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NATIONAL INSTITUTE FOR RESERCH IN TUBERCULOSIS

INDIA'S PROGRESS IN ADDRESSING THE CHALLENGE OF TUBERCULOSIS

Stakeholder engagement for strengthening TB care using public-private partnership, patient centred service delivery models and integration of digital health technologies

Gates Foundation

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Foreword

India's Advances and Challenges in TB Elimination

Tuberculosis (TB) remains a significant public health challenge, but it is equally a social and economic one. The burden of TB is felt most deeply by families and communities whose lives are shaped by vulnerability, limited access to services, and persistent stigma. This report, grounded in regional consultations and enriched by diverse stakeholder perspectives, underscores the need for a holistic, people-centred approach to TB elimination.

The findings emphasise the importance of recognising gendered and social dimensions of the disease. Women, adolescents, and marginalised communities often encounter barriers in accessing diagnosis, treatment, nutrition support, and digital platforms that facilitate social protection. Addressing these inequities is critical not only for improving individual outcomes, but also for strengthening India's overall response to TB.

The consultations also highlight the remarkable progress India has made in digital health, indigenous diagnostics, AI-enabled screening, and public–private collaboration. These advances demonstrate the country's capacity for innovation and its readiness to lead globally in the fight against TB. However, technology alone is not enough. Community engagement, survivor-led advocacy, psychosocial counselling, and post-treatment care must remain integral to programme strategies.

The Women's Collective Forum is committed to ensuring that policies and programmes reflect the voices and lived experiences of women, frontline workers, and TB survivors. I commend ICMR–NIRT, state teams, CII, development partners, and community organisations for producing a report that is comprehensive, actionable, and aligned with national priorities.

As India advances toward its TB elimination goal, this document serves as an important resource—one that calls for collective responsibility, coordinated action, and an unwavering commitment to dignity, equity, and resilience for every individual affected by TB.

Mrs Smriti Z. Irani

Founder & Chairperson
The Alliance for Global Good: Gender Equity & Equality
Advisor – Women's Collective Forum

Foreword

India stands at a pivotal moment in its mission to end tuberculosis, building on decades of scientific progress and renewed political and community commitment. This report captures that continuing journey and provides a prospective framework to expedite progress towards the elimination of tuberculosis by 2030

Through the National Tuberculosis Elimination Programme, the country has expanded free nationwide diagnosis and treatment, rapidly scaled up molecular testing, and positioned digital platforms such as Nikshay at the core of surveillance and patient management. These advances—combined with nutritional support, active case finding, and community outreach—underscore India's commitment to a comprehensive, equity-driven response to TB.

This document synthesises insights from regional stakeholder consultations convened by ICMR-NIRT in partnership with the Women's Collective Forum, bringing together programme managers, clinicians, researchers, private practitioners, TB survivors, development partners, and community representatives from across India. The consultations focused on six thematic areas: service delivery, digital health integration, public–private partnerships, context-specific challenges in the Northeast, vulnerabilities in rural and tribal communities, and the needs of migrant populations, grounding the report in both programmatic realities and lived experience.

The recommendations advance differentiated, patient-centred models of care, with particular attention to individuals with severe disease, undernutrition, alcohol dependence, adolescents, women, and those living with post TB sequelae. They also highlight the potential of India's innovation ecosystem from AI enabled diagnostics and digital adherence technologies to integrated data platforms, to close diagnostic gaps, improve treatment outcomes, and strengthen health system resilience.

A consistent theme across the consultations is the centrality of partnership: between public and private sectors, between national and state programmes, between communities and health systems, and across sectors working on nutrition, livelihoods, social protection, and mental health. By foregrounding the needs of rural, tribal, northeastern, and migrant communities, the report situates TB elimination within a broader commitment to social justice and inclusive development.

This report is presented as a practical guide for policymakers, programme leaders, practitioners, and civil society to translate evidence into action at scale. With urgency, accountability, and sustained investment, India can not only achieve its TB elimination targets but also offer the world a compelling model of people centred, innovation driven TB control.

Dr Srinath Satyanarayana

Director, ICMR-NIRT

Foreword

India's Advances and Challenges in TB Elimination

Tuberculosis continues to be one of India's most urgent public health priorities. While the country has made significant strides in expanding diagnostics, strengthening treatment pathways, and enhancing community engagement, the consultations synthesised in this report demonstrate that sustained, coordinated effort is essential to meet our national goal of TB elimination.

The stakeholder discussions captured a wide spectrum of challenges and innovations—from the need for differentiated care models, improved nutritional and psychosocial support, and strengthened private-sector engagement, to the importance of robust digital systems for surveillance, adherence, and programme monitoring. These insights reaffirm that TB elimination requires interventions that are clinically sound, socially responsive, and operationally feasible across diverse settings.

The report also highlights India's strong trajectory in adopting indigenous diagnostics, AI-driven tools, and advanced molecular technologies. When deployed equitably and supported by trained frontline workers, these innovations can accelerate early detection, reduce diagnostic delays, and improve treatment outcomes. At the same time, the vulnerabilities faced by tribal communities, migrants, adolescents, and urban poor communities demand tailored, context-specific solutions that strengthen last-mile delivery.

CII Centre for Health views this as a clarion call for programme planners, policymakers, and partners in prioritising interventions that deliver sustainable impact. I congratulate ICMR–NIRT, the Women's Collective Forum, state programme teams, civil society groups, and TB champions whose collective expertise has shaped this report.

With continued political commitment, scientific leadership, and community participation, India is well positioned to advance toward a TB-free future. This report provides valuable guidance as we work together to translate that aspiration into reality.

Dr Randeep Guleria

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We extend our heartfelt thanks to Dr Manoj Murhekar (Former) Director of ICMR-National Institute for Research in Tuberculosis (ICMR-NIRT) and Dr Srinath Satyanarayana Director of ICMR-NIRT for their encouragement and support to the organising team in conducting these consultations as well as compiling the report. Finally, we thank the staff of ICMR-NIRT for their time, knowledge, and valuable input during the discussions. Overall, the consultation’s success stems from the collaborative expertise, knowledge sharing, and commitment of all participants toward strengthening India’s TB elimination efforts.

Abbreviations

ACF	Active Case Finding
ACSM	Advocacy Communication and Social Mobilsation
ANM	Auxiliary Nurse Midwife
ART	Antiretroviral Therapy
ASHA	Accredited Social Health Activist
AUDIT-C	Alcohol Use Disorders Identification Test - Consumption
AYUSH	Ayurveda, Yoga and Naturopathy, Unani, Siddha, and Homeopathy
BMI	Body Mass Index
CAGE	Cut down, Annoyed, Guilty, and Eye-opener.
CBNAAT	Cartridge-Based Nucleic Acid Amplification Test
CDSCO	Central Drugs Standard Control Organisation
CSR	Corporate Social Responsibility
CTD	Central TB Division
DAY-NULM	Deendayal Antyodaya Yojana-National Urban Livelihoods Mission
EDNS	Energy Dense Nutrient supplement
ICMR-NIRT	ICMR- National Institute for Research in Tuberculosis
LTBI	Latent TB infection
MDR-TB	Multi Drug resistant TB
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
NSDC	National Skill Development Corporation
NTEP	National Tuberculosis Elimination Programme
PDS	Public Distribution System
PPIA	Public–Private Interface Agency
PPP	Public-Private Partnership
PTLD	Post-Tuberculosis Lung Disease
SHG	Self Help Group
SSC	Sector Skill Councils
TB	Tuberculosis
TPT	Tuberculosis Preventive Treatment

Executive Summary

This executive summary highlights India's significant progress in combating tuberculosis (TB) through the National Tuberculosis Elimination Programme (NTEP), which emphasises the use of advanced molecular diagnostics, digital health technologies, patient and community-centric care. Despite substantial improvements towards TB elimination, India continues to bear a major portion of the global TB burden, accounting for about 27% of cases worldwide. Challenges such as socioeconomic disparities, malnutrition, comorbidities, and disruptions due to the COVID-19 pandemic still impede elimination efforts.

The report derives from a series of regional stakeholder consultations conducted by ICMR-NIRT in partnership with the Women's Collective Forum, engaging policymakers, NTEP representatives, healthcare providers (both public and private), researchers, and TB survivors from multiple Indian states and Union territories. These consultations aimed to identify critical challenges and formulate strategic responses by fostering multi-sectoral collaboration.

The following executive summary is structured into six themes which recommends a comprehensive integrated approach combining technology, community participation, and policy support to achieve TB elimination goals. Identified key priority areas encompass enhancing public-private partnership frameworks, expanding digital health technologies, and advocating for patient-centred approaches. Our findings necessitates continuous investment, capacity enhancement, research and innovation to promote indigenous technologies and digital tools, while concurrently strengthening health system resilience and addressing the social determinants of TB.

Theme I: Service delivery

India contributes about a quarter of the world's TB burden, facing persistent challenges despite significant progress by the NTEP. The following theme provides a detailed overview of service delivery gaps, emerging evidence, and actionable recommendations for India's TB elimination mission.

1.1 Mortality reduction:

Reducing TB mortality remains a key priority for the NTEP, as most TB-related deaths occur outside the treatment cascade, reflecting systemic and behavioural disparities across states. Addressing this requires state-specific mortality reduction strategies that include structured post-treatment follow-up, regular TB mortality audits, and

targeted capacity building for healthcare providers. Routine assessment of deaths and risk factors should inform evidence-based policy actions, while the introduction of real-time digital mortality audit dashboards can strengthen surveillance, accountability, and prompt responses to prevent avoidable TB deaths.

1.2 Differentiated care for high-risk individuals

The National TB Elimination Programme is addressing gaps in hospitalization and follow-up for severely ill patients through a differentiated, patient-centred care model that includes hospital protocols and community-based support involving caregivers, survivors, and health workers. Priorities include integrating alcohol screening, psychosocial counselling, and mental health linkages to reduce TB-related morbidity. Special attention to adolescents and women through youth-friendly clinics similar to the ICMR-NIRT's Child, Adolescents And Young Adults Clinic (CHAYA), adolescent-specific guidelines, integration of reproductive and mental health services, and improved access to social protection schemes will strengthen engagement, reduce stigma, and promote equitable, gender-responsive TB care.

1.3 Nutritional Intervention for individuals with Tuberculosis

Malnourished TB patients often delay care and struggle to complete treatment, making Nutritional support a vital component of TB management. Integrating food basket deliveries through platforms like Public Distribution System (PDS), Saksham Anganwadi and POSHAN 2.0, and PM POSHAN can enhance household food security, while routine assessments of food insecurity and digital BMI tracking in Nikshay can guide timely interventions. Quarterly nutrition reporting, mandatory deworming, provision of energy-dense supplements, and collaboration with AYUSH and local food systems will strengthen the link between TB treatment and nutritional recovery.

1.4 Community engagement and socio-economic Rehabilitation

Limited community awareness and delayed care-seeking continue to hinder timely TB diagnosis and treatment in India. Strengthening collaboration between NTEP and Self Help Groups can enhance community engagement, while coordination with the HIV programme can optimize shared resources and counselling services. Socioeconomic rehabilitation remains vital, requiring a national livelihood framework for TB survivors that includes job placement, vocational training, workplace TB advocacy, and simplified digital access to welfare benefits like PDS and DBT to promote recovery and long-term resilience.

1.5 Post-Tuberculosis Lung Disease (PTLD)

Research indicates that significant proportion of TB survivors exhibit chronic respiratory symptoms or structural lung damage, such as fibrosis, bronchiectasis, and airflow obstruction. PTLD significantly impacts morbidity, disability, and mortality rates. Establishing a national framework for post-TB care is crucial. The key recommendations include development of digital and AI-driven surveillance tools for PTLD, the integration of a national post-TB follow-up database within Nikshay, the

establishment of dedicated PTLD clinics, the training of healthcare workers in pulmonary rehabilitation, and collaboration with AYUSH systems to create integrated post-TB care protocols.

1.6 Service Delivery in High-Burden Urban Areas

TB control in urban cities like New Delhi is challenged by fragmented healthcare delivery, weak sample transportation system, and overburdened laboratories, causing diagnosis and treatment delays. A multi-sectoral TB management framework integrating hospitals, clinics, and urban health services is essential, with resource allocation based on local disease patterns and migration trends. Strengthening linkage with Urban Livelihoods Mission (DAY-NULM) for urban poor, tailored Information Education and communication (IEC) for different communities, and centralized 24/7 laboratories using efficient commercial logistics models can enhance diagnostic efficiency and ensure equitable TB care in urban setting.

1.7 TB champions engagement for TB elimination

The TB Champions initiative embodies a people-centred approach by empowering survivors as community leaders in TB elimination. Establishing structured networks within treatment units and linking survivors to skill development and livelihood opportunities through National Skill Development Corporation (NSDC), corporate social responsibility (CSR) initiatives, and livelihood missions can strengthen their long-term empowerment. Certified psycho-social care training for survivors will enable peer-led counselling to improve adherence and mental well-being. Dedicated funding is crucial to institutionalize and expand the TB Champions Network as an integral part of TB elimination efforts.

1.8 Challenges Faced by NTEP Frontline Workers

Optimising the deployment of frontline staff based on TB burden, geographic factors, and patient volumes is crucial for ensuring equitable workload distribution and mitigating work burden. The implementation of regular skill-building and motivational initiatives, exemplified by ICMR-NIRT's "Wings of Support" model in Tambaram, Tamil Nadu, would effectively mitigate burnout. Developing a robust employee welfare policy that encompasses incentives, travel reimbursements, health insurance, and salary standardisation for frontline workers necessitates prioritisation. Operational research on work patterns, documentation processes, and barriers to patient-centred service delivery among frontline workers may produce evidence-based strategies.

1.9 Engagement of Medical Colleges in NTEP Service Delivery

Medical colleges play a crucial role in strengthening TB services under NTEP, but clinician and student engagement in TB management and research remains limited. Inconsistent participation of Medical colleges in TB task force meeting and lack of

accountability hinder progress. Strengthening TB education through mandatory TB-related content in medical curricula and exams, along with advocacy for active faculty and student involvement, can improve engagement. Establishing national guidelines for TB bed projections, isolation infrastructure, and promoting hospital-wide integration for better admissions and infection control will further enhance TB care and preparedness.

Theme 2: Digital Health Integration

India's National Tuberculosis Elimination Programme (NTEP) is progressing towards the 2030 elimination target through the integration of advanced diagnostics, digital health innovations, and data-driven management systems. The country is emerging as a global leader in TB innovation by addressing regulatory barriers, promoting affordability, and bridging digital equity gaps. Key tools such as digital adherence systems (99 DOTS), targeted next-generation sequencing (tNGS), AI-assisted X-ray and cough analysis, real-time LAMP, tongue swab diagnostics, and TrueAMP for tuberculous as well as non-tuberculous detection are transforming case detection, drug resistance monitoring, and adherence tracking.

However, the diagnostic innovation ecosystem faces several bottlenecks, including extended regulatory timelines, limited validation facilities, dependence on imported raw materials, and slow WHO approvals that delay commercialization. Digital and AI-based firms also struggle with the lack of durable handheld X-ray devices and comprehensive, high-quality TB datasets for model training. Additionally, stigma and limited community participation continue to impede digital adoption, while private-sector integration into national digital systems remains weak.

To strengthen this ecosystem, expanding accredited validation centres, implementing AR-based training programs to enhance radiological and diagnostic capability, and integrating AI tools with clinical and imaging data are key priorities. Developing cost-effective molecular assays for wider adoption, enabling faster regulatory clearances, and advancing indigenous vaccine research will accelerate innovation. Closer alignment of private-sector digital initiatives with NTEP platforms and sustained investment in data infrastructure will be crucial for building a resilient, technology-driven TB control system in India.

Theme 3: Public Private Partnership

Nearly 60 percent of individuals with TB symptoms in India initially seek care from private providers, underscoring the critical need for robust and sustained public–private partnerships to meet national TB elimination goals. Successful state-level initiatives such as the STEPS model in Karnataka, Tamil Nadu, and Kerala, and the Public–Private Interface Agency (PPIA) in Rajasthan, demonstrate the potential of coordinated frameworks to expand TB detection and ensure treatment adherence. However, long-term sustainability remains a challenge due to heavy reliance on third-party agencies, delays in NGO reimbursements, and limited oversight of treatment quality within the private sector.

To address these gaps, policy measures should focus on building institutional capacity through adaptable incentive frameworks, output-based payment models, and systematic tracking of reimbursements and diagnostics via Nikshay-linked invoice registries. Strengthening collaboration among ASHAs, NTEP staff, and private practitioners can further enhance case notifications, sample transport efficiency, and integration of TB screening into private health services. Establishing tele counselling networks for private sector patients, expanding private hospital consortiums, and adopting SMART metrics for performance monitoring can improve accountability and patient follow-up. Additionally, capacity building through targeted training in extrapulmonary TB diagnosis, rational drug prescription, and infection control protocols is essential. Expanding coverage of TB preventive therapy for high-risk groups such as patients on anti-TNF therapy or transplant recipients will help reduce incidence and strengthen TB control across private healthcare settings.

Theme 4: Distinct Challenges in the Implementation of NTEP in Northeast India

Tuberculosis elimination in Northeast India faces unique and multifaceted challenges shaped by difficult terrain, poor connectivity, ethnic and linguistic diversity, and fragile health infrastructure. With nearly 750 ethnic groups spread across a mountainous region, cultural and language barriers often hinder communication between health workers and communities, limiting access to timely diagnosis and care. Dependence on traditional healers, population mobility among tea garden and cross-border workers, and rising substance use further exacerbate treatment delays and discontinuation. Recurrent natural disasters, displacement, and stigma have also disrupted service delivery and continuity of care.

To overcome these obstacles, region-specific and community-driven strategies are essential. Strengthening cross-border TB coordination with Southeast Asian countries, engaging tribal leaders and traditional healers in TB awareness, and appointing TB Champions in remote villages can enhance community ownership and adherence. Forming TB–NCD Comorbidity Coordination Committees across north-eastern states will promote integrated service delivery and resource-sharing. Equally vital are investments in logistics, supply chains, and digital infrastructure, including a central AI-enabled portal for real-time data and X-ray uploads to support field diagnostics. Additionally, disaster-resilient microplanning, multilingual IEC materials in local dialects, and gender-sensitive care models—particularly for marginalized women in tea garden communities—are critical to sustaining equitable and uninterrupted TB care across the Northeast.

Theme 5: Challenges in Eliminating Tuberculosis in Rural and Tribal Regions

Tuberculosis in India's rural and tribal communities is deeply linked to poverty, weak health systems, cultural barriers, and stigma, resulting in poor care access and treatment adherence. These underserved populations face additional barriers such

as limited financial inclusion, workforce shortages, and poor digital connectivity, calling for community-driven strategies to ensure equitable TB services. Strengthening continuous drug supply, expanding diagnostic facilities, enhancing mobile outreach, training healthcare providers in culturally sensitive care, and empowering tribal youth and especially women in community level TB management that can collectively improve early detection, treatment continuity, and community resilience against TB.

Theme 6: Issues Pertaining to Migrant Populations in NTEP Service Delivery

Migrant populations in India encounter critical obstacles to TB care due to high mobility, informal employment, and limited health access, often resulting in delayed diagnosis and disrupted treatment. Addressing these challenges requires an integrated migrant health framework combining various sectors like HIV, NCD and vector borne disease services at common delivery points. Strengthening data systems for frontline workers and establishing an online inter-state referral platform can improve tracking and continuity of care. Targeted interventions should include nationwide mapping of non-notified settlements to identify high-burden migrant clusters, as well as outreach programs in educational institutions for early awareness and screening. Aligning NTEP activities with other sectors and promoting community-led microplanning can ensure more responsive scheduling of active case-finding and tailored service delivery for mobile populations.

Summary

This consultation emphasised India's commitments in improving TB service delivery, regulatory efficiency, ensuring affordability, and advancing digital equity and innovation along with improved private sector engagement in the country. Through continued investment and multi-sectoral collaboration, NTEP's technology-driven strategy can dramatically improve early detection, treatment adherence, and outcomes bringing the country closer to the 2030 TB elimination goal. Strengthening health infrastructure, embedding digital technology and equity, ensuring uninterrupted care in crises, and empowering communities through partnership models will be critical to overcome the existing barriers and achieving TB elimination targets.

TB Mukt Bharat

Challenges and Recommendations

Insights from Regional and National Stakeholder consultations

Service Delivery Challenges

- Suboptimal implementation of differentiated care
- Inadequate multisectoral coordination
- Limited community awareness
- Insufficient psychosocial support
- Inadequate engagement with medical colleges for inpatient care
- Inequitable workload, pay disparities and lack of motivation among frontline workers

Service Delivery Recommendations

- Implement community based care models & post TB rehabilitation units
- Strengthen multi-sectoral coordination
- Establish patient support group and integration with DAY-NULM for livelihood support
- Mandatory representation of medical colleges in TB task force meeting
- Develop evidence based strategies for optimising human resource management

Public Private Partnership Challenges

- Inadequate coordination between private health services and NTEP
- Irrational drug prescription
- Inadequate monitoring in private sector
- Resistance to TPT & inadequate TPT coverage among high risk patients in private sector
- Delayed renumeration for private sector partners

Public Private Partnership Recommendations

- Strengthening collaboration between NTEP & Private sector
- Training of private doctors in TB guidelines
- Family led progress tracker for medication adherence
- Expand contracting options for private services based on outputs
- Nikshay based tracking of payments for private sector

Digital Health Integration Challenges

- Logistical and financial barriers for large-scale clinical trials incorporating digital innovations
- Prolonged regulatory approvals
- Unavailability of raw materials and high-quality durable devices in India
- Stigma & limited community participation in digital adoption
- Inadequate private sector integration in NTEP

Digital Health Integration Recommendations

- Expanding accredited validation centres & sustained investment in data infrastructure
- Augmented reality training to enhance diagnostic competence
- Developing and improving cost effective, user friendly, low maintenance assays & devices
- Strengthen psychosocial support, improve community awareness & closer alignment with private sector

Rural , Tribal & Migrants Challenges

- Poor digital infrastructure
- Limited financial inclusion
- Gaps in sample transportation & drug supply
- Lack of awareness among health care providers
- Fragmented coordination between NTEP, NCD, MCH programme
- Documentation constraints
- Low ACF coverage and workforce shortages

Rural, Tribal & Migrants Recommendations

- Investing and developing digital infrastructure
- Link workers to facilitate Nikshay-DBT
- Expanding diagnostic facilities
- Training health care providers in TB management
- IEC materials in local dialect
- Leveraging Panchayati Raj, health and wellness clinics and other programmes for expanding service delivery
- Strengthen human resources to improve ACF

Northeast Unique Challenges

- Migration, human displacement, ethnicity, and topography
- Natural disasters and service Disruption
- Barriers in ACF & inadequate diagnostic services
- Stigma, Substance Use & Rising NCDs
- Gaps in Health System & Resource Allocation
- Private sector fragmentation

Northeast Unique Solutions

- Engaging tribal leaders & traditional healers in TB awareness
- Strengthening cross-border TB elimination effort
- Last-mile community driven support model
- Offline-enabled Nikshay portal
- Coordination between TB & NCD programmes
- Increased resource allocation and procurement support

Introduction

India has made significant advances through the National Tuberculosis Elimination Programme (NTEP), utilizing molecular diagnostics, digital health technologies, and social support systems. Despite these improvements, India still bears a high TB burden, contributing to approximately 27% of global TB cases, hindered by socio-economic factors, malnutrition, comorbidities, and disruptions caused by COVID-19. This report summarises India's progress and ongoing efforts in TB elimination, focusing on stakeholder consultations conducted by ICMR-NIRT in collaboration with Women's Collective Forum, across different regions to address key challenges and strategies in TB control. This comprehensive effort aims to refine India's TB strategies by incorporating multisectoral stakeholder input, with a focus on expanding public-private collaboration, digital health innovations, and patient-centred care models to achieve TB elimination goals despite existing socioeconomic and systemic challenges.

Methodological Approach

To systematically address the challenges and opportunities in enhancing Tuberculosis (TB) care via stakeholder engagement, ICMR-NIRT organised a series of three regional consultations across South, West, North, East, and Northeast regions. These consultations involved key stakeholders, including policymakers, representatives from the National Tuberculosis Elimination Programme (NTEP), Central Tuberculosis Division (CTD), government and private healthcare providers, researchers, and TB survivors. The consultations aimed to produce actionable insights in three domains: Public-Private Partnership (PPP), Digital Health Integration, and Patient-Centred Service Delivery Models, to inform policy and programmatic recommendations for the advancement of TB elimination in India.

The regional consultations employed a mixed-method participatory approach, which included plenary discussions, thematic breakout sessions, and group deliberations. Stakeholders were intentionally chosen to guarantee representation from various sectors, geographic areas, and tiers of TB service delivery (national, state, and district). The organising committee and ICMR-NIRT scientists conducted a pre-consultation desk review of existing policies, NTEP reports, published literature, and case studies on PPP, digital health initiatives, and patient-centred care models to inform the discussion framework.

Consultations were structured sessions that collected stakeholder insights on current interventions, operational difficulties, and potential for innovation and expansion. Discussions and consultations in each domain focused on established thematic areas, including TB notification, digital diagnostic tools, service delivery standards, socio-economic and psychosocial support, and the needs of the frontline workforce. Structured templates and note-taking tools facilitated systematic documentation of inputs.

Following the consultations, qualitative data from all regional workshops were aggregated and analysed using a thematic synthesis approach to identify cross-cutting issues, best practices, and region-specific challenges. Quantitative information on interventions, coverage, and outcomes (where available) was triangulated to support evidence-based recommendations.

The findings were consolidated into a comprehensive national report, summarising actionable recommendations for strengthening PPP mechanisms, integrating digital health innovations, and optimising patient-centred TB service delivery models.

This report is structured into six major themes namely service delivery, digital health, PPP, unique challenges in Northeast, Tribal population and Migrant population. Each theme further elaborates on several sub-themes. This document may provide policy guidance for NTEP and other national stakeholders to accelerate efforts towards tuberculosis elimination in India. The appendix of the report includes a detailed agenda and a list of participants.

1

Service Delivery

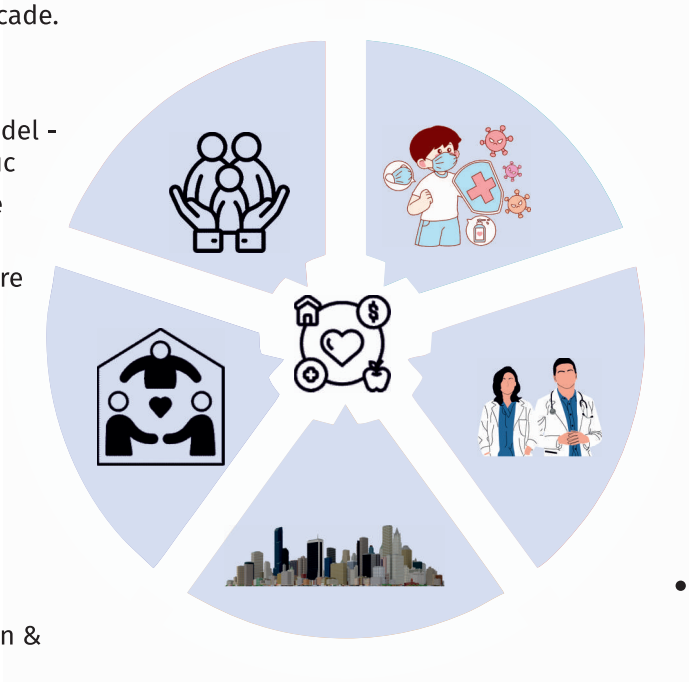
TB Service delivery
Challenges

TB mortality

- 70% TB deaths occur outside treatment cascade.
- Delayed diagnosis
- Unavailability of differentiated care model - age and gender specific
- Alcohol and substance abuse
- Inadequate Post TB care
- Poor nutrition and comorbidities

Frontline workers

- Inequitable workload
- Pay disparity
- Lack of motivation
- Gaps in communication & soft skills



Health seeking behaviour

- Limited community awareness and delayed healthcare-seeking behaviour
- Unavailability of counsellors for psychosocial support
- Limited awareness of Social protection schemes and livelihood rehabilitation

Engaging Medical Colleges

- insufficient clinical/programmatic management of TB
- Absence of respiratory medicine department
- Limited coordination and motivation

Urban TB control

- Poor coverage and high mortality in homeless.
- Complex operational & structural challenges
- inadequate multi-sectoral coordination

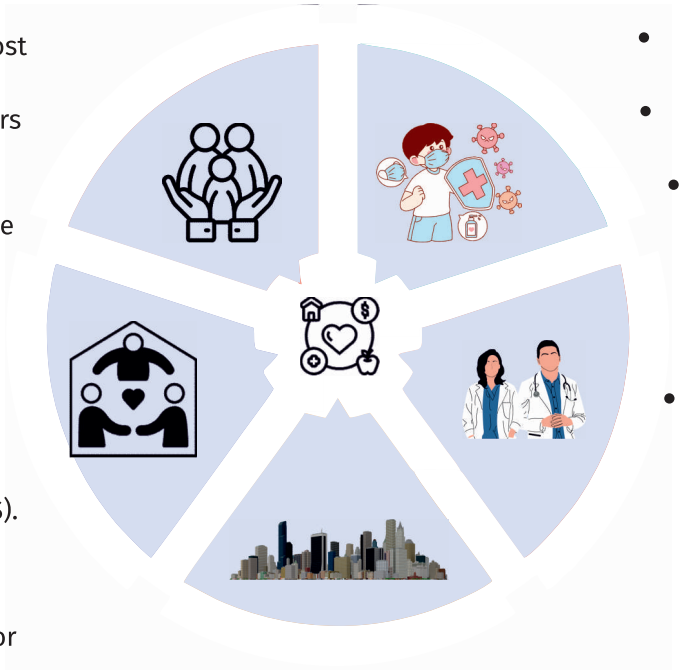
TB Service delivery
Recommendations

Holistic care to reduce TB mortality

- Real time TB mortality audits
- Implement community based care models & Post TB rehabilitation units
- Training family caregivers in differentiated care
- Implementing AUDIT-C scale & training frontline workers in counselling
- Developing age specific clinical guidelines
- Implementing gender equitable care
- Implementing Energy Dense Nutritional Supplementation (EDNS).

Frontline workers

- Optimise deployment for equitable workload
- Motivation & Skill training
- Incentive and pay equity



Urban TB control

- Multi-sectoral management framework
- Tailored ACSM for urban population
- Integration with DAY-NULM for livelihood
- Collaboration with other sectors

Health seeking behaviour

- Implementing Patient support group- eg; Wings of Support
- Engaging TB champions as counsellors
- Engaging Self Help Groups & Social Media Influencers
- Integrate quality of care monitoring from patient's perspective

Engaging Medical Colleges

- Increase Representation in TB task force meeting
- Curriculum reform to include TB as mandatory topic in UG & PG level
- Strengthening infrastructure and clinical care

Introduction

India contributes about one-fourth of the world's tuberculosis (TB) burden, with around 2.5 million new cases and nearly 300,000 deaths annually. Over the past decade, the National Tuberculosis Elimination Programme (NTEP) has introduced a range of initiatives aimed at achieving the country's goal of TB elimination by 2030. These include free nationwide diagnosis and treatment, rapid expansion of molecular diagnostics, shorter treatment regimens for drug-resistant TB, scaling up active case finding, TB preventive therapy (TPT), 3HP regimens and nutritional support through the Nikshay Poshan Yojana. The Nikshay digital platform has become central to improving case notification, treatment adherence, and outcome monitoring.

Despite significant advances in detection and reporting, marked by closing the notification gap by 100,000 cases, India continues to bear a major portion of the global TB burden. The COVID-19 pandemic disrupted programme operations, as much of the TB workforce was reassigned to pandemic control, compromising continuity of care and surveillance.

NTEP continues to strengthen its four-pillar strategy of "Detect, Treat, Prevent, and Build" under the National Strategic Plan for TB Elimination. This includes early detection and accurate diagnosis, effective treatment, prevention through community partnerships and TB prophylaxis, and capacity-building at all levels. Continued emphasis on public-private collaboration, digital integration, and patient-centred strategies is considered vital to accelerating progress toward TB elimination in India.

In line with this, the country has experienced a rapid expansion in diagnostics, with a total of 8,415 molecular diagnostic tools currently implemented across India. NTEP has included several new diagnostics, notably molecular tests such as CB-NAAT and TRUE-NAAT. Shorter treatment regimens are now accessible to adults with drug-resistant tuberculosis. Active case finding for TB disease and TB preventative therapy (TPT) for latent TB infection (LTBI) has been scaled and implemented across the country. Nikshay poshon is being implemented to tackle undernutrition in patients with TB and their contacts. The Nikshay portal is a significant initiative, providing a digital platform for case notification, treatment adherence, and efficient tracking of treatment outcomes. Engaging the private sector represents a significant initiative undertaken by both state and central TB divisions. While mortality and incidence have reduced, several barriers continue to impede TB control in India. A comparison of the initial TB survey conducted in 1955 with the recent prevalence survey conducted by NIRT in 2019 shows that the prevalence of TB has not significantly changed. This requires introspection of the existing services and opportunities for the new ones.

Subthemes 1: TB Mortality and driving factors

India's recent TB verbal autopsy study by the NTEP highlights critical insights into TB-related mortality patterns and contributing factors. Only 30% of TB deaths occurred within the treatment framework monitored under Nikshay, while 70% took place outside the programme. Among the 123,000 deaths studied, 46,190 occurred before diagnosis, 40,300 were diagnosed but untreated, and 37,200 occurred post-treatment. Key contributing factors to deaths outside the treatment cascade included delayed health-seeking behaviour, comorbidities, and late diagnosis. Within the treatment period, non-adherence, drug reaction management issues, and poor comorbidity care were predominant causes.

It is important to address non-adherence, social stigma, substance abuse, and insufficient social protection—elements that exacerbate mortality rates. Moreover, insufficient post-treatment follow-up and absence of rehabilitation contributes to mortality. Mortality distribution across states is uneven, with higher rates observed in Puducherry, Kerala, Goa, Karnataka, and Lakshadweep (over 6%), and lower rates in Jharkhand, Nagaland, AP, Telangana, and Dadra & Nagar Haveli.

Overall, to reduce TB mortality, India must integrate robust surveillance, social interventions, and accountability mechanisms across public & private health systems.

Summary of Recommendations:

- Develop state-specific mortality reduction strategies acknowledging varying TB burdens and contextual factors.
- Implement real-time mortality audits at state and district levels using digital dashboards and health management information systems (HMIS).
- Strengthen inter-sectoral collaborations to address socio-economic drivers.
- Introduce a comprehensive post-treatment rehabilitation package, with national-level monitoring.
- Expand the Nikshay portal to capture the complete care continuum.
- Conduct periodic mortality estimates and risk factor analyses at all levels.
- Train healthcare workers to perform TB death audits, modelled after maternal death audits.
- Reintroduce third-party evaluations of NTEP.

Subtheme 2: Differentiated care for high-risk individuals.

The present systems offer limited hospitalisation and follow-up for severely ill patients under the TB programme. NTEP is therefore adopting a differentiated care model to provide patient-specific, severity-based management for TB rather than the current uniform approach. NTEP has introduced a triage mechanism based on clinical indicators such as inability to stand unaided, respiratory rate above 24/min, oxygen saturation below 94%, and BMI ≤ 14 kg/m², or BMI ≤ 16 kg/m² with pedal oedema.

A colour-coded classification system (Red for daily, Yellow for weekly, and Green for monthly monitoring) is being developed to track patients' conditions and prioritise care. The model emphasises community and household-level involvement, with family members and community workers trained to support patient management after discharge. Examples from Karnataka, where differentiated counselling and community follow-up were successfully piloted, and Maharashtra, where all primary healthcare staff were trained to identify and refer high-risk cases promptly, show that differentiated care model is beneficial for patients. This approach evolves TB care from a standard approach to a tiered, patient-centred framework that incorporates facility-based triage, community outreach, and family empowerment, which are essential for enhancing survival and treatment success in vulnerable TB patients.

Summary of Recommendations:

- Develop and implement hospital-based differentiated care protocols for high-risk TB patients, especially those with low BMI.
- Establish community-based care models, ensuring household-level follow-up and rehabilitation after discharge.
- Incorporate psychosocial counselling and social protection into differentiated care.
- Build capacity through training for family caregivers, TB survivors, and health workers, supplemented by easy-to-understand IEC materials.
- Conduct implementation research to evaluate the outcomes of community and family engagement in differentiated care delivery.
- Introduce a structured skill-building curriculum for frontline workers and caregivers to standardize the approach nationwide.

Subtheme 3: Alcohol reduction interventions for individuals with TB

Addressing alcohol use among individuals with TB is critical for improving treatment adherence and outcomes. Alcohol dependence significantly complicates TB management, with studies showing a one-year morbidity rate of nearly 40% among patients with both conditions. Routine screening and structured counselling for alcohol use are therefore essential within TB programs.

Most TB deaths and treatment failures among individuals with alcohol use occur outside formal treatment systems due to poor adherence, delayed diagnosis, and comorbidities. Frontline workers can screen for alcohol consumption using simple indicators such as daytime or roadside drinking and validated tools like the AUDIT-C or CAGE questionnaires. Patients with alcohol-related liver impairment require clinical management, including the use of hepatoprotective drugs and tailored anti-TB therapy.

Inter-sectoral collaboration with mental health programs, de-addiction centres, and NGOs is vital for providing psychosocial counselling and rehabilitation support.

Experiences from Karnataka highlight that rather than expecting patients to quit alcohol completely, emphasising the completion of TB therapy while supporting nutritional intake and consistent medication adherence yields better outcomes. Engaging family members to monitor and support treatment is equally important.

Overall, integrating alcohol reduction strategies into TB care through behavioural interventions, family counselling, and system-wide collaboration will be crucial to reducing treatment failure and mortality among TB patients with alcohol use problems in India.

Summary of Recommendations:

- Incorporate routine alcohol screening in TB programs using tools like AUDIT-C or CAGE.
- Train frontline health workers in addiction assessment and psychosocial counselling.
- Strengthen coordination with mental health and rehabilitation services for referral and co-management.
- Focus on completion of TB treatment as the primary outcome, rather than immediate alcohol cessation.
- Implement liver function monitoring and necessary clinical interventions for TB patients with alcohol use disorder.
- Promote community and family involvement to sustain adherence and provide nutritional and emotional support.

Subtheme 4: Age- and gender-specific TB treatment

Adolescents and women represent vulnerable groups within India's TB burden, each facing distinct challenges in diagnosis, treatment, and social acceptance. Approximately 10% of all TB cases occur amongst adolescents, with some regions reporting levels as high as 24%, whose clinical cure rates mirror those of adults, yet their treatment journey is complicated by stigma, social constraints, and self-image concerns. Many adolescents, particularly girls, experience distress over medication side effects like skin darkening from clofazimine, as well as disruptions in education, menstruation, and social life due to stigma and family rejection.

Children and adolescents often face educational and psychosocial setbacks from prolonged absences, and parents frequently conceal TB diagnoses due to fear of discrimination. In states like Tamil Nadu, those aged over 12 are categorised as adults, leading to care in adult facilities ill-suited to their developmental needs. Rural and tribal women encounter additional barriers, including domestic discrimination, poor autonomy in healthcare decisions, and digital inequities that limit access to financial and social welfare schemes.

Currently, unlike the HIV programme, the TB programme lacks a structured, age-specific care model for adolescents. Establishing such frameworks within the NTEP is essential to deliver holistic, gender- and age-appropriate care. Collaboration with

educational institutions, school health initiatives, and community networks would enable better TB awareness, screening, and adolescent engagement.

TB care in India must involve an approach that is gender- and age-responsive, considering psychosocial development, stigma, and societal inequities, especially for adolescent girls and women, through customised care pathways and interdisciplinary collaboration.

Summary of Recommendations:

- Strengthen coordination between NTEP and the education sector to institutionalise TB support for adolescents.
- Expand school-based TB education and screening via School Health Programs.
- Establish Teen TB Clinics similar to ICMR-NIRT's Child, Adolescents And Young Adults Clinic (CHAYA) to provide adolescent-sensitive counselling and psychosocial services.
- Introduce school TB ambassadors to improve awareness, stigma reduction, and cough etiquette.
- Develop clinical guidelines for adolescent girls that integrate TB care with reproductive and mental health interventions.
- Address digital and financial inequities among women, ensuring equitable access to TB-related social protection schemes.

Subtheme 5: Nutritional Intervention for individuals with Tuberculosis

Malnutrition remains one of the most critical barriers to effective TB prevention and treatment in India. Undernutrition not only increases vulnerability to TB but also worsens disease outcomes and hampers medication tolerance. Most TB patients who are malnourished seek treatment late, often presenting with severely low body weight (15–20 kg), which limits their ability to tolerate anti-TB therapy. Food insecurity among TB patients and their households compounds this problem, increasing the risk of treatment failure and mortality.

Integrating nutrition as a formal component of TB care can substantially improve outcomes. Evidence from the RATIONS trial in India demonstrates that providing food rations combined with micronutrients to TB patients and their families significantly reduces TB incidence, mortality, and relapse rates. Nutritional supplementation leads to faster sputum conversion, marked weight gain, and improved treatment adherence. Implementing direct food basket deliveries aligned with schemes such as the Public Distribution System (PDS), Saksham Anganwadi and POSHAN 2.0, and PM POSHAN programs would ensure food availability and coverage. For patients with severe undernutrition, inpatient nutritional support and mandatory deworming at treatment initiation can enhance absorption and recovery.

Systematic monitoring of nutritional status is essential. Auto-calculating BMI fields in Nikshay and incorporating quarterly undernutrition indicators in programme performance reviews would support targeted responses. Digitally tracking patients' BMI trends can enable early intervention for those at nutritional risk.

Nutrition must be treated as a core therapeutic component of TB care, not an adjunct. Strengthened multisectoral collaboration, digital monitoring, and community engagement will be indispensable for achieving improved recovery, reduced transmission, and progress toward India's TB elimination goals by 2030.

Summary of Recommendations:

- Strengthen intersectoral collaboration with PDS, Saksham Anganwadi and POSHAN 2.0, and other national food programs to integrate nutritional supplementation.
- Conduct needs assessments to understand household-level food insecurity and design targeted nutrition plans.
- Develop and test energy-dense nutritional supplements (EDNS) and evaluate their acceptability and effectiveness.
- Partner with AYUSH and local food systems to incorporate traditional and indigenous nutrition options.
- Use of smart digital tools (like wearables) to monitor BMI and nutritional progress in real time.
- Implement community-level interventions such as Social Impact Bonds and CSR-based nutrition drives through Nikshay Mitra and Nikshay Poshan.
- Establish standardised nutritional care protocols adjusted to patients' BMI and clinical stage for both outpatient and inpatient settings.

Subtheme 6: Community engagement

Limited community awareness and delayed healthcare-seeking behaviours remain major barriers to timely TB diagnosis and treatment in India. Many individuals first present for care after significant lung damage has occurred. Expanding TB awareness through mass and social media campaigns is crucial for early detection and stigma reduction. Successful examples include the use of women's self-help groups (SHGs) in Karnataka and Bihar, where community engagement led to up to a 30% increase in presumptive TB testing, effectively linking patients with diagnostic and treatment services.

Family members play a central role in ensuring adherence and emotional support, making caregiver engagement critical to TB treatment success. Initiatives such as Community DOTS and the 100-day TB Elimination Campaign have strengthened community-based observation, improved follow-up, and emphasised the "human touch" in patient care. ASHA workers and community counsellors continue to be key in providing psychosocial support, supervision, and linkage with health facilities.

Collaboration with HIV counsellors, who already have experience in patient-centred care, can further strengthen TB counselling capacity.

While private sector healthcare often offers higher quality services, its accessibility remains limited to urban India. Therefore, re-strategising resources to enhance rural and tribal health service capacities is needed to ensure equity and reach the unreached.

A unified approach that integrates community engagement, inter-sectoral collaboration and quality monitoring is crucial for enhancing early TB detection, promoting adherenceand reinforcing trust among patients, families, and the healthcare system.

Summary of Recommendations:

- Institutionalise collaboration between NTEP and SHG bodies at treatment-unit levels to sustain grassroots community engagement.
- Strengthen inter-sectoral coordination with HIV, NCD, and MCH programme to share counsellors, resources, and best practices.
- Identify and train lay counsellors and family caregivers for psychosocial and adherence support, enabling patient- and family-centred care.
- Create TB advertisements and systematically engage social media influencers, community structures, and local networks to amplify TB awareness and reduce stigma.
- Establish patient support groups involving TB survivors, families, and communities in every treatment facility.
- Conduct implementation research, such as cluster randomised trials, to measure the impact of community engagement interventions on treatment outcomes.
- Reinforce DOTS for vulnerable populations at high risk of loss to follow-up.
- Integrate a quality-of-care assessment framework capturing patient perspectives across both public and private sectors.

Subtheme 7: Socioeconomic Rehabilitation and Livelihood Support

Socioeconomic rehabilitation and livelihood support play a crucial role in breaking the cycle of poverty and illness among TB patients in India. Many individuals affected by TB remain unaware of available social protection schemes such as the Public Distribution System (PDS), Ayushman Bharat, and bank-linked cash assistance through the Nikshay Poshan Yojana (NPY). Despite these programs, studies show that financial aid remains fragmented—only about one-third to half of TB patients receive the benefits due to barriers such as documentation issues or lack of bank access.

Strengthening social reintegration through livelihood-based rehabilitation models is essential to ensure long-term well-being. One effective model from Tambaram, Tamil Nadu, provides vocational training and income opportunities for cured and destitute

patients. Industry-level advocacy in Hyderabad has also demonstrated success: companies now offer additional sick leave for employees with TB and include TB screening within routine health checks. These examples highlight how workplace policies and multisectoral engagement can drive social inclusion and reduce stigma.

To achieve sustained impact, TB elimination efforts must be integrated into broader national development agendas linking with urban planning, smart city initiatives, and livelihood programs under the MSME, National Skill Development Corporation (NSDC), and Sector Skill Councils (SSC). Tackling social determinants such as housing, employment, and nutrition is essential to reduce TB vulnerability.

Effective TB control requires not only medical intervention but also social inclusion and economic empowerment. Integrating social protection, industry collaboration, and livelihood support within national TB strategies will enhance both treatment adherence and long-term recovery outcomes.

Summary of Recommendations:

- Develop a national livelihood rehabilitation framework for socioeconomically vulnerable TB survivors, including job placement and vocational support.
- Foster coordination between NTEP and industrial, corporate social responsibility (CSR), and skill development institutions (NSDC, MSME).
- Identify and disseminate best practice models such as the GHTM Tambaram rehabilitation initiative at national and regional levels.
- Promote industry-level TB advocacy, ensuring workplace TB screening, treatment support, and paid medical leave policies.
- Digitally streamline social security linkages, eliminating administrative barriers to benefits like PDS and DBT through smart integration platforms.
- Incorporate TB-related social interventions into urban smart city planning, focusing on housing, population density, and sanitation.

Subtheme 8: Post-Tuberculosis Lung Disease (PTLD)

Post-Tuberculosis Lung Disease (PTLD) is a major but underestimated health challenge in India, affecting a large proportion of individuals even after successful TB treatment. Studies show that between 18% and 87% of TB survivors experience chronic respiratory symptoms or structural lung damage, including fibrosis, bronchiectasis, and airflow obstruction. PTLD contributes significantly to morbidity, disability, and mortality. TB survivors face up to a threefold higher risk of death compared to the general population. Despite its burden, PTLD services in India remain fragmented, with no standardized rehabilitation or follow-up structure currently in place.

Developing a national framework for post-TB care is essential. This should include the establishment of dedicated PTLD clinics in tertiary hospitals and medical colleges, integration of post-TB follow-up within Nikshay, and the training of healthcare

workers in pulmonary rehabilitation. Regular patient assessment for lung function, early recognition of chronic pulmonary aspergillosis, and nutritional and psychological support should form part of the care continuum.

Digital health solutions, such as AI-based lung monitoring tools and telemedicine, can improve accessibility and long-term follow-up, especially in rural or resource-limited settings. Leveraging Ayushman Bharat (PM-JAY) schemes for post-TB rehabilitation and incorporating AYUSH-based care for immune recovery and respiratory strengthening can further enhance outcomes.

Addressing PTLD must become a national health priority. Early detection, structured rehabilitation, and long-term follow-up supported by digital technologies and multisectoral collaboration are critical to preventing chronic disability, improving survivors' quality of life, and sustaining India's TB elimination gains.

Summary of Recommendations:

- Establish post-TB care and rehabilitation units at tertiary and community health levels to manage chronic respiratory complications.
- Develop and integrate a national post-TB follow-up database within Nikshay to systematically record lung health outcomes, recurrence, and mortality.
- Train health personnel in pulmonary rehabilitation techniques, incorporating physiotherapy and nutritional recovery.
- Collaborate with AYUSH systems to develop integrated post-TB care protocols focusing on immunity and nutrition.
- Utilise digital and AI-driven surveillance tools for real-time lung function monitoring and evaluate their cost-effectiveness in programmatic settings.

Subtheme 9: Service Delivery in High-Burden Urban Areas

Urban TB management in India, particularly in high-burden cities such as Delhi, poses complex operational and structural challenges. In Delhi, two-thirds of newly diagnosed TB patients initially seek care from informal providers or pharmacies, leading to delayed diagnosis and gaps in treatment continuity. Among the homeless, the TB death rate reaches 10%, with a disease prevalence of 1,400 per 100,000 highlighting the urgent need for structured urban TB care coordination. Delhi's healthcare landscape comprises a diverse mix of hospitals, clinics, polyclinics, and dispensaries, yet these operate largely in silos, creating inefficiencies despite the city's rich health infrastructure.

Effective TB control in metropolitan settings calls for multi-sectoral, coordinated governance frameworks connecting municipal bodies, public hospitals, mohalla clinics, and private providers. Cities like Mumbai and Chennai offer replicable models. Mumbai's municipal corporation has effectively managed its high MDR-TB burden by integrating leadership, data-driven surveillance, and public-private partnerships, while Chennai employs women health volunteers and sanitary inspectors trained in TB screening as part of its broader public health strategy.

New approaches, such as community-based active case finding (ACF), have been highly effective when aligned with local schedules and community engagement through residential associations, market committees, and social media platforms. Yet, health-seeking behaviour among urban populations especially the affluent remains poor, requiring differentiated advocacy and communication (ACSM) models. Programmes like Telangana's Swastika initiative demonstrate how urban corporations can mobilise all available resources for TB elimination, emphasising decentralized leadership and optimised workforce distribution.

Gaps in sample transportation and the overburdening of diagnostic laboratories continue to be major obstacles to timely TB diagnosis and treatment completion. Inefficiencies in the specimen referral process often delay results, contributing to patient attrition along the diagnostic cascade. Establishing a robust, well-coordinated specimen transport network is therefore crucial to improving diagnostic turnaround time and preventing delays in care.

Innovative state-level models, such as Telangana's centralised testing network, demonstrate a scalable solution to this problem. The model offers 139 integrated testing points, ensuring high coverage and efficient sample processing through optimized logistics and data-driven coordination. Strengthening and replicating such centralized systems across other states would help bridge the diagnostic gap, streamline workflow, and enhance programme efficiency while minimising losses in the TB care continuum

Strengthening service delivery in urban high-TB-burden settings requires context-specific strategies, cross-sector collaboration, expanded human resource capacity, and the adoption of digitally enabled, community-centred models to reach both vulnerable and affluent populations alike.

Summary of Recommendations:

- Design a multi-departmental and multi-sectoral management framework for TB control in metropolitan cities.
- Map and categorise healthcare providers in high-burden cities like New Delhi to streamline services across public, private, and informal sectors.
- Reallocate human resources and redesign urban TB budgets based on localised burden, migration patterns, and population needs.
- Strengthen TB outreach to urban poor, homeless, and migrant groups by partnering with Deendayal Antyodaya Yojana-National Urban Livelihoods Mission (DAY-NULM) and staffing additional field-level health visitors.
- Develop tailored ACSM interventions for urban affluent areas through residential networks, social media campaigns, influencers, and workplace screening programs.
- Promote intersectoral partnerships involving municipal authorities, national livelihood missions, and civil society to ensure inclusive urban TB care.

- Incorporate 24/7 centralised laboratories for specimen processing and transportation using business models inspired by logistics platforms.
- Disseminate best practices from corporates and urban TB-free initiatives in Chennai, Mumbai, and Telangana to inform scalable national strategies.

Subtheme 10: TB champions engagement for TB elimination

The TB Champions initiative under the National Health Mission (NHM) and National TB Elimination Programme (NTEP) represents a transformative community-based approach that empowers TB survivors to support others through counselling, advocacy, and awareness-building. Initially piloted in Mumbai, it has now expanded to multiple states, including Tamil Nadu, Assam, and others, where survivor-led support systems have shown remarkable success in reducing stigma and improving treatment adherence.

The Tamil Nadu TB Champions Network, launched in 2022, currently comprises approximately 2,700 to 2,800 trained survivors, actively engaged in patient counselling and stigma reduction. Across India, more than 30,000 TB Champions including those from tribal and rural areas, have been trained in psychosocial counselling and community engagement, with 13 established state networks supporting NTEP's outreach operations. These survivors share lived experiences, promote early health-seeking behaviour, and help mitigate discrimination, especially among marginalised populations.

Given the limited availability of professional counsellors only 180 DR-TB centres have dedicated counselling staff. Training TB survivors as peer counsellors offers a sustainable solution. Clinicians, social workers, and community health workers can further strengthen this model by offering ongoing mentorship and psychosocial support. The integration of TB champions with skill-building and livelihood programs ensures long-term sustainability and community participation.

TB Champions exemplify a people-centred approach to TB elimination transforming survivors into community leaders who bridge healthcare gaps through empathy, lived experience, and grassroots advocacy, thereby strengthening India's mission toward a TB-free nation by 2030.

Summary of Recommendations:

- Establish TB champion and survivor networks within every treatment unit to enhance stigma reduction, peer support, and community advocacy.
- Integrate skill development and livelihood linkages (through NSDC, CSR, or livelihood missions) to empower TB survivors economically and ensure sustained engagement.
- Institutionalise TB survivor-led counselling platforms within healthcare facilities to enhance patient retention, adherence, and mental health support.

- Create a dedicated national TB care helpline (TB Care Line) connecting patients with trained survivors for continuous emotional and treatment support.
- Provide certified training programs for survivors in psychosocial care, supported by NHM and NTEP in collaboration with academic institutions.
- Allocate dedicated resources and funding (via NTEP, CSR, or state TB budgets) for expanding the TB Champions Network and embedding it in advocacy, ACSM, and community support functions.
- Develop screening tools to identify suitable TB champions possessing leadership and volunteer aptitude for community health engagement.

Subtheme 11: Challenges Faced by NTEP Frontline Workers

Frontline workers form the backbone of the NTEP, serving as the vital link between patients, communities, and healthcare. These workers including Senior Treatment Supervisors (STS), Senior Tuberculosis Laboratory Supervisors (STLS), Health Visitors (HV), DR-TB Counsellors, and PPM Coordinators are central to improving TB detection, notification, and treatment adherence. However, persistent human resource and system-level constraints hinder their performance and affect service quality.

A. Human Resource and Operational Challenges Each frontline worker currently covers a population of 1.5–2 lakh and multiple health facilities, limiting their ability to provide consistent patient follow-up. Inadequate staffing and heavy workloads mean that many are unable to visit all PHCs regularly, leading to service gaps. Patients often require admission but lack accessible tertiary facilities sometimes located 20–30 km away. Establishing block-level isolation units with a few beds would help manage severely ill and undernourished TB patients locally.

B. Community and System Barriers For community-based activities such as Active Case Finding (ACF), workers must navigate multiple administrative approvals from panchayats and ward members, delaying implementation. Additionally, data management workloads, including extensive Nikshay documentation, reduce the time spent with patients. Transportation constraints, referral difficulties between districts, and the lack of confirmation mechanisms in Nikshay further hamper care continuity.

C. Motivation, Capacity Building, and Welfare Frontline personnel often experience burnout, financial strain, and job insecurity due to pay disparities and delayed reimbursements. Introducing annual motivational training, welfare schemes, and performance-based incentives could help improve morale. Equipping them with regular training in communication, psychosocial counselling, and alcohol-specific interventions is essential, given their frequent interaction with patients struggling with addiction. Providing tools like tablets or offline Nikshay upload features could also enhance efficiency and reduce redundant paperwork.

Addressing human resource deficits, improving welfare provisions, and empowering frontline workers with digital tools and psychosocial skills will significantly strengthen TB service delivery and accelerate India's path toward elimination.

Summary of Recommendations:

- Optimize deployment of frontline staff based on TB burden, geography, and patient volumes for equitable workload distribution.
- Introduce annual skill-building and motivational programs to address burnout (e.g., ICMR-NIRT's "Wings of Support" model at Tambaram, Tamil Nadu).
- Develop a structured employee welfare policy covering incentives, travel reimbursements, health insurance, and salary standardisation.
- Strengthen counselling and communication skill training, including alcohol and lifestyle-related counselling modules.
- Conduct operational research on work patterns, documentation processes, and barriers to patient-centred service delivery.
- Evaluate and enhance Nikshay's user interface for ease of use, offline data syncing, and real-time referral confirmations.

Subtheme 12: Engagement of Medical Colleges in NTEP Service Delivery

Medical colleges are vital to strengthening TB service delivery under the NTEP. However, engagement of clinicians, faculty, and students in TB management and research remains limited. Although National and State Task Force (NTF/STF) meetings are conducted regularly, medical college-level participation is inconsistent, and faculty attendance is often optional rather than mandatory. Strengthening academic accountability and integrating TB-related competencies into medical education are therefore essential.

A. Current Gaps Even professionally trained clinicians often lack updated knowledge of TB guidelines, leading to occasional mismanagement. Many respiratory medicine and internal medicine faculty members prioritise non-TB specialisations (such as critical care, asthma, or COPD) over TB. Undergraduate and postgraduate curricula also lack sufficient focus on TB, resulting in low awareness and motivation among trainee doctors. Including at least one mandatory TB-related question in medical examinations could improve knowledge and accountability.

B. Strengthening Infrastructure and Clinical Care In high-burden states such as Uttar Pradesh, Bihar, and Delhi, the absence of respiratory medicine departments and inadequate inpatient capacity in many medical college hospitals hinder TB management. Medical colleges should establish TB centres or TB wards with 20 dedicated beds, while all district hospitals and block-level facilities should have at least two isolation beds each. These designated TB wards could be created within existing air-conditioned hospital spaces or top-floor isolation units to mitigate infection risks. Additionally, bed projections for TB admissions could guide state governments in future resource allocation.

C. Policy and Education Reforms The National Medical Commission (NMC) should mandate online and in-person training modules for undergraduate and postgraduate students to strengthen TB competencies. Integrating NTEP capacity-building modules and continuous medical education (CME) programs at medical colleges would enhance adherence to national TB guidelines. Re-establishing the respiratory medicine postgraduate stream within the NMC framework is equally essential to ensure a pipeline of TB-trained specialists.

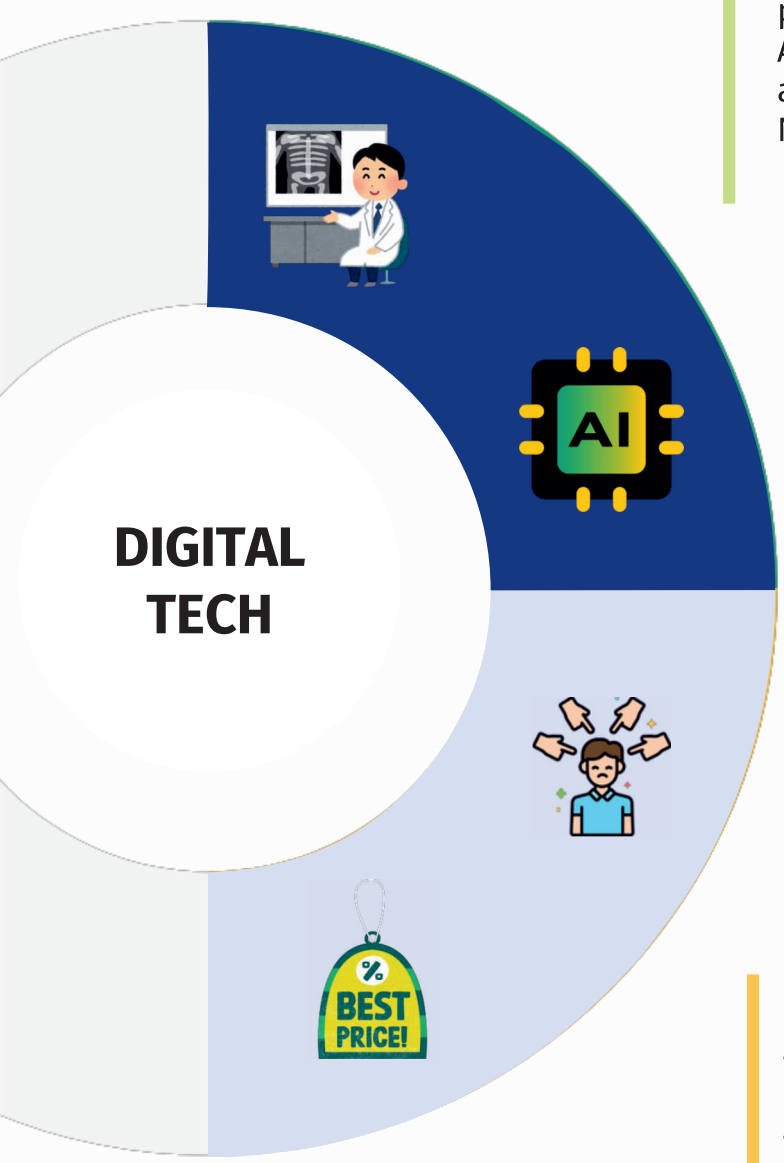
Meaningful engagement of medical colleges through curriculum reform, infrastructure expansion, and active faculty participation will significantly enhance India's TB care ecosystem and accelerate progress toward elimination goals.

Summary of Recommendations:

- Make faculty and staff attendance mandatory at medical college TB task force meetings to improve clinical coordination and admissions of serious TB cases.
- Incorporate mandatory TB-focused questions in NMC-conducted UG and PG exams to reinforce TB knowledge and relevance.
- Develop national guidelines for TB bed projections and isolation infrastructure across medical colleges and district hospitals.
- Promote horizontal hospital integration, enabling seamless TB patient admissions and infection control through innovative structural designs.
- Empower medical officers to make admission decisions for TB patients based on clinical judgment rather than rigid admission criteria.
- Undertake continuous advocacy campaigns within medical colleges to promote faculty, student, and health-worker participation in TB elimination.
- Urge the NMC to restore postgraduate respiratory medicine programs and integrate TB care into family medicine curriculum.

Digital Health Integration

Digital Technology Integration



Newer Technology and Digital Initiatives for diagnosis, treatment and adherence

99DOTS Light, Targeted Next-Generation Sequencing , AI-based X-ray, Expanded NAAT platform, Vaccine research and ecosystem AI X-ray CAD, rt-LAMP, Cure AI, TrueLyse, Cough accoustics AI, TrueAMP, TB STAMP device, Nanoparticle based formulations

Challenges Faced by Indigenous Innovators

- Evolving mutation panels and datasets for precision testing.
- Logistical and financial barriers for large-scale clinical trials incorporating digital innovations
- Prolonged regulatory approvals
- Unavailability of raw materials and high-quality durable devices in India
- Stigma & limited community participation in digital adoption

Recommendations

- Expanding accredited validation centres & sustained investment in data infrastructure
- Augmented reality training to enhance diagnostic competence
- Developing and improving cost effective, user friendly, low maintenance assays & devices
- Affordable molecular assays and blockchain tracking

Introduction

India's National Tuberculosis Elimination Programme (NTEP) is rapidly evolving through the introduction of new diagnostics, digital health technologies, and data-driven management systems to meet the goal of eliminating TB by 2030. These interventions mark a paradigm shift focusing on strengthening disease detection, improving adherence, and ensuring precise treatment through advanced molecular tools, artificial intelligence (AI), and indigenous innovations. By bridging regulatory gaps, ensuring affordability, and promoting digital equity, India is positioning itself as a global leader in TB innovation and control.

Subtheme 1: New Technology and Digital Initiatives under NTEP

The NTEP has integrated cutting-edge tools to enhance diagnosis, drug resistance detection, monitoring, and treatment adherence:

- Digital adherence monitoring: Earlier platforms like 99Dots and the newer 99Dots Light are being aligned with new regimens, including BPaLM, to track adherence. Pilot projects such as those at ICMR–NIRT involve therapeutic drug monitoring to detect non-responders and rationalize drug regimens using pharmacokinetic/pharmacodynamic (PK/PD) analysis.
- Targeted Next-Generation Sequencing (tNGS): Training across NTEP sites is underway to implement tNGS-based DST, which drastically reduces diagnostic turnaround time and improves accuracy in drug resistance profiling.
- AI-based screening tools: Digital chest X-ray systems supported by AI algorithms validated by ICMR offer faster interpretation with high sensitivity for TB detection. The next generation of screening tools, including Cough AI, and innovative blood-, serum-, tongue-swab- and urine-based tests, are being developed to achieve faster, non-sputum-based detection.
- Expanded NAAT platforms: In addition to GeneXpert and TrueNAT (8,293 machines nationwide), new molecular systems such as PathoDetect can soon detect resistance to both rifampicin and isoniazid. MyLab's fluoroquinolone DST NAAT, currently under ICMR validation, is also expected to enhance accuracy and speed.
- Vaccine research and innovation: India's vaccine ecosystem is gaining momentum, with the NTEP supporting indigenous vaccine candidates. The programme is proactively facilitating global collaborations to ensure wider validation and faster adoption of any vaccine proven safe and effective in Indian trials.

Subtheme 2: Indigenous Indian Tools for Diagnosis

India's growing biotechnology landscape is driving cost-effective innovation for field-level TB detection and rapid diagnostics:

- AI X-ray CAD: Computer-aided detection tools are now being fine-tuned for use in paediatrics and immunocompromised patients, where manual interpretation can be difficult. Early trials show strong potential for active case finding (ACF), though challenges like exposure variability and image standardization persist.
- Real-Time LAMP (rt-LAMP): Developed by Sree Chitra Thirunal Institute, Kerala, this fluorescence-based, 96-well test detects Mycobacterium tuberculosis in about 10 minutes, with 89% sensitivity and 94% specificity at a cost of ₹300 per sample. It is now CDSCO-approved and undergoing ICMR validation.
- An AI platform for radiographic image interpretation offering results in 20 seconds. Approved in the U.S. for research use, it is being evaluated by ICMR for large-scale implementation and cost savings.
- A new device enabling PCR detection from tongue swabs within 30 minutes, designed for paediatric and non-sputum cases.
- A cough acoustics AI system using smartphone-integrated microphones to detect TB signatures from short voluntary coughs with 70% specificity and 50% sensitivity. It is approved under a test license by CDSCO.
- A test undergoing ICMR validation that identifies non-tuberculous mycobacteria (NTM), M. tuberculosis, and resistance to INH, fluoroquinolones, and rifampicin simultaneously.

Subtheme 3: Indigenous Tools for Treatment Adherence

Digital adherence and patient support technologies are being redesigned to focus on personalized and family-centred care:

- IEC and patient-centric support: The emphasis has shifted toward education and counselling over reliance on digital tracking. Lessons from 99Dots have highlighted the need for human engagement to sustain adherence.
- AI-driven adherence: Integration of AI-powered reminder systems and side-effect monitors is being explored to identify patients needing additional support.
- Nanoparticle-based TB formulations and PK/PD tracking systems are being tested to minimize side effects and optimize dosing.
- A small digital dispenser provides real-time adherence tracking through SMS and automated alerts to caregivers if doses are missed. It has achieved over 96% adherence among 1,500 patients in pilot studies.

Subtheme 4: Challenges Faced by Indigenous Innovators

Despite India's growing diagnostic innovation ecosystem, significant hurdles persist:

- Difficulty obtaining confirmed case samples for validation.
- Evolving mutation panels and cross-reactivity datasets for precision testing.
- Logistical and financial barriers to conducting large-scale clinical trials.
- Prolonged WHO approval processes delaying commercialisation.
- Dependence on foreign raw materials and delayed CDSCO regulatory approvals.

Subtheme 5: Challenges for Digital and AI-Based Firms

- Frequent battery replacements and hardware costs in handheld X-ray systems pose major operational burdens. More durable, user-friendly devices are needed.
- Persistent stigma continues to affect both patients and healthcare workers. Comprehensive sensitisation for patients, families, and staff must accompany digital adoption.
- Private sector regulation remains inconsistent, with limited antibiotic stewardship and diagnostic audits. Improved alignment with NTEP's treatment protocols and digital integration is critical.
- Developing high-quality, well characterised TB datasets for training robust AI models remains a key challenge, compounded by the cost of sophisticated imaging hardware

Recommendations and Research Priorities

- Offer augmented reality (AR) training to healthcare staff to enhance diagnostic and radiological competence.
- Expanding the list of accredited validation centres could accelerate approvals and deployment.
- Integrate clinical data and sputum quality parameters into AI algorithms to improve diagnostic accuracy.
- Validate and deploy Targeted NGS (tNGS) across certified labs to accelerate drug susceptibility testing (DST).
- Combine AI tools with clinical and imaging data (e.g., chest X-rays, cough acoustics) to enhance mass-screening efficiency.
- Develop affordable molecular assays, ensuring timely deployment in national testing centres.
- Improve digital tool cost-efficiency and create user-friendly, low-maintenance devices for rural use.
- Introduce blockchain tracking systems to bring transparency in Nikshay Mitra financial support.
- Strengthen research on vaccine innovation, particularly focusing on indigenous vaccine candidates.

3

Public Private Partnership

Public Private Partnership

Innovations in private sector

- Flexible payment mechanism for specimen transportation
- Cost neutral service calls for patients
- Family led progress tracker for adherence
- Cough surveillance in pharmacies & private sector consortium
- Differentiated care – colour coded triage system

Gaps in Private Sector

- Irrational and over prescription of drugs
- Inadequate airborne infection control in pulmonary units
- Inadequate TPT for high-risk patients
- Inadequate management of EPTB
- Delayed payment NGOs

Recommendations to strengthen public-private partnership

- Digitise and scale up tools for treatment and adherence tracking
- Flexible incentive, E-vouchers, digital payments and integrated call center under PPIA
- Invoice registries for tracking provider payments
- Expand contracting options for private services based on outputs
- Leveraging Nikshay for real time payment tracking
- Comprehensive training programs for private providers on TB care

Introduction

In India, nearly 60% of people exhibiting tuberculosis (TB) symptoms first seek care from private clinicians. If these providers are effectively integrated into the Public–Private Partnership (PPP) system and trained according to national TB guidelines, no patient would remain undiagnosed, and the cost of treatment could be virtually eliminated. Patients frequently prefer private healthcare due to the proximity of clinics, perceptions of better service, and the complexity of navigating government hospital systems. However, TB diagnosis and treatment in the private sector often become costly, whereas all TB services are free in the public programme. Hence, a strong and well-structured public–private collaboration is vital for India's TB elimination goal.

The private healthcare sector, while efficient in reducing the time from symptom onset to treatment initiation, struggles to ensure long-term treatment adherence, necessitating support from government programs and NGOs. Empowering private physicians with technical guidance from NTEP while linking them to government-provided treatment and follow-up mechanisms has proven to improve outcomes. Over time, NGO-facilitated models which connect private providers to the public health system have demonstrated high success rates in both notification and treatment completion, as NGOs can manage coordination tasks that private physicians often lack time to perform.

The Joint Effort for Elimination of Tuberculosis (JEET) and Patient Provider Support Agency (PPSA) initiatives are notable examples of successful PPP implementation. These models provide private providers with support for patient notification, free diagnostics and drugs, adherence monitoring, and public health action. As of 2024, engagement efforts resulted in 950,000 TB case notifications from private providers across India. However, challenges such as "physician shopping" and diagnosis delays, often extending 30–60 days, remain concerns that must be addressed through improved system connectivity and patient tracking.

Innovative state-level partnerships, including the STEPS model in Karnataka, Tamil Nadu, and Kerala, and the Public–Private Interface Agency (PPIA) in Rajasthan, have shown measurable impact. These models incentivize private healthcare providers for case notification, treatment completion, and quality TB care, including HIV testing, comorbidity screening, contact tracing, and preventive therapy. Collectively, they have strengthened multisectoral coordination and improved accountability between private and public systems. Expanding these public–private frameworks nationwide is essential to make TB elimination in India a realistic and achievable goal.

Subtheme 1: Innovations in private sector.

India's private healthcare sector plays a pivotal role in TB detection and treatment, with over 60% of individuals with TB symptoms seeking care from private providers. However, gaps in coordination, referral mechanisms, and diagnostic integration continue to hinder early detection and complete treatment. Recent innovations in diagnostic systems, case finding, and sample transportation show promising opportunities for scaling public–private collaboration and improving outcomes.

A. Innovations and Good Practices In Rajasthan, effective collaboration among ASHA workers, NTEP staff, and private practitioners has strengthened the sample transportation system. Private providers receive incentives via flexible payment mechanisms for transporting specimens for NAAT testing, ensuring faster confirmation and early treatment initiation. Simple, cost-neutral interventions such as service calls to patients by private providers have reduced loss to follow-up from 35% to 8%, highlighting the importance of patient engagement systems. Tracking systems developed by NGOs serve as a family-led progress tracker where households record medication intake and refill details, improving adherence monitoring.

Few corporate hospitals have successfully integrated TB screening into their standard service packages, demonstrating that TB care aligned with NTEP guidelines can be both clinically beneficial and financially sustainable. Additionally, forming state-level consortiums of private hospitals facilitates direct coordination between the State TB Officer and large private networks like National Task Force models used for medical colleges.

B. Data-Driven and Tech-Based Approaches In Himachal Pradesh, a novel surveillance method screens individuals purchasing cough syrups in government and private pharmacies for TB, which has significantly increased case detection. Over 400 chemists, including AYUSH providers, were trained to enter data into a digital cough surveillance application, with patient tracking supported by ASHA and community health workers. Similarly, in Madhya Pradesh, monitoring monthly retail sales of cough medications from pharmaceutical companies in coordination with drug inspectors has effectively reduced diagnostic delays and treatment gaps.

Technology-enabled case finding, such as QR code-based screening in outpatient departments and WhatsApp-based communication networks among hospitals, has improved turnaround times and inter-facility coordination. These models reveal how innovation and digital integration can enhance efficiency and accountability in the private sector.

Scaling private-sector innovations such as incentive-based sample transport, digital case tracking, and cough surveillance can close diagnostic gaps, reduce delays, and enhance accountability, bringing India closer to its TB elimination goal by 2030.

Summary of Recommendations:

- Digitise and scale up tools for improved treatment tracking.
- Create flexible incentive structures and payments for private practitioners involved in TB sample transport and notification.
- Establish dedicated call centres or tele counselling networks to strengthen follow-up and continuity of care.
- Introduce financially viable TB screening models for private hospitals to encourage participation.
- Expand state and district-level private hospital consortiums for streamlined coordination with the NTEP.
- Implement digital cough surveillance systems in pharmacies to track cough syrup sales and predict TB trends.
- Launch mathematical modelling research to explore links between TB prevalence, private sector notification trends, and drug consumption data (human and veterinary).

Subtheme 2: Management Models, Notifications, and Monitoring of Private Sector Engagement - Gaps and Opportunities.

The Patient Provider Interface Agency (PPIA) model, developed with support from the Gates Foundation, has significantly improved private-sector engagement in TB management across India. Initially implemented in Mumbai, Patna, and Mehsana, the model later expanded to states like Uttar Pradesh, Bihar, and Rajasthan. Its core concept revolves around using intermediary agencies or NGOs as liaisons between private providers and the public system to facilitate notifications, treatment monitoring, and patient support.

Under the PPIA model, patients in the private sector access free diagnostics and government-supplied drugs through vouchers or e-vouchers, while participating laboratories, pharmacies, and clinics receive digital payments via an integrated call-centre and IT network. Over four years of operation:

- 88% of patients received free TB medications.
- Treatment success ranged from 75–80%, and notifications increased 4.6 times in Patna, 1.8 times in Mehsana, and substantially in Mumbai.
- Time to diagnosis and treatment initiation was significantly reduced.

The model demonstrated that covering ~75% of private provider interactions could lead to measurable reductions in TB incidence over time. These results contributed to the nationwide PPSA (Patient Provider Support Agency) scale-up under the JEET project supported by the Global Fund.

A. State-Level Innovations and Payment Mechanisms

Rajasthan adopted a refined model, the Public–Private Interface System (PPIS), evolving from PPSA to enhance coordination and sustainability. Instead of relying on lab notifications, it mandated physician-led notifications integrated with Nikshay. Doctors received combined incentive payments including ₹200 per notification, ₹500 from CTD, and ₹100 for sputum transport while additional payments were allocated for tests like HIV and diabetes screening. Quarterly invoice systems monitored by District PPM Coordinators ensured accountability and timely UDST and HIV testing.

Tracking the denominator of private TB patients emerged as a crucial metric, using drug sales data to estimate coverage in states with higher private-sector reliance (Uttar Pradesh, Bihar, Maharashtra, Rajasthan). The establishment of technical support units (TSUs) across 240 districts now aids contract management, performance tracking, and grievance resolution.

B. Digital Tools and Communication Systems

The integration of the Nikshay platform has enhanced transparency by enabling notifications, monitoring incentive payments, and tracking private-provider performance in real time. Cities like Mumbai and Darbhanga have piloted voucher management systems both paper-based and digital (eRupi) to promote service delivery and patient adherence while preventing misuse.

Persistent Challenges

- Heavy dependence on third-party agencies reduces institutional sustainability.
- Delayed payments to NGOs disincentivise participation in future bidding cycles.
- Monitoring the quality of care and ensuring continuity of treatment in private settings remain difficult.
- In some instances, misuse of patient data from Nikshay by intermediaries was reported.

Although the PPIA and PPSA models have significantly enhanced private sector collaboration and improved TB notifications, they have also heightened the government's reliance on external implementing agencies an arrangement that is not sustainable in the long term. The withdrawal of donor or NGO support could disrupt these operations entirely. Hence, future efforts should prioritize building stronger health system capacities within NTEP to perform these functions independently.

Summary of Recommendations:

- Adopt a segmented engagement strategy tailored to regional contexts instead of uniform national models.
- Strengthen private sector screening for both pulmonary and extrapulmonary TB.
- Develop mechanisms for direct coordination and communication between health departments and private networks, similar to PPIS.

- Build invoice registries for systematic tracking of provider payments and diagnostic reimbursements.
- Expand contracting options for private services (diagnostics, X-rays, pharmaceuticals, rapid tests) using output-based payment systems.
- Introduce SMART metrics to monitor private TB care quality such as access to NAAT testing, direct benefit transfers, and fixed-dose combination drugs.
- Ensure differential performance targets based on private sector case load and notification denominators across states.
- Scale up TSUs to support contract agencies and institutionalize supervision.
- Leverage Nikshay for real-time payment tracking to minimise administrative delays and fraudulent claims.

Subtheme 3: Differentiated care models within the private sector – Identified gaps and potential opportunities.

In India, differentiated care models are emerging as an effective approach to improve tuberculosis (TB) management in the private healthcare sector, focusing on patient-centred strategies, early triage, and integrated service delivery.

A. Differentiated Care in Private Hospitals Some private hospitals in Delhi have piloted a colour-coded triage system to assess disease severity where yellow indicates the need for close monitoring and red denotes the need for hospital admission. Caregivers are trained to recognise early warning signs and assist in timely care escalation. To support early case detection, an intensive case-finding booklet has been developed to identify pulmonary and extrapulmonary forms of TB, mapping local diagnostic facilities and services.

B. The Mumbai Model: A Scalable Public–Private Partnership Mumbai model offers a successful example of a differentiated, patient-centric TB care system driven by a public–private partnership with NGO support. The model operates through a hub-and-spoke structure, where peripheral clinics (spokes) promptly refer suspected TB cases to identified hub specialists. NGOs play an instrumental role in

- training private clinicians,
- coordinating diagnostic and treatment linkages, and
- managing sputum collection and transport to public sector laboratories.

This system has improved notification rates, reduced diagnostic delays (with GeneXpert results available within 24 hours), and accelerated treatment initiation. The introduction of digital interfaces such as Nikshay login credentials for private doctors allows direct access to diagnostic data, enabling better treatment monitoring and regimen adjustments.

Under this model, TB medications are dispensed free of cost at partner private pharmacies, ensuring affordability and adherence. Additionally, several private

providers have installed GeneXpert machines, expanding access to molecular diagnostics. Comprehensive, multidisciplinary outpatient services—including counselling, psychiatry, and nutrition—operate under one roof, coordinated through a triage centre. Such integrated care has led to significant improvements in patient outcomes and cure rates.

C. Patient-Cantered Engagement Activities Mumbai's programme emphasises patient engagement through innovative outreach activities in clinics (art, music, and interactive activities), which enhance patient morale, reduce stigma, and improve retention during long treatment courses. The result has been a sharp increase in collaboration among private physicians and stronger adoption of standardised TB protocols.

Differentiated care models in the private sector particularly those integrating digital technologies, structured triage, and patient engagement demonstrate immense potential to close diagnostic and treatment gaps while enhancing patient outcomes through superior coordination, accessibility, and continuity of care.

Summary of Recommendations

- Identify predictors of mortality through systematic triage assessments at baseline to guide early intervention in private settings.
- Address subclinical and early symptomatic TB by updating national guidelines and enhancing private sector capacity for early detection and care linkage.
- Replicate Mumbai's NGO-based partnership model across other states through knowledge exchange, wider networking, and technical collaboration between NGOs, NTEP, and private hospitals.

Subtheme 4: Other challenges in private sector.

A. Diagnosis and Prescription Challenges A major concern is the irrational prescription of anti-TB drugs which contributes to the development of drug resistance. Furthermore, some private physicians often prescribe random drug dosages that are not weight-based, posing serious risks to underweight or malnourished patients. To improve accountability, Kerala has implemented a model requiring every pharmacy to maintain a register of Schedule H drug sales. District TB Officers (DTOs) inspect these registers to identify unnotified TB patients receiving treatment privately. Encouragingly, 95% of private hospitals in Kerala now use only NTEP-endorsed drug formulations.

B. Airborne Infection Control and Facility Gaps Infection control infrastructure remains inadequate in most private pulmonology units, many of which lack ventilated or air-conditioned isolation areas. It is essential to develop and enforce infection control guidelines specific to private hospitals where general and TB patients are managed together.

C. Preventive Therapy and High-Risk Populations While the public sector successfully provides TPT to child and HIV contacts, other high-risk groups such as patients receiving anti-TNF therapy, rheumatology patients, and organ transplant recipients are primarily treated in the private sector. These patients are often missed by public programs due to limited coordination and programmatic overload. Strengthening government–private linkages is necessary to track these patients, screen for TB and LTBI and ensure appropriate initiation of TPT.

D. Management of Extrapulmonary TB (EPTB) The absence of clear admission protocols and structured training for private practitioners managing EPTB further fragments care. Many private doctors lack expertise in sample collection, particularly for complex EPTB forms such as gastrointestinal, genitourinary, gynaecological, and CNS TB leading to unnecessary referrals to tertiary facilities. Establishing AI-enabled referral systems can simplify the identification of diagnostic facilities and streamline coordination. The NTEP training module on EPTB (2023) emphasizes the importance of continuous practitioner education and capacity development across primary, secondary, and tertiary levels.

Strengthening TB management within the private sector demands a systematic approach to training, prescription regulation, and infection control, with particular attention to EPTB and high-risk patient groups. Establishing robust surveillance, digital tracking, and public–private coordination mechanisms will be key to ensuring safe, standardised, and equitable TB care delivery.

Summary of Recommendations

- Conduct comprehensive training programs for private providers on appropriate TB drug use and develop real-time digital monitoring systems for prescription practices.
- Implement infection control guidelines for private hospitals managing TB alongside other conditions.
- Ensure TPT coverage expansion for high-risk patients (anti-TNF therapy users, transplant recipients, etc.) managed predominantly by private providers.
- Scale up tools like the intensive case-finding booklet (covering pulmonary and extrapulmonary TB) for private-sector use.
- Incorporate EPTB-specific training modules into existing PPSA/PPIA frameworks to enhance diagnostic and clinical management capacity.

Distinct Challenges in the Implementation of NTEP in Northeast India

TB CARE IN NORTHEAST – GAPS & RECOMMENDATIONS

GAPS

Culture & Geography

Migration, ethnicity, and topography

Human Displacement and Service Disruption

Technology

Technology Limitation in Service Delivery

Barriers in ACF & Laboratory Capacity

Behavioural & Social Factor

Stigma, Substance Use & Rising NCDs

Nutritional Support Gaps

System Constraints

Gaps in Health System & Resource Allocation

Private sector fragmentation

Northeast Landscape

750 ethnic groups, multiple dialects, 80% mountainous terrain, sharing international borders, frequent disasters, superstitions, stigma , poor infrastructure and connectivity

RECOMMENDATIONS

Community Involvement

Last-mile community driven support model

Micro-planning with District Disaster Management

Technology Adaptation

Offline-enabled Nikshay portal

Fostering adaptive service models & Technology Training

ACSM

Audio Visual-IEC in local dialects.

CSR consortium -Nikshay Mitra

TB –NCD Coordination committee

Policy Intervention

Increased resource allocation and procurement support

Partnerships with private hospitals and healers

Introduction

Achieving tuberculosis (TB) elimination in Northeast India demands a tailored, region-specific approach that accounts for its ethnic diversity, geographic complexity, and infrastructural challenges. The region's difficult terrain dispersed tribal populations, and cultural heterogeneity limit healthcare access, emphasizing the need for context-sensitive, community-centred, and multi-sectoral interventions. It requires merging medical, social, and cultural strategies—leveraging local leadership, technology, and cross-sector partnerships. Sustainable progress will hinge on strong government coordination, empowered communities, and regional innovation that recognizes both the vulnerabilities and the resilience of the northeastern populations

Subtheme 1: Major challenges in programme implementation in the Northeast

A. Migration, ethnicity, and topography TB elimination efforts in Northeast India face unique and complex challenges linked to geography, ethnic diversity, infrastructure limitations, and sociocultural factors. The region, covering 8% of India's land area, shares international borders with Myanmar, China, Nepal, and Bangladesh, and is home to around 750 ethnic groups speaking hundreds of dialects. These linguistic and cultural diversities, combined with mountainous terrain and poor connectivity, have created significant barriers to healthcare access and programme implementation.

The region's hilly terrain and remote settlements lead to logistical difficulties in service delivery. Communities often rely on traditional healers and informal systems of medicine, delaying diagnosis and treatment. Migrant populations including tea garden workers and cross-border migrants face fragmented access to care and poor follow-up, increasing the risk of TB transmission and treatment loss.

B. Weak Public Health Indicators and Health System Constraints Northeast states, particularly Assam and Meghalaya, rank below the national average in infant mortality, maternal mortality, and malnutrition. The burden of comorbid conditions like HIV, diabetes, and malignancies further complicates TB management. Health infrastructure is fragile, with shortages of human resources, poor cold chain systems, and frequent power supply failures disrupting vaccine and drug delivery. In some remote districts, supplies still rely on head loads and drones for transport, highlighting deep logistical gaps.

C. Bureaucracy and Resource Bottlenecks Procurement delays, fragmented fund flow, and bureaucratic hurdles slow the distribution of medicines, diagnostic tools, and incentive payments. It often takes 8–9 days for vaccine delivery in some border districts due to communication and transportation issues. These systemic gaps continue to obstruct effective programme execution.

D. Substance Use, co-morbidities, and Rising NCDs The Golden Triangle route (Myanmar, Laos, Cambodia, Yunnan–China) contributes to heavy drug trafficking in the region. Drug and alcohol use are rising sharply, leading to high rates of co-morbidity and poor treatment adherence among TB patients. The integration of TB and NCD screening programs is underway, though the reverse-screening system remains poorly implemented in peripheral areas.

E. Stigma, Non-Disclosure, and Private Treatment Stigma continues to deeply affect TB outcomes. Around 10–20% of TB patients in the region avoid official registration due to fear of social exclusion, seeking private treatment instead. Misconceptions about TB being incurable reinforce secrecy, resulting in 30% of treatment discontinuations. This trend is particularly pronounced among higher-income and urban groups who prefer private facilities.

F. Human Displacement and Service Disruption Frequent floods, landslides, and ethnic unrest, notably in states like Manipur, cause recurrent service disruptions and mass displacement. Many people from hill districts travel to lowland areas for treatment but face barriers during political or climatic crises, interrupting continuity of care.

Summary of Recommendations

- Adopt innovative and localised strategies to address hidden barriers unique to the Northeast's terrain, culture, and demography.
- Initiate cross-border TB elimination efforts with Southeast Asian countries to address international migrant-related transmission.
- Engage tribal leaders and traditional healers to build trust, improve case notifications, and boost treatment completion rates.
- Develop a "last-mile community support model," assigning TB champions in each remote village to provide psychosocial care and treatment follow-up.
- Create a network of cured TB survivors to act as long-term community-based TB advocates.
- Encourage community ownership models to overcome barriers to service delivery and promote sustained engagement.
- Implement psychosocial interventions targeting patients' social circles to mitigate TB stigma and promote disclosure and adherence

Subtheme 2: TB and co-morbidity in Northeast India

Managing TB and its related comorbidities in Northeast India remains a serious challenge due to diverse health system gaps, demographic disparities, and uneven resource distribution. States such as Assam, Mizoram, Manipur, Meghalaya, and Arunachal Pradesh display high prevalence of TB alongside rising rates of HIV, diabetes, and low Body Mass Index (BMI) which significantly worsen treatment outcomes.

Co-morbidity Burden Across States In Arunachal Pradesh and Tripura, widespread malnutrition contributes to a high prevalence of low BMI among TB patients. Approximately 60% of patients in Arunachal present with low BMI, often at an advanced disease stage, underlining the need for energy-dense nutritional supplementation (EDNS). Meanwhile, in Assam, there is high burden of TB-diabetes comorbidity, yet only 21–24% of patients receive anti-diabetic therapy (ADT), highlighting a substantial treatment gap. Similarly, while 85% of TB patients in Arunachal are screened for diabetes, ADT coverage dropped from 36% in 2023 to 23% in 2024.

In Manipur, TB–HIV co-infection stands at 5–7% with low ART coverage, and ADT availability remains limited (15–17%) despite 82% diabetes screening coverage. Mizoram demonstrates higher HIV positivity, with coinfection rates around 11% and moderate ART coverage, but Tb–diabetes co-morbidity treatment lags below 50%. Nagaland shows a 9–10% TB–HIV prevalence, while Sikkim and Tripura fare comparatively better, with less than 1–2% HIV–TB rates and higher ART and ADT accessibility.

These data reflect significant inconsistencies in routine screening, ART and ADT supply, and clinical follow-up across states. Despite good screening rates in several areas, therapeutic coverage remains low, primarily due to logistical barriers and shortages in medication supply chains.

Programmatic Gaps

- Inadequate coordination between TB and NCD programs: Shared screening frameworks for TB–diabetes and TB–HIV are poorly aligned, resulting in missed opportunities for integrated care.
- Fragile medication supply lines: Frequent stockouts of insulin and ART compromise long-term treatment adherence.
- Healthcare access and workforce limitations: Peripheral health units lack trained staff for dual screening and long-term comorbidity management.
- Insufficient data harmonisation: Fragmented health records undermine accurate estimation of comorbidity prevalence and progress tracking.
- Addressing TB co-morbidities in Northeast India demands an integrated, multi-disease management approach that bridges TB, NCD, and HIV programs.
- Strengthening cross-programme coordination, ensuring uninterrupted drug supply, and expanding comorbidity screening coverage are essential to curbing the growing dual disease burden in the region.

Summary of Recommendations

- Establish TB–NCD co-morbidities Coordination Committees in all northeastern states to institutionalise joint planning and resource-sharing mechanisms.
- Develop comprehensive technical guidelines linking TB, NCD, RBSK, and RRSK frameworks to strengthen collaborative service delivery.

- Encourage WHO-led technical support and facilitation, ensuring regular review of TB–HIV and TB–diabetes coordination committees at the state level.
- Ensure consistent supply of essential medications, including insulin and ART, through strengthened logistics and procurement systems.
- Promote dual screening protocols for early detection of TB and associated risk factors such as diabetes, hypertension, and HIV.
- Integrate systematic nutritional and psychosocial support for low-BMI patients to improve treatment outcomes.

Subtheme 3: Technology Limitations in Northeast India.

Technology-enabled TB service delivery in Northeast India faces persistent limitations due to the region's geography, poor connectivity, and underdeveloped digital infrastructure. Despite substantial investments in mobile diagnostics such as handheld X-ray machines and TrueNAAT devices, these tools have achieved only partial population coverage. For example, in Mizoram (population 1.1 million), screening reached just 40–50% of people despite full deployment of equipment. Limited internet access, network instability, and weak data storage capacity continue to impede the functioning of surveillance and reporting systems (Nikshay).

Field reports indicate that hardware availability alone does not translate into comprehensive coverage or real-time reporting. Server constraints and funding shortages exacerbate data-handling inefficiencies, while health workers struggle with slow uploads of diagnostic images and patient data. Remote and hilly topographies make online data synchronisation nearly impossible, forcing frontline workers to rely on paper documentation, which delays report validation and case tracking.

To address these challenges, experts recommend a hybrid model that combines centralised data integration through artificial intelligence (AI) platforms with offline-compatible digital systems. A dedicated AI-supported TB portal could automate X-ray interpretation, connect local facilities to regional diagnostic hubs, and allow faster diagnosis even in low-connectivity areas. Similarly, adapting Nikshay for offline functionality would greatly enhance usability for health workers who operate in network-limited districts.

While digital diagnostics and surveillance systems have shown potential, their impact in the Northeast remains constrained by infrastructure deficits. Strengthening digital resilience through AI integration, offline operability, and sustainable funding is key to achieving inclusive, technology-driven TB care in the region.

Summary of Recommendations

- Implement a centralised AI portal to streamline the uploading of field X-rays, automate report generation, and build real-time analytic dashboards for the region.

- Develop an offline-enabled version of the Nikshay portal to facilitate uninterrupted data entry, case notification, and tracking by health workers in areas with intermittent network access.
- Expand server infrastructure and data storage capacity, ensuring secure and scalable network access.
- Establish technical support units within northeastern states to maintain and train personnel for digital TB tools.

Subtheme 4: Challenges related to ACF, diagnosis and Sample Transportation in Northeast.

TB control in the Northeast continues to face significant operational challenges. Despite expanded coverage under the 100-day campaign, long-standing issues related to active case finding (ACF), diagnosis, sample transport, and laboratory efficiency remain unresolved. While diagnostic capacity in the Northeast has expanded, its impact is hindered by logistical, environmental, and quality-related constraints. Sustainable progress will depend on grassroots innovation, network coordination, and practical replication of proven models like Mumbai's courier system, supported by training, decentralisation, and quality assurance frameworks.

A. Barriers in Active Case Finding and Diagnosis In Assam, only 324 out of 854 tea gardens have been engaged by the NTEP through community health worker networks. Although intensified case finding identified 10–15% of new TB cases from these sites, the collection of poor-quality sputum samples under target-driven pressures has led to diagnostic inefficiencies and wastage of resources. The tea gardens, home to highly congested and malnourished populations, continue to be recognised TB hotspots due to poor sanitation and lack of care-seeking behaviour.

Handheld X-ray devices have shown potential to bridge diagnostic gaps, especially in hilly and inaccessible areas such as Manipur and Arunachal Pradesh, where presumptive TB patients often do not reach healthcare facilities.

Similarly, challenges remain in diagnosis of paediatric TB which accounts for approximately 24% of total cases. Despite this, there is lack of diagnostic facilities, like the absence of gastric aspirate facilities often results in symptom-based empirical treatment rather than laboratory-confirmed diagnosis.

Extra pulmonary TB (EPTB) shows increasing prevalence in certain northeastern districts. Cervical TB and Beijing strain-related infections have been reported in Sikkim, Arunachal Pradesh, and parts of Ladakh, where high bacillary load individuals can remain asymptomatic yet infectious.

B. Bottlenecks in Sample Transportation and Laboratory Capacity Sample transport infrastructure remains a major constraint in Northeast region. In Kolkata and Guwahati, sputum samples collected from peripheral units often reach laboratories late in the afternoon mostly after cut-off times, leaving them unprocessed. Laboratory staff in district units can handle only 40 samples per day, which restricts

output. Although the NTEP has decentralised diagnostic networks and installed NAAT and TrueNAAT machines across all northeastern states, many devices remain underutilised.

In contrast, Mumbai's human courier model, which enables 24x7 sample transport and immediate processing, presents a replicable innovation for the Northeast.

Summary of Recommendations

- Strengthen collaboration between District TB Officers (DTOs) and grassroots community workers to design localised, context-driven solutions for sample collection and transportation.
- Train NGO workers and community volunteers to operate diagnostic tools such as TrueNAAT and portable X-ray machines.
- Encourage district-level innovation, fostering decentralisation and adaptive service models within NTEP to suit local terrain and resource conditions.
- Introduce new diagnostic tools including dry blood spots, stool tests, tongue swabs, and open RT-PCR to improve detection in low-infrastructure settings.
- Equip every northeastern district with at least one digital handheld X-ray device to expand early detection and screening coverage.
- Balance ACF targets with emphasis on quality sputum samples to ensure more reliable laboratory outcomes.
- Conduct specialised training for healthcare professionals across both public and private sectors on diagnosing asymptomatic and extrapulmonary TB.

Subtheme 5: Other operational issues specific to Northeast

The Northeast region faces distinctive obstacles in maintaining TB service delivery due to recurrent natural disasters, limited health infrastructure, diverse socio-cultural contexts, and resource disparities. A state-specific, multi-stakeholder strategy is required to build resilient systems, ensure treatment continuity during emergencies, and address wider service delivery inequities.

A. Service Delivery During Disasters Frequent disruptions caused by floods, landslides, cyclones, and ethnic unrest often halt TB treatment adherence. While emergency efforts by NGOs, churches, tribal associations, and youth groups provide short-term humanitarian aid, structured protocols for medication continuity remain inadequate. Lessons from Kerala's disaster-resilient TB response (2018 floods) which ensured uninterrupted drug supply through real-time monitoring and pre-crisis planning highlight the need for similar state-level health disaster strategies in the Northeast.

Developing district-level disaster protocols, sensitizing District Disaster Management Teams (DDMTs) on TB continuity, and mobilising trained community volunteers is crucial. Collaboration with social media influencers and NGOs can also improve outreach during crises.

B. Awareness, IEC, and Nutritional Support Gaps IEC material in local tribal and ethnic dialects remains scarce despite active efforts by the Ministry of Tribal Affairs. Audio-visual communication in vernacular languages rather than printed materials has proven more effective in communities with low literacy levels (example from state of Odisha). Strengthening the TB Champions network as community communicators can localise IEC dissemination.

The region also faces challenges in identifying Nikshay Mitra donors, particularly in Assam, where programme sustainability is limited. Expanding local partnerships through CSR consortiums and developing energy-dense nutrient supplements (EDNS) tailored to local diets could improve outreach and adhere to cultural food practices.

C. Resource Allocation and System Convergence Funding models tied to population size disadvantage smaller states like Sikkim compared to Assam, undermining equitable support for TB initiatives. Despite the presence of functional health systems in states such as Mizoram, Sikkim, and Tripura, fragmentation between departments reduces efficiency. Strengthening interdepartmental convergence, stakeholder partnerships, and cross-sectoral platforms could enhance accountability and strategic alignment.

D. Human Resources and Private Sector Engagement In the Northeast, program delivery heavily depends on ASHA workers, who require regular training, incentives, and logistical support. In Assam's tea gardens and remote tribal belts, volunteers and TB survivors should be recruited to ensure last-mile delivery. Engaging traditional healers and standalone private practitioners remains challenging. As many private clinics fail to follow NTEP guidelines, systematic mechanisms such as drug sale tracking dashboards and pharmacy linkages with DTOs could help locate "missing" TB patients.

In West Bengal, which shares demographic and healthcare similarities with the Northeast, delays in treatment initiation and high pre-treatment loss to follow-up with 25% starting therapy late—demonstrate the urgent need for improved coordination with private hospitals. Many private facilities diagnose TB but cannot dispense medications, leading to gaps in care.

E. Medical College Coordination in TB Management and Programme Activities Coordination between medical colleges and the NTEP in the Northeast remains poor similar to other states, both public and private, to admit TB patients. Reasons include overcrowding, infection concerns, and risks to immunocompromised individuals. With private hospital costs being prohibitively high, access for moderately ill patients is restricted, overburdening a few government institutions.

Although NTEP and the National Medical Commission (NMC) plan to establish dedicated TB beds, implementation has been slow. The exclusion of respiratory medicine from the MBBS curriculum has further reduced clinical competence and student involvement in TB care. Dependence on digital diagnostics and limited bedside learning contribute to underreporting, with colleges accounting for only

20–25% of expected TB case notifications.

While initiatives such as a dedicated task force and Kerala's model show promise, major obstacles persist namely administrative autonomy, lack of staff and funds, and conflicts over manpower allocation. Suggested measures include sustained engagement, incentives, elective TB courses for undergraduates, and research grants (example for TB theses). The COVID-19 experience demonstrated that consistent collaboration substantially improves TB notification rates.

Summary of Recommendations

- Develop state-tailored TB elimination plans for all northeastern states with active community participation.
- Create a regional coordination platform to integrate stakeholders across sectors under a shared TB elimination objective.
- Strengthen community-driven volunteer systems for continuity of TB care during disasters.
- Institutionalize micro-planning frameworks with DDMTs to ensure TB service delivery is embedded in disaster preparedness.
- Produce multilingual audio-visual IEC materials suited to local dialects.
- Develop gender-sensitive quality care guidelines for women, especially in marginalized tea garden populations.
- Form a CSR consortium to sustain Nikshay Mitra support, focusing on Assam and high-burden districts.
- Validate and scale up culturally acceptable EDNS models for undernourished TB patients.
- Implement rapid-response units to minimize treatment delays and loss to follow-up in disaster and post-conflict areas.
- Strengthen partnerships with private hospitals and healers for effective medicine distribution and service integration.
- Launch real-time drug sale monitoring dashboards supervised by state drug inspectors to identify unnotified TB cases.
- Reintroduce respiratory medicine into the NMC curriculum, addressing faculty shortages through rotational teaching, online modules, and digital learning platforms (e.g., ICMR-NIRT's TB online course).
- Activate the community medicine departments to support TB notifications and related programmatic functions.

15

Challenges in Eliminating Tuberculosis in Rural and Tribal Regions

CHALLENGES IN TB ELIMINATION

Rural and Tribal Regions

1 Barriers in Health Seeking & Diagnosis

- Sample Transportation & Drug supply constraints
- Economic insecurity
- Delay in diagnosis

2 Socio-economic challenges

- Lack of Aadhar card & Bank account
- Barriers in accessing Nikshay-poshan

3 Stigma and Cultural Barriers

- Deep rooted misperception
- Lack of local language IEC
- Role of Traditional Healers

4 Telemedicine and Digital Inequity

- Poor digital infrastructure
- Lack of trained manpower
- Interrupted connectivity

5 Communication Gaps

- Lack of understanding of local culture
- Poor TB knowledge among healthcare workers

6 Ineffectiveness of TB-free Panchayats

- Existence of hamlet
- Lack of understanding of local socio geography

7 System & Inter-Sectoral Gaps

- Fragmented coordination between NTEP, NCD, MCH program
- Lack of incentives for ASHA workers
- Lack of convergence with Ayushman Arogya Mandir

8 Undernutrition and Limited Nikshay Mitra Coverage

- Lack of BMI data in Nikshay portal
- Delay in food basket delivery
- Reliance on local food habits

RECOMMENDATIONS FOR TB ELIMINATION

Rural and Tribal Regions

1 Barriers in Health-Seeking

- Strengthen ACSM
- Expand mobile outreach
- Modular clinical training for Rural MO's

2 Socio-economic challenges

- Link workers to bridge administrative gaps in Nikshay-DBT
- Increase Awareness about livelihood options

3 Stigma and Cultural Barriers

- IEC in local dialect
- Sensitising & improve awareness among tribal healers for TB referral

4 Telemedicine and Digital Inequity

- Training of AAMs & volunteers
- Addressing digital inequity
- Inclusion of vulnerable population

5 Communication Gaps

- Training in compassionate and culturally appropriate communication
- Comprehensive training on TB care

6 TB Free Panchayats

- TB Free hamlets & flexible TB free certification criteria
- Social & anthropological research to understand context

7 System and Inter-Sectoral Gaps

- Leveraging Panchayati Raj & AAMs for expanding service delivery
- Partnership with Ministry of tribals & others

8 Undernutrition and Limited NIKSHAY Mitra Coverage

- Linking isolated population towards social welfare schemes
- Aadhar based PDS and Nikshay linkage

Introduction

Tuberculosis (TB) remains deeply intertwined with social inequality and limited access to healthcare in India's tribal and rural communities, where poverty, weak health systems, cultural barriers, and stigma continue to affect care-seeking and treatment adherence. Studies across India show that nearly 75% of tribal individuals with TB-like symptoms do not seek medical care promptly, and those who do often delay consultation for over a month due to lack of awareness, financial hardship, and poor accessibility.

Subtheme 1: Health-Seeking Barriers and Service Gaps

Improving TB outcomes in tribal and rural India requires a blend of trust-building, decentralization, and cultural alignment. Reducing provider–patient distance, empowering local leaders, and integrating traditional caregivers into mainstream TB programs can greatly enhance health-seeking behaviour and accelerate progress toward TB elimination.

A. Barriers to Health-Seeking in Tribal and Rural Areas In underdeveloped tribal areas such as Chhattisgarh residents face hardships due to transportation shortages, irregular drug supply, and economic insecurity. People often travel long distances on foot to reach public facilities, as private options are virtually non-existent. Many patients prioritise subsistence work over health. Consequently, numerous deaths occur outside Nikshay monitoring systems, highlighting poor surveillance.

TB notification rates in Chhattisgarh remain among the lowest relative to prevalence. For every case reported, approximately five cases likely go undetected within the community. Reliance on smear microscopy instead of NAAT due to the absence of equipment in rural centres further contributes to underreporting. Comparatively, states such as Tamil Nadu and Himachal Pradesh, where upfront NAAT and cough surveillance are implemented, show higher detection and notification rates.

B. Stigma and Awareness Gaps Tribal and rural communities face persistent stigma surrounding TB often greater than that seen with HIV. Misconceptions of TB as incurable remain prevalent, and limited outreach in local languages weakens programme reach. Studies indicate that effective community-based education, delivered in local dialects, significantly improves treatment uptake and preventive therapy (TPT) initiation.

C. Cultural Barriers and Role of Healers and Leaders A critical determinant of healthcare choices in tribal areas is the community's high dependence on traditional healers or 'tribal priests', who are viewed as the first responders to illness. Younger individuals may show interest in visiting hospitals, but older generations prefer traditional treatment systems rooted in cultural identity. Recognizing this, experts emphasize engaging tribal leaders and healers as allies rather than competitors. Their involvement in referrals, community counselling, and alcohol reduction initiatives can significantly improve adherence and case detection.

D. Communication Gaps and Lack of Empathy At the provider level, poor communication and perceived insensitivity among healthcare workers further undermine trust in the formal system. Doctors from diverse social and urban backgrounds often lack contextual understanding of tribal cultures and socioeconomic struggles. Evidence shows that even a brief empathetic consultation like spending an additional 30 seconds explaining TB symptoms, treatment expectations, and prevention, can strengthen trust and improve TPT acceptance.

Summary of Recommendations

- Ensure uninterrupted supply of TB drugs and NAAT testing facilities in rural and tribal areas.
- Expand mobile outreach and last-mile delivery of drugs through frontline workers to overcome transport barriers and wage-loss constraints.
- Strengthen ACSM (Advocacy, Communication & Social Mobilization) strategies, including IEC materials in local dialects, to reduce stigma.
- Reassess TB-free certification criteria to account for low notification rates in marginalized communities.
- Introduce training modules for doctors in compassionate and culturally appropriate communication.
- Institutionalise financial incentives and recognition for tribal leaders and healers who facilitate TB referrals and awareness activities.
- Support social and anthropological research to examine tribal health beliefs, alcohol use, and gendered health norms affecting TB care.

Subtheme 2: Socio-economic Challenges

Rural and tribal populations remain among the most underserved groups within India's NTEP due to a complex intersection of infrastructural, administrative, cultural, and geographic barriers. Persistent challenges such as weak financial inclusion, shortage of medical human resources, digital inequity, and fragmented inter-sectoral coordination require tailored, community-centred solutions to ensure equity in TB service delivery.

A. Barriers in Direct Benefit Transfer (DBT) and Access to Care In many tribal districts, such as Chhattisgarh, patients face major obstacles in accessing Nikshay Poshan Yojana (DBT) benefits due to lack of Aadhaar cards, inactive or mismatched bank accounts, and dependence on poor internet connectivity. The 15-day delay in Nikshay ID generation worsens initiation of treatment. Patients and frontline workers are burdened with bureaucratic verification processes, leaving many without support during the critical early treatment phase. Coordination with MGNREGA and daily wage earners can help reach financially vulnerable individuals in these regions.

B. Context-Sensitive Implementation: The concept of TB-free Panchayats, though effective in many states, is ill-suited to tribal states like Madhya Pradesh and Chhattisgarh, where hamlets replace conventional village structures. A TB-free hamlet model, focusing on micro-targeted community engagement rather than administrative boundaries, would better reflect tribal sociodemographic domain. Targets should prioritise hotspot hamlets and high-burden clusters rather than more easily accessible villages.

C. Telemedicine and Digital Inequity Digital health tools and teleconsultations show great promise but remain underutilised in rural and tribal areas due to poor infrastructure. Most patients meet doctors only once that is at the time of notification while follow-up is done by Senior Treatment Supervisors (STS). Expanding telemedicine platforms, while addressing data connectivity and human resource shortages, is essential. Training tribal youth or women to operate handheld X-ray devices could also address the human resource gap and improve diagnostic outreach.

D. Undernutrition and Limited Nikshay Mitra Coverage Undernutrition among TB patients is significantly higher in tribal belts like Chhattisgarh, yet BMI data are often missing from the Nikshay portal despite available height and weight records. Only 29% of patients received food baskets after two months of treatment. Culturally contextualized Energy Dense Nutritional Supplements (EDNS) and regular supervision mechanisms are needed to ensure consistent food support coverage.

E. System and Inter-Sectoral Gaps Fragmented coordination among NCD, TB, and MCH programs has reduced the efficiency of contact tracing and comorbidity screening. ASHAs, drawn more toward better-remunerated programs like MCH, often deprioritize TB tasks. Integrating TB modules into NCD and HWC village camps could improve coordination.

Furthermore, tribal language IEC materials, adapted for Odisha and Jharkhand populations, remain scarce. Strengthening multi-sectoral partnerships addressing nutrition, transport, and water access and linking Aadhaar based PDS and Nikshay systems could directly benefit malnourished TB patients.

F. Leveraging Panchayati Raj and HWCs for Rural Outreach In Uttarakhand, hilly terrain and sparse communication networks hinder service integration. Collaboration with Panchayati Raj institutions can enhance sample transport and screening efficiency.

The Madhya Pradesh model of linking Ayushman Arogya Mandir (AAMs) with NAAT hubs via bike-rider logistics and WhatsApp-enabled coordination exemplifies best practice. Ensuring full medicine availability and enabling contact tracing and adherence monitoring at HWC levels would make TB care truly decentralised and accessible.

Strengthening NTEP in tribal and rural contexts requires a decentralized, equity-centred framework. By combining local governance models, digital inclusion, and community participation with practical innovations like drone transport and micro-level hamlet targeting, India can significantly accelerate TB elimination efforts in its most underserved regions.

Summary of Recommendations

- Appoint link workers to bridge administrative gaps between Nikshay ID and DBT processes.
- Replace the concept of TB-free Panchayats with TB-free hamlets in regions acknowledging tribal-geographic realities.
- Build soft-skill and counselling capacity among community health workers at the AAMs level.
- Improve infrastructure and local transport system.
- Train Panchayat and HWC staff to coordinate diagnostics and medicine logistics for rural settings.
- Address digital inequity by improving connectivity and expanding inclusion of vulnerable populations.
- Certify tribal youth and women to manage handheld diagnostics such as X-rays or sample devices.
- Link isolated tribes to national health and social welfare schemes via partnerships with the Ministry of Tribal Affairs.
- Develop modular clinical training packages for rural medical officers to ensure timely presumptive diagnosis in low-specialist areas.

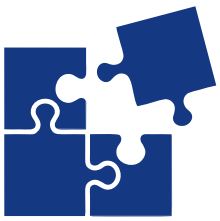
6

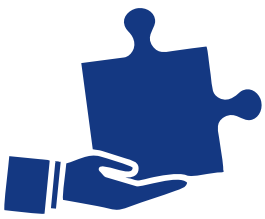
Issues Pertaining to Migrant Populations in NTEP Service Delivery

TB SERVICE DELIVERY FOR MIGRANT POPULATION

CHALLENGES & SOLUTIONS

CHALLENGES	SOLUTIONS
• Mobility • Daily wage dependency • Crowded & unhygienic environment	• Develop integrated migrant health framework which is migrant friendly & flexible • Strengthening inter-state & inter-district referrals
• Language differences • Unstable housing • Non notified slums & inadequate documentation	• Mapping of non notified slums • Developing migrant portal similar to Covid-19 portal • IEC in multiple languages
• Higher transmission & low ACF coverage • Poor treatment outcomes	• Increase awareness about TB • Integrate NTEP with Targeted Intervention models
• Emerging Migrant population of College & University students	• Evolving TB control Clubs • Engaging teachers





Introduction

Migrant populations are among the most vulnerable and underserved in India's National Tuberculosis Elimination Programme (NTEP). High mobility, informal employment, poor living conditions, and limited health coverage make providing continuous TB care to this group an immense challenge. Evidence shows that one-third of New Delhi's residents are migrants, many of whom live in slums or unauthorized colonies, placing them at heightened risk of delayed diagnosis and treatment interruption. NTEP success among India's migrant population depends on shifting from reactive to adaptive service models. Culturally sensitive outreach, language inclusion, flexible clinic timings, and inter-state coordination are essential for building continuity of care. Collaborations with migrant networks, urban local bodies, private sector workplaces, and educational institutions offer the most practical route to achieving equitable TB elimination for this mobile, yet pivotal, demographic.

A. Migration and Health Vulnerabilities Migration patterns are diverse ranging from daily wage labourers and street vendors to seasonal and circular migrants who frequently move between states. Many live in crowded, unhygienic environments where tuberculosis prevention is not a priority, often overshadowed by needs such as access to water, housing, and food security. Mobility, daily wage dependency, and stigma drive patients toward informal or private providers, especially since government clinics often operate during their working hours.

Barriers such as language differences, lack of identification, and unstable housing also hinder continuity of care. Many migrants use multiple addresses or no fixed address, preventing proper follow-up and notification. Studies reveal a correlation between urban migration, high TB prevalence, and treatment default, with transmission occurring within densely packed informal settlements.

B. TB Service Delivery Gaps and Opportunities Effective TB service delivery for migrants demands flexible, inclusive approaches adapted to their movement and working patterns. Current NTEP operations largely cater to static populations, leaving many mobile workers unserved. Active Case Finding (ACF) efforts often fail to reach migrants since drives are scheduled during regular working hours; evidence shows better migrant participation when conducted on Sundays or evenings. Successful pilot interventions have integrated migrant gatekeepers, volunteers, and peer educators who are fluent in local dialects and trusted within the community.

A migrant tracking portal, developed during the COVID-19 pandemic, could be reactivated and repurposed for TB patient monitoring and inter-state referral management. The introduction of mandatory TB screening tied to job security in workshops, factories, or housing colonies could encourage early detection while minimizing stigma-related job loss. Additionally, building referral linkages across states and districts, especially between source and destination regions, would ensure treatment continuity for mobile patients.

C. Emerging Populations at Risk Migrants are not limited to labourers. College and university students, whose movement is also high, represent an overlooked subgroup prone to stigma and delayed reporting. States like Himachal Pradesh have introduced TB control clubs on campuses, modeled after existing HIV awareness programs, to encourage voluntary screening and reduce stigma among students.

D. Geographic and Programmatic Focus Urban hotspots must be identified through geospatial mapping of non-notified slums, rather than relying solely on addresses reported at tertiary hospital diagnosis points. Research shows that a majority of urban TB notifications reflect diagnostic, not residential, locations, obscuring true transmission pockets among migrants. Adopting microplanning approaches from immunization programs can help local teams identify and engage high-risk groups within migrant clusters.

Summary of Recommendations

- Develop an integrated migrant health framework encompassing TB, HIV, and vector-borne diseases under common service points.
- Enhance documentation and data-sharing capacity for frontline workers to track migrant patient details and coordinate timely referrals.
- Establish an online inter-state referral platform for seamless case management between source and destination districts.
- Initiate phased TB outreach programs in educational institutions to sensitize staff, students, and volunteers.
- Conduct nationwide mapping of non-notified urban settlements to identify high-burden migrant clusters for targeted interventions.
- Integrate NTEP with Targeted Intervention (TI) models of the HIV programme, which already engage transient and hard-to-reach populations.
- Build microplanning systems with migrant communities to improve local ACF scheduling and awareness campaigns.

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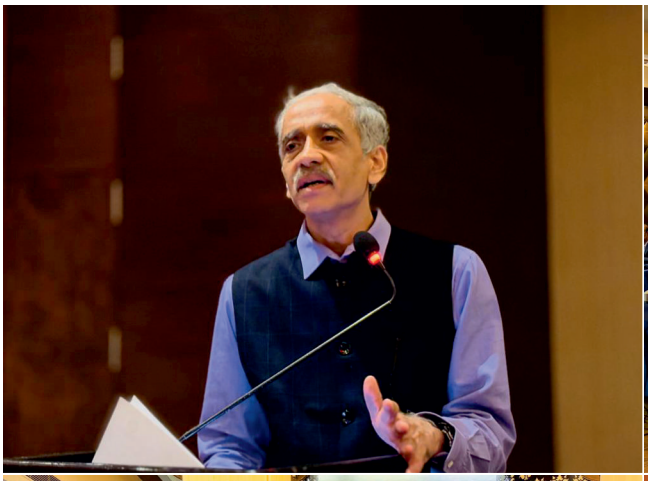









Radisson

Overview
Radisson



EXIT

Notes

Notes

ICMR - National Institute for Research in Tuberculosis

தேசிய காசநோய் ஆராய்ச்சி நிறுவனம்

WHO Collaborating Centre for Tuberculosis Research and Training

The Indian Council of Medical Research-National Institute for Research in Tuberculosis (ICMR-NIRT), located in Chennai, is a premier institution dedicated to TB research. Established in 1956, the institute is a flagship entity of the Indian Council of Medical Research and a WHO Collaborating Centre for Tuberculosis Research and Training. ICMR-NIRT's mission is to provide the scientific knowledge and technologies needed to support the fight against TB by conducting comprehensive research on all aspects of tuberculosis and HIV-TB, including its clinical, bacteriological, epidemiological, behavioural, and laboratory facets.

Throughout its history, ICMR-NIRT has made significant, internationally recognized contributions that have influenced global and national health policies. Notable achievements include providing key evidence that domiciliary (home-based) treatment for TB was as effective as sanatorium care, helping to revolutionize treatment accessibility and reduce costs. The institute also played a crucial role in validating the Directly Observed Treatment, Short-course (DOTS) strategy and conducting the world's largest BCG vaccine trial. With state-of-the-art facilities, it remains a leader in developing and evaluating diagnostic tools and therapies for TB, serving as a key partner in India's National TB Elimination Programme (NTEP).

https://www.nirt.res.in/

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About The Women's Collective Forum (WCF)

The Women's Collective Forum (WCF) is a pan-sectoral platform focused on equity-led systems transformation through scalable, institutionally grounded models.

Its enterprise initiative, SPARK – The 100K Collective, addresses the "missing middle" of women-led businesses—enterprises that are already established but remain excluded from formal finance, markets, digital systems, and regulatory frameworks. Through bootcamps in 300 locations, SPARK will work with 100,000 women entrepreneurs to strengthen their capacity to engage with capital, platforms, and institutions, ensuring that systems become navigable for those already building.

Beyond enterprise, WCF collaborates with leading health, technology, and management institutions to advance maternal health protocols, disease elimination, and the integration of new health technologies. In law and governance, WCF supports implementation of India's evolving criminal law frameworks with a focus on survivor-centricity and institutional accountability.

WCF also convenes cross-sectoral dialogues to highlight India's leadership in frugal innovation and systems change, engaging with global leaders and national platforms to translate research into policy and practice.

Across all these areas, WCF's model is consistent: build partnerships that connect evidence to institutions, and design approaches that can scale to strengthen systems for equity.

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INDIA'S PROGRESS IN ADDRESSING THE CHALLENGE OF TUBERCULOSIS

Stakeholder engagement for strengthening TB care using public-private partnership, patient centred service delivery models and integration of digital health technologies