists of included articles were hand-searched to identify additional relevant studies. WHO Global Tuberculosis Reports (2024 and 2025) and national TB treatment guidelines from India and Kyrgyzstan were consulted as primary policy documents.

2.3 Inclusion and Exclusion Criteria

Articles were included if they met the following criteria:

- Published in peer-reviewed journals between January 2010 and March 2025
- Addressed pulmonary TB epidemiology, clinical features, diagnosis, or treatment outcomes
- Written in English with sufficient methodological quality and transparent reporting
- Included original research studies, systematic reviews, meta-analyses, or authoritative clinical guidelines

Articles were excluded if they focused exclusively on extrapulmonary TB without relevance to pulmonary disease, had methodological quality concerns (e.g., no clear study design or unverifiable data), or were published only as conference abstracts without full peer-reviewed text.

2.4 Study Selection and Data Extraction

After the initial database search, titles and abstracts were screened for relevance by two reviewers (VB and PD). Full texts of potentially eligible articles were retrieved and assessed against inclusion criteria. Disagreements were resolved through discussion with a third reviewer (RN). Data were extracted systematically and organized thematically into four domains: (1) epidemiology, (2) clinical features, (3) diagnostic methods, and (4) treatment protocols. Descriptive synthesis was used to identify consistent patterns and translate findings into clinical recommendations.

2.5 Quality Assessment

Methodological quality of included primary studies was appraised using the Newcastle-Ottawa Scale for observational studies and AMSTAR-2 criteria for systematic reviews and meta-analyses. Only studies rated as moderate to high quality were used to inform quantitative statements in the Results section.

3. RESULTS

3.1 Global Epidemiology

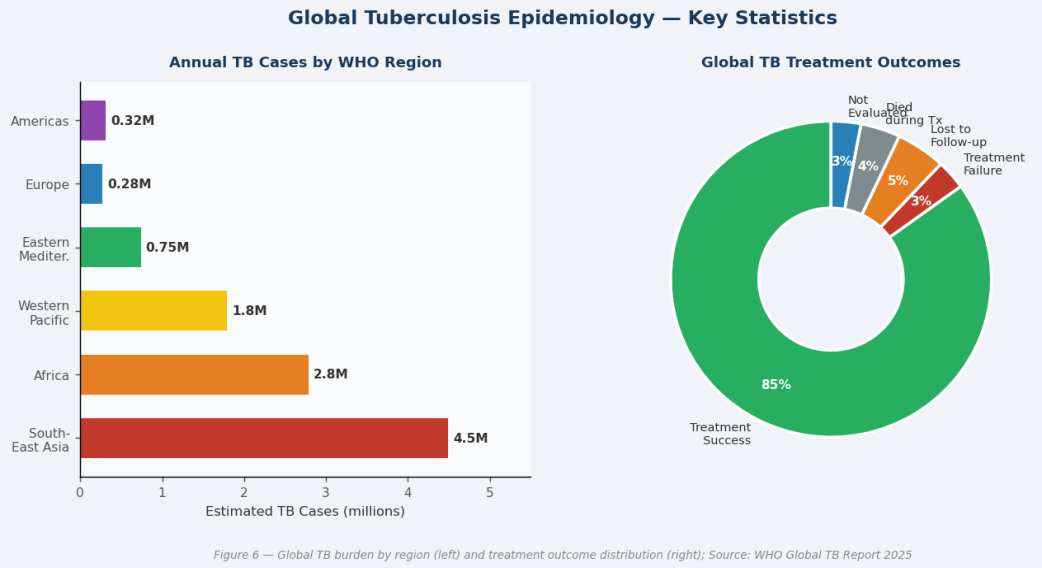

Figure 3: Global TB epidemiology — annual case distribution by WHO region (left) and treatment outcome proportions (right); Source: WHO Global TB Report 2025.

Tuberculosis continues to impose an enormous burden on global health systems. According to the WHO Global TB Report 2025, approximately 10.8 million new TB cases were reported worldwide in 2024, with an estimated 1.3 million deaths [1]. Higher incidence rates are consistently reported in low- and middle-income countries, with South-East Asia (approximately 4.5 million cases) and Africa (approximately 2.8 million cases) bearing the greatest regional burden [1].

Table 1: Epidemiological Profile of Pulmonary Tuberculosis — Global, India, and Kyrgyzstan (Sources: WHO Global TB Report 2025; India TB Report 2023).

Parameter	Global Data	India	Kyrgyzstan
Annual TB cases (2024 est.)	~10.8 million new cases/year	~2.69 million (highest burden globally)	~8,000–10,000 new cases/year
TB mortality (2024 est.)	~1.3 million deaths/year	~480,000 deaths/year	~600–700 deaths/year
TB incidence rate	133 per 100,000 population	196 per 100,000 population	77 per 100,000 population

Major risk groups	HIV, malnutrition, poverty, overcrowding	Dense urban population, limited rural access, malnutrition	Migrant workers, socioeconomic deprivation, alcohol use
Drug-resistant TB burden	~400,000 MDR/RR-TB cases/year	~119,000 MDR/RR-TB cases/year	Rising — enhanced MDR-TB surveillance under way
Treatment success rate (DS-TB)	~88% globally	~85% (national average)	~80–83%
HIV-TB co-infection	~8% of all TB cases	~2.8% of TB cases HIV-positive	~2% of TB cases HIV-positive

3.2 Clinical Features

The classical symptoms of active pulmonary tuberculosis were consistently reported across the reviewed literature. Cough lasting more than two weeks was the most frequently described presenting symptom, reported in 85–95% of culture-confirmed PTB cases in prospective studies [5,8]. Systemic symptoms — fever, night sweats, and weight loss — were present in 60–80% of confirmed cases depending on population and disease stage. Hemoptysis, while clinically alarming, was documented in only 15–30% of cases and is more commonly associated with advanced cavitary disease [8,12].

Table 2: Clinical Manifestations of Pulmonary Tuberculosis with Reported Frequencies (Sources: MSF Guidelines 2025 [8]; Dheda et al. 2016 [12]; Shrivas & Singh 2025 [5])

Symptom	Reported Frequency (literature range)	Clinical Significance
Persistent cough (>2 weeks)	85–95% of confirmed cases	Most sensitive symptom; WHO-recommended screening trigger
Fever (especially afternoon)	60–80%	Common; low-grade pattern often overlooked
Night sweats	60–75%	Classic constitutional symptom
Weight loss / anorexia	55–75%	Associated with worse nutritional status and outcomes
Fatigue and generalized weakness	70–85%	Non-specific; contributes to diagnostic delay
Hemoptysis (blood in sputum)	15–30%	Suggests advanced or cavitary disease

Dyspnea (breathlessness)	20–40%	Present in extensive or bilateral disease

Diagnostic delay — defined as the interval between symptom onset and confirmed diagnosis — ranged from 30 to 120 days across included studies, with the longest delays reported in rural and resource-limited settings [15]. This delay is a key driver of onward community transmission.

3.3 Diagnostic Methods

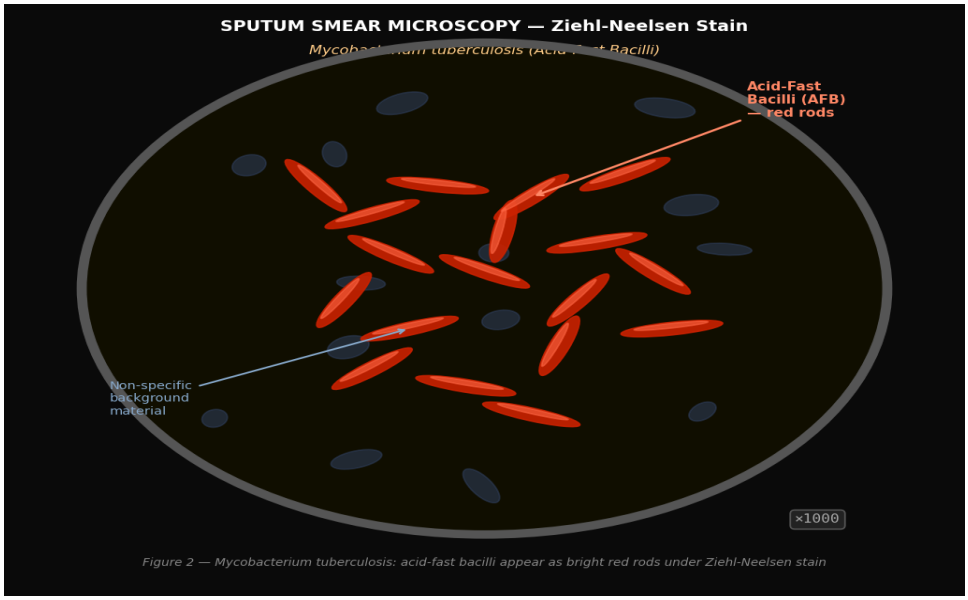

Figure 4: Sputum smear microscopy (Ziehl-Neelsen stain) — Mycobacterium tuberculosis appears as bright red acid-fast bacilli against a blue counterstained background. Magnification x1000

Diagnostic accuracy varies substantially between methods. Sputum smear microscopy, the most widely available test, has a sensitivity of only 45–65% in unselected populations, falling further to 20–40% in HIV-positive patients due to reduced bacillary load [10]. Sputum culture on Lowenstein-Jensen media or liquid MGIT culture remains the microbiological gold standard with sensitivity >95% but requires 2–8 weeks for results [10]. The GeneXpert MTB/RIF molecular assay has transformed the diagnostic landscape, achieving sensitivity of 88% in smear-negative patients (rising to >95% in smear-positive cases) and specificity of 99%, while simultaneously identifying rifampicin resistance within approximately two hours [6,9].

Table 3: Diagnostic Methods for Pulmonary Tuberculosis with Sensitivity and Specificity (Sources: Nahid et al. 2016 [10]; Horne et al. 2023 [9]; Rimal et al. 2022 [6]).

Diagnostic Method	Sensitivity	Specificity	Key Notes
Sputum Smear Microscopy (AFB)	45–65% (20–40% in HIV+)	98%	Widely available, low cost; poor sensitivity in advanced HIV
Sputum Culture (LJ / MGIT)	>95%	98–99%	Gold standard; results in 2–8 weeks
Chest X-Ray	~87% (varies)	~89% (varies)	Upper-lobe infiltrates, cavitation; not pathognomonic
GeneXpert MTB/RIF	88% (smear-neg); >95% (smear-pos)	99%	Detects RIF resistance; WHO-recommended first-line test
Tuberculin Skin Test (TST)	~70–90%	~70–90%	Identifies latent infection; limited specificity in BCG-vaccinated
IGRA	~80–90%	~96%	More specific for LTBI; less affected by BCG vaccination

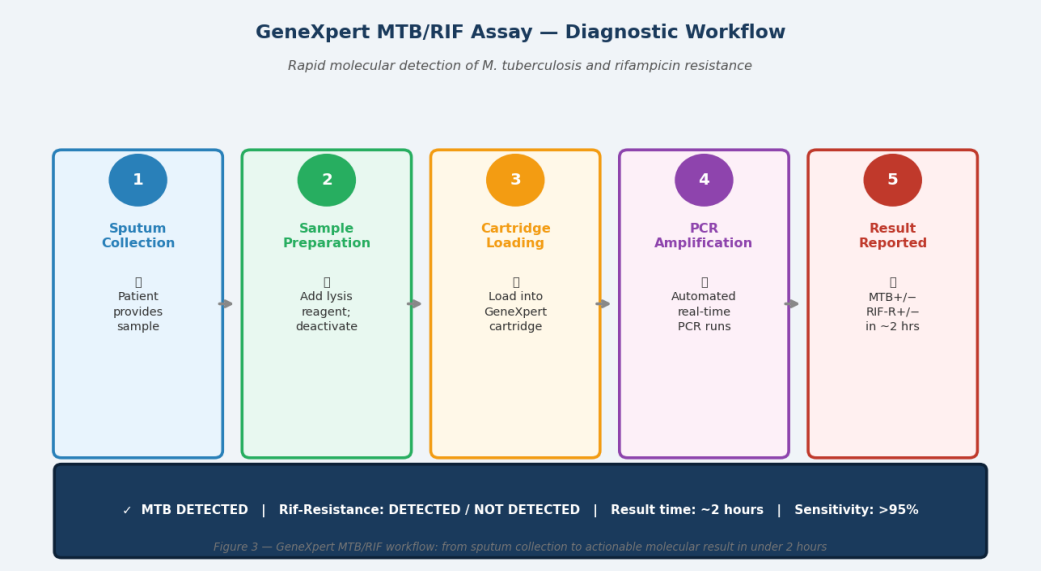

Figure 5: GeneXpert MTB/RIF diagnostic workflow — from sputum collection to molecular result in under 2 hours, with simultaneous detection of rifampicin resistance.

Clinical Insight: When to Use GeneXpert

GeneXpert MTB/RIF is particularly valuable in smear-negative or HIV-positive patients, where conventional microscopy sensitivity is markedly reduced. WHO now recommends GeneXpert as the initial diagnostic test in all presumptive TB cases where available. It detects

rifampicin resistance as a proxy for MDR-TB, enabling timely initiation of appropriate second-line therapy.

3.4 Treatment Regimens

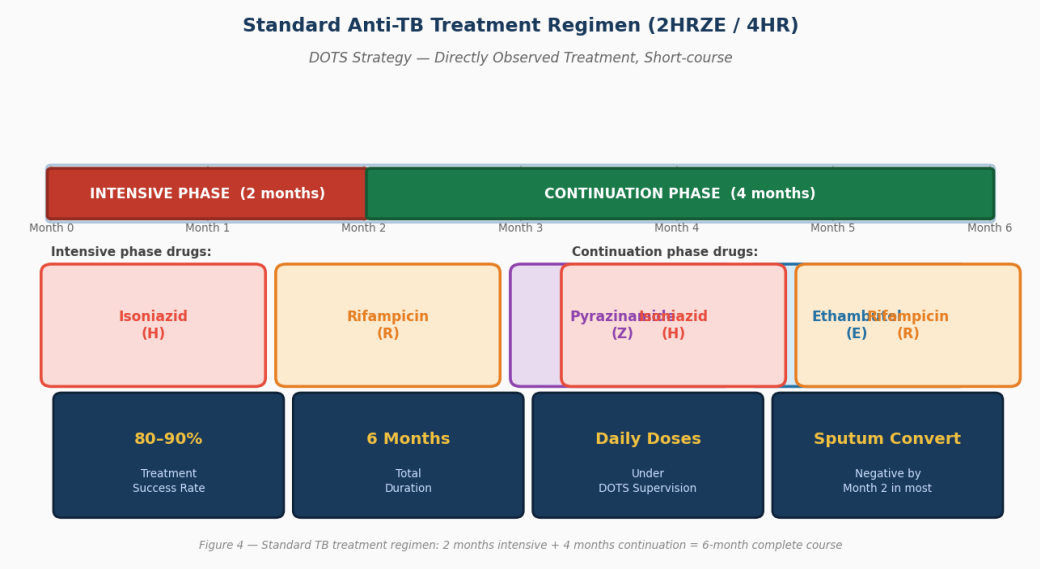

Figure 6: Standard anti-TB treatment regimen (2HRZE/4HR) — intensive phase (2 months, four drugs) followed by continuation phase (4 months, two drugs), with key outcome statistics.

The standard first-line regimen (2HRZE/4HR) achieves treatment success in 80–90% of drug-susceptible TB cases globally when patients complete the full course [1,10]. Sputum smear conversion — the transition from smear-positive to smear-negative — occurs in approximately 90% of patients by the end of the intensive phase (week 8) [10]. Treatment failure, defined as sputum remaining or reverting to positive at month 5 or beyond, occurs in approximately 3% of patients treated with first-line regimens globally [1].

Table 4: Standard First-Line Anti-Tuberculosis Treatment Regimen (2HRZE/4HR) with Outcomes (Source: Nahid et al. 2016 [10]; WHO Global TB Report 2025 [1]).

Phase	Duration	Medications	Key Outcome
Intensive Phase	2 months (8 weeks)	Isoniazid (H) + Rifampicin (R) + Pyrazinamide (Z) + Ethambutol (E)	~90% sputum conversion by week 8
Continuation Phase	4 months (16 weeks)	Isoniazid (H) + Rifampicin (R)	80–90% treatment success at 6 months

For drug-resistant TB, WHO-recommended longer regimens are required. MDR-TB treatment success rates range from 59–63% globally — significantly lower than drug-susceptible TB — and are associated with substantially higher costs, greater drug toxicity, and longer treatment durations of 18–24 months [1,4]. This disparity underscores the critical importance of preventing resistance through ensuring full adherence to first-line regimens.

4. DISCUSSION

4.1 Interpreting the Findings

The evidence reviewed consistently demonstrates that pulmonary tuberculosis rewards clinical vigilance and punishes diagnostic delay. The cardinal triad of prolonged cough, fever, and weight loss represents a critical window for early intervention. The 30–120 day average diagnostic delay documented in the literature is not merely a clinical inconvenience — each day of delay prolongs infectivity in the community, with a single untreated smear-positive patient capable of infecting 10–15 contacts per year [15].

GeneXpert MTB/RIF emerges as one of the most impactful diagnostic advances of the past decade. Its ability to provide a result within two hours — compared to weeks for culture — has been transformative in resource-limited settings. A 2023 Cochrane systematic review (Horne et al.) pooling data from over 16,000 patients confirmed sensitivity exceeding 95% in smear-positive specimens and approximately 88% in smear-negative specimens, with consistent specificity of 99% [9].

4.2 Alignment with WHO Guidance

Findings are broadly consistent with WHO 2025 consolidated TB guidelines, which recommend GeneXpert as the initial diagnostic test, universal drug susceptibility testing at diagnosis, and standardized DOTS-based therapy. The global treatment success rate of approximately 88% for drug-susceptible TB — while meaningful progress — falls short of the WHO End TB Strategy target of 90% by 2025, highlighting continued need for adherence support and system strengthening [1,2].

4.3 Contribution to the Literature

Contribution and Originality of This Narrative Review

This review makes the following specific contributions to the existing literature:

1. Integration of quantitative epidemiological data from India and Kyrgyzstan — two distinct high-burden contexts — enabling clinically relevant comparison of national TB control strategies.

2. A synthesized comparison of diagnostic test performance (sensitivity, specificity) across all major modalities, presented in a single clinician-accessible reference table.
3. Practical, tiered clinical recommendations structured by professional role (clinician, diagnostic service, treatment team, hospital administration), which are absent from single-method research articles.
4. An up-to-date synthesis of MDR-TB treatment outcome data alongside drug-susceptible TB outcomes, contextualizing the comparative therapeutic challenge.

4.4 Limitations

Several limitations should be acknowledged. As a narrative review, this work is inherently subject to selection bias — the authors selected studies based on relevance, which may underrepresent negative findings or heterogeneous outcomes. The review relies on previously published literature, which may not capture the most recent local epidemiological changes, particularly in Kyrgyzstan, where surveillance data are less granular. Many included source studies were retrospective or regionally focused, limiting generalizability. Future prospective, population-based studies from Central Asian and South Asian settings would strengthen the evidence base.

5. Practical Recommendations

For Clinicians

Maintain high suspicion for TB in patients with cough lasting more than two weeks, particularly when accompanied by fever, night sweats, or unexplained weight loss. Do not defer diagnostic workup while awaiting radiological results. Initiate two sputum specimens for AFB smear and GeneXpert simultaneously on the same day of clinical presentation.

For Diagnostic Services

Adopt a combined diagnostic strategy as the minimum standard: sputum smear microscopy + GeneXpert MTB/RIF + chest radiography. Reserve culture and drug susceptibility testing for smear-negative cases with high clinical suspicion, and for all cases requiring resistance profiling. Report results within 24 hours of sample receipt.

For Treatment Teams

Strict adherence to the 2HRZE/4HR regimen is non-negotiable. Implement DOTS or digital adherence monitoring for all confirmed cases. Prioritize enhanced follow-up for patients with

HIV co-infection, diabetes mellitus, malnutrition, or prior TB treatment, as these groups carry the highest risk of treatment failure and relapse.

For Hospital Administration

Invest in infection control infrastructure: negative-pressure isolation rooms, adequate N95 mask supply, and systematic TB screening protocols for healthcare workers. Integrate TB and HIV clinic services to streamline care for co-infected patients. Audit treatment outcomes quarterly against WHO benchmarks.

6. CONCLUSION

Pulmonary tuberculosis continues to be one of the most pressing infectious disease challenges of our time. Despite significant advances in diagnostics and treatment, the disease persists — driven by social determinants, healthcare inequities, and the ever-present threat of drug resistance. The evidence synthesized in this narrative review reinforces a consistent set of principles: earlier recognition of symptoms, wider deployment of rapid molecular diagnostics, strict adherence to standardized anti-TB regimens, and robust patient follow-up.

When these principles are applied consistently — as demonstrated by the 80–90% treatment success rates achievable with the 2HRZE/4HR regimen — outcomes are meaningfully improved and community transmission can be curtailed. Achieving the WHO End TB Strategy targets will require sustained, multi-level commitment: from the bedside clinician recognizing the first productive cough, to the health system providing accessible diagnostics, to the national policymaker funding the infrastructure to make it all possible.

7. Future Research Directions

- Prospective, hospital-based cohort studies in Central Asia and South Asia evaluating real-time treatment outcomes and resistance emergence patterns
- Quantitative investigation of comorbidity impact — HIV, diabetes, malnutrition — on treatment success and drug-susceptible TB relapse rates
- Randomized controlled trials evaluating novel 4-month treatment regimens (e.g., containing rifapentine) in diverse population groups
- Health economic analyses of digital adherence technologies versus traditional DOTS in low-income settings
- Comparative urban-versus-rural analyses to identify modifiable service delivery gaps in diagnostic access

- Studies on host immunological biomarkers for TB activity monitoring and early treatment response prediction

REFERENCES

1. World Health Organization. Global Tuberculosis Report 2025. Geneva: WHO; 2025.
2. WHO. Consolidated guidelines on tuberculosis, Module 3: Diagnosis. Geneva: WHO; 2025.
3. WHO. Consolidated guidance on tuberculosis data generation and use: Module 1: Surveillance. Geneva: WHO; 2024.
4. Saukkonen JJ, et al. ATS/CDC/ERS/IDSA Clinical Practice Guideline on Treatment of Drug-Susceptible and Drug-Resistant Tuberculosis. Am J Respir Crit Care Med. 2025;211(1):e1-e58.
5. Shrivas A, Singh S. Tuberculosis diagnosis and management: recent advances. J Glob Infect Dis. 2025;17(1):3-9.
6. Rimal R, et al. Diagnostic performance of GeneXpert MTB/RIF in smear-negative presumptive TB patients. BMC Infect Dis. 2022;22:321.
7. Jain J, et al. Diagnostic accuracy of GeneXpert MTB/RIF assay for tubercular pleural effusion. PLoS One. 2021;16(6):e0251618.
8. MSF Medical Guidelines. Pulmonary tuberculosis: clinical features and management. Geneva: MSF; 2025.
9. Horne DJ, et al. Xpert MTB/RIF and Xpert MTB/RIF Ultra for pulmonary tuberculosis and rifampicin resistance in adults (systematic review). Cochrane Database Syst Rev. 2023;CD009593.
10. Nahid P, et al. Official American Thoracic Society/Centers for Disease Control and Prevention/Infectious Diseases Society of America Clinical Practice Guidelines: Treatment of Drug-Susceptible Tuberculosis. Clin Infect Dis. 2016;63(7):e147-e195.
11. Central TB Division, MoHFW, India. India TB Report 2023. New Delhi: Ministry of Health and Family Welfare; 2023.
12. Dheda K, Barry CE 3rd, Maartens G. Tuberculosis. Lancet. 2016;387(10024):1211-1226.
13. Getahun H, et al. Management of latent Mycobacterium tuberculosis infection: WHO guidelines for low tuberculosis burden countries. Eur Respir J. 2015;46(6):1563-1576.
14. Lonnroth K, et al. Drivers of tuberculosis epidemics: the role of risk factors and social determinants. Soc Sci Med. 2009;68(12):2240-2246.
15. Sreeramareddy CT, et al. Time delays in diagnosis of pulmonary tuberculosis: a systematic review of literature. BMC Infect Dis. 2009;9:91.