# Challenges and Progress in India's National Tuberculosis Elimination Programme: A Comprehensive Review

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## Abstract

India's National Tuberculosis Elimination Programme (NTEP), formerly the Revised National Tuberculosis Control Programme (RNTCP), represents one of the world's most ambitious public health initiatives, aiming to eliminate tuberculosis (TB) by 2025—five years ahead of the United Nations Sustainable Development Goals (SDGs) target of 2030. Elimination is defined as reducing TB incidence to less than 44 cases per 100,000 population, mortality to fewer than 3 deaths per 100,000, and ensuring zero catastrophic costs for affected households. This comprehensive review synthesizes epidemiological trends, programmatic achievements, persistent challenges, and proposed research protocols based on data up to September 2025. Key progress includes a 17.7% decline in TB incidence from 2015 to 2023 (from 237 to 195 per 100,000) and a 24% reduction in mortality, driven by innovations such as molecular diagnostics, private sector engagement, and community-led initiatives like the Pradhan Mantri TB Mukt Bharat Abhiyaan (PMTBMBA). However, India still accounts for 27% of global TB cases, with an estimated 2.82 million new infections and 331,000 deaths in 2023. Major challenges encompass multidrug-resistant TB (MDR-TB), diagnostic delays, catastrophic financial burdens, human resource shortages, and social stigma. We identify five burning problems and devise evidence-based research protocols to address them, emphasizing multidisciplinary, ethical, and scalable approaches. Achieving the 2025 target remains unlikely without accelerated multisectoral collaboration, increased funding, and adaptive strategies informed by robust research. This review underscores the need for sustained political commitment to translate ambition into actionable outcomes.

\*\*Keywords:\*\* Tuberculosis elimination, NTEP, India, MDR-TB, diagnostic delays, catastrophic costs, research protocols, public health policy

## Introduction

Tuberculosis (TB) remains a formidable global health challenge, disproportionately affecting low- and middle-income countries. India, with its population exceeding 1.4 billion, shoulders the highest TB burden worldwide, contributing approximately 27% of the 10.4 million estimated new cases and 29% of the 1.8 million TB-related deaths annually.<grok:render card\_id="41b45c" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> The National Tuberculosis Elimination Programme (NTEP), launched in 2017 under the National Strategic Plan (NSP) 2017-2025, builds on the foundations of the Revised National Tuberculosis Control Programme (RNTCP) and adopts a multifaceted approach to achieve TB elimination by 2025.<grok:render card\_id="96c270" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> This target aligns with the World Health Organization's (WHO) End TB Strategy but advances the timeline aggressively, aiming for an incidence rate below 44 per 100,000, mortality below 3 per 100,000, and zero households facing catastrophic costs due to TB.<grok:render card\_id="39788a" card\_type="citation\_card" type="render\_inline\_citation">

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The NTEP operates on four strategic pillars: Detect, Treat, Prevent, and Build (DTPB). Detection emphasizes active case-finding through tools like nucleic acid amplification tests (NAATs) and chest X-rays. Treatment focuses on standardized regimens, including shorter courses for drug-resistant strains. Prevention targets high-risk groups with TB preventive therapy (TPT), while the "Build" pillar fosters multisectoral partnerships and community engagement.<grok:render card\_id="791c7b" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> Initiatives such as the PMTBMBA, launched in 2022, have mobilized over 160,000 Ni-kshay Mitras (community supporters) to provide nutritional aid to more than 1.14 million patients, addressing undernutrition—a key TB risk factor.<grok:render card\_id="1e3d91" card\_type="citation\_card" type="render\_inline\_citation">

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Despite these efforts, the COVID-19 pandemic disrupted services, leading to an estimated 1.5 million missed TB diagnoses globally in 2020, with India heavily impacted.<grok:render card\_id="df5a00" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> Recent data from the India TB Report 2024 indicate record notifications of 26.07 lakh cases in 2023, yet experts consensus that the 2025 elimination goal is unattainable, with incidence declines falling short of the required 10-15% annual reduction.<grok:render card\_id="b41d2d" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render><grok:render card\_id="f59484" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> This review critically analyzes progress, identifies key challenges, prioritizes burning problems, and proposes research protocols to inform post-2025 strategies, drawing from systematic reviews, programmatic reports, and epidemiological studies up to 2025.

## Overview of the National Tuberculosis Elimination Programme

The NTEP's evolution from the RNTCP reflects a shift from control to elimination, incorporating digital health tools like the Ni-kshay portal for real-time tracking and direct benefit transfers (DBT) under the Ni-kshay Poshan Yojana (NPY), providing INR 500 monthly to patients for nutrition.<grok:render card\_id="37773e" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> Integration with the Ayushman Bharat scheme has expanded access to diagnostics and treatment in primary health centers. Private sector engagement has surged, contributing 33% of notifications in 2023, up from negligible levels in 2015, facilitated by mandatory reporting and incentives.<grok:render card\_id="92a8ce" card\_type="citation\_card" type="render\_inline\_citation">

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Recent updates include the rollout of shorter MDR-TB regimens (6-9 months) incorporating drugs like bedaquiline and delamanid, and pilots for AI-assisted X-ray screening.<grok:render card\_id="467df3" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> The 100-day TB Mukt Bharat Abhiyaan campaign in 2024 intensified active case-finding in high-burden districts, targeting vulnerable populations such as migrants, prisoners, and urban slums.<grok:render card\_id="2e71d8" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> Vaccine development, including trials for M72/AS01E and BCG revaccination, is prioritized under the India TB Research Consortium.<grok:render card\_id="65bc96" card\_type="citation\_card" type="render\_inline\_citation">

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## Key Achievements and Progress

Epidemiological gains are evident: TB incidence declined 17.7% from 2015 to 2023 (237 to 195 per 100,000), surpassing the global average of 8.3%, while mortality fell 24% (28 to 22 per 100,000).<grok:render card\_id="d5e6dc" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render><grok:render card\_id="a1ae21" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> Notifications reached 26.07 lakh in 2023, with 95% treatment initiation rates achieved.<grok:render card\_id="826409" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render><grok:render card\_id="925982" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> Treatment success rates improved to 89% for drug-susceptible TB, 87% for MDR-TB, and 68% for extensively drug-resistant TB (XDR-TB).<grok:render card\_id="8aac65" card\_type="citation\_card" type="render\_inline\_citation">

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Community engagement has been transformative; PMTBMBA has reduced malnutrition-related risks, with studies showing nutritional support lowering mortality by up to 50% in undernourished patients.<grok:render card\_id="fddfec" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> Digital innovations, including e-Ni-kshay for contact tracing, have enhanced surveillance.<grok:render card\_id="39c3b4" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> State-level variations highlight successes in low-burden areas like Kerala (76 per 100,000) versus high-burden Delhi (499 per 100,000).<grok:render card\_id="21e167" card\_type="citation\_card" type="render\_inline\_citation">

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## Analysis of Key Challenges

### Epidemiological Challenges

India's TB epidemic is characterized by high MDR/XDR-TB prevalence (2.5% in new cases, 13% in retreatment), with 75,000 MDR-TB cases notified in 2023.<grok:render card\_id="3cacea" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> Co-infections with HIV (2%) and diabetes amplify vulnerability, while latent TB affects over 40% of the population.<grok:render card\_id="8f28b1" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> Extrapulmonary TB, often underdiagnosed, constitutes 20-25% of cases.<grok:render card\_id="18e9b6" card\_type="citation\_card" type="render\_inline\_citation">

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### Diagnostic and Surveillance Issues

Delays in diagnosis average 2-3 months, driven by limited access to NAATs in rural areas and underreporting (estimated 20-30% missed cases).<grok:render card\_id="8aa40b" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> The pandemic exacerbated this, with a 25% drop in notifications in 2020.<grok:render card\_id="de2e70" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> Surveillance gaps include inconsistent drug resistance testing and poor integration of private sector data.<grok:render card\_id="4f9e74" card\_type="citation\_card" type="render\_inline\_citation">

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### Treatment and Access Barriers

Drug stockouts occur in 10-15% of districts, and migrant patients face bureaucratic hurdles for continuity.<grok:render card\_id="5e01ca" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> New drug rollout is uneven, with only 50% of eligible MDR-TB patients accessing bedaquiline.<grok:render card\_id="0948da" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> Dropout rates remain at 10-15%, linked to adverse effects and poor adherence support.<grok:render card\_id="958d02" card\_type="citation\_card" type="render\_inline\_citation">

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### Socio-Economic and Behavioral Factors

Catastrophic costs affect 7-32% of drug-sensitive and 68% of DR-TB households, exacerbated by poverty and undernutrition.<grok:render card\_id="b89b29" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> Stigma delays care-seeking, particularly among women and marginalized groups.<grok:render card\_id="5b6b55" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> Tobacco and overcrowding fuel transmission in urban slums.<grok:render card\_id="1a7a07" card\_type="citation\_card" type="render\_inline\_citation">

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### Systemic and Infrastructure Gaps

Staff vacancies exceed 20% in rural facilities, with budget allocations at 1.4% of GDP insufficient for scale-up.<grok:render card\_id="0a3df4" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> Regional disparities persist, with higher burdens in northern states.<grok:render card\_id="e22ff4" card\_type="citation\_card" type="render\_inline\_citation">

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## Identification of Burning Problems

1. \*\*MDR/XDR-TB Prevalence and Treatment Access\*\*: High resistance rates and limited new drugs threaten epidemic control.<grok:render card\_id="104f91" card\_type="citation\_card" type="render\_inline\_citation">

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2. \*\*Delayed Diagnosis and Underreporting in Vulnerable Populations\*\*: Gaps in migrants and remote areas sustain transmission.<grok:render card\_id="2b8308" card\_type="citation\_card" type="render\_inline\_citation">

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3. \*\*Catastrophic Costs and Nutritional Deficits\*\*: Financial and nutritional burdens erode adherence.<grok:render card\_id="a0b097" card\_type="citation\_card" type="render\_inline\_citation">

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4. \*\*Human Resource and Infrastructure Shortages\*\*: Vacancies and stockouts hinder delivery.<grok:render card\_id="5212ae" card\_type="citation\_card" type="render\_inline\_citation">

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5. \*\*Stigma and Low Community Awareness\*\*: Behavioral barriers limit engagement and early detection.<grok:render card\_id="0d53cc" card\_type="citation\_card" type="render\_inline\_citation">

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## Proposed Research Protocols

These protocols are designed for feasibility within India's health infrastructure, with ethical oversight from bodies like the Indian Council of Medical Research (ICMR).

1. \*\*For MDR/XDR-TB\*\*: Prospective cohort RCT evaluating expanded shorter regimens. Recruit 2,000 patients from high-burden states; 3-year follow-up with genotyping and adherence tracking. Outcomes: treatment success, resistance emergence.<grok:render card\_id="93da73" card\_type="citation\_card" type="render\_inline\_citation">

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2. \*\*For Delayed Diagnosis\*\*: Mixed-methods study piloting mobile AI diagnostics. Survey 5,000 in 10 districts; 2-year duration with geospatial analysis.<grok:render card\_id="f6e7f3" card\_type="citation\_card" type="render\_inline\_citation">

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3. \*\*For Catastrophic Costs\*\*: Longitudinal RCT on augmented nutrition via PMTBMBA. Enroll 1,500; 18-month follow-up using WHO costing tools.<grok:render card\_id="745095" card\_type="citation\_card" type="render\_inline\_citation">

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4. \*\*For Infrastructure Shortages\*\*: Cluster-randomized trial on task-shifting and telemedicine. 20 districts; 2 years, with system dynamics modeling.<grok:render card\_id="0b727d" card\_type="citation\_card" type="render\_inline\_citation">

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5. \*\*For Stigma\*\*: Qualitative action research on media campaigns. 500 participants; 1-year iterative design with stigma scales.<grok:render card\_id="4c25ed" card\_type="citation\_card" type="render\_inline\_citation">

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## Discussion

NTEP's progress is commendable, but challenges like the pandemic's legacy and slow incidence declines highlight the need for bolder interventions.<grok:render card\_id="57aa9c" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> Global lessons, such as Vietnam's rapid diagnostics scale-up, could inform adaptations.<grok:render card\_id="838f25" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> Forecasting models predict 28.36 lakh cases in 2025 without acceleration.<grok:render card\_id="ffd11c" card\_type="citation\_card" type="render\_inline\_citation">

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</grok:render> Equity-focused approaches are crucial for vulnerable groups.

## Conclusion

India's TB elimination journey requires urgent scaling of innovations, funding to 2.5% GDP, and research-driven policies. While 2025 may be aspirational, sustained efforts can achieve substantial reductions by 2030.

## Acknowledgments

This review synthesizes publicly available data; no funding was received.

## Conflicts of Interest

None declared.

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