INTERNATIONAL MULTIDISCIPLINARY JOURNAL FOR RESEARCH AND STUDIES
Journal Homepage: https://www.imjrs.com
2026, Volume 1, Issue 1, Page 21-27
OPEN ACCESS
Research Article

From TB Cure to Lung Health: Screening and Early Detection of Post-Tuberculosis Lung Disease in Resource-Limited Settings

Prof. (Dr.) Adesh Kumar[1], Dr. Ragni Kumari*[2]

[1]Professor, Department of Pulmonary Medicine, Uttar Pradesh University of Medical Sciences (UPUMS), Saifai, Etawah–206130, Uttar Pradesh, India.

[2]Assistant Professor, Department of Optometry, Faculty of Allied & Healthcare Sciences, Uttar Pradesh University of Medical Sciences (UPUMS), Saifai, Etawah–206130, Uttar Pradesh, India.

***Corresponding author: Dr. Ragni Kumari**
Assistant Professor, Department of Optometry, Faculty of Allied & Healthcare Sciences, Uttar Pradesh University of Medical Sciences (UPUMS), Saifai, Etawah–206130, Uttar Pradesh, India.

Received date: September 20, 2026; **Revised date:** October 11, 2026; **Accepted date:** November 01, 2026

ABSTRACT

Background: Successful tuberculosis (TB) treatment does not necessarily ensure complete respiratory recovery. Post-tuberculosis lung disease (PTLD) encompasses persistent respiratory symptoms, structural lung abnormalities and physiological impairment following TB. However, routine identification remains challenging in resource-limited settings because of limited access to spirometry, chest imaging and specialist respiratory services. This review examines practical and context-appropriate strategies for identifying individuals who may benefit from further respiratory assessment following completion of pulmonary TB treatment. **Methods:** This narrative review synthesises international consensus-based clinical standards, major reviews of PTLD, systematic evidence on pulmonary function following pulmonary TB, and emerging research on symptom-based and functional screening approaches. It is not a systematic or scoping review; therefore, no claim of exhaustive database coverage, PRISMA-compliant study selection, formal risk-of-bias assessment or pooled estimates is made. **Discussion:** End-of-treatment assessment represents an important opportunity to identify persistent respiratory morbidity. A feasible approach involves a tiered assessment pathway comprising brief symptom and risk assessment for all individuals completing pulmonary TB treatment, basic clinical examination and pulse oximetry where available, followed by targeted chest radiography, spirometry, six-minute walk testing and specialist investigations according to clinical indications and local capacity. Symptoms alone cannot reliably confirm or exclude PTLD, and persistent, recurrent or worsening symptoms warrant evaluation for recurrent TB and alternative diagnoses. A 2026 American Thoracic Society conference abstract reported preliminary findings from Uganda evaluating the St George's Respiratory Questionnaire for COPD (SGRQ-C) symptom domain and six-minute walk distance as potential screening approaches. The reported sensitivity–specificity trade-offs require full publication and external validation before thresholds are adopted more widely. **Conclusion**: PTLD screening should be conceptualised as an integrated care pathway rather than a single diagnostic test. Programmes should combine feasible case-finding strategies with appropriate referral, diagnostic confirmation, clinical management and longitudinal follow-up. India's National Tuberculosis Elimination Programme (NTEP) provides a potential platform for phased implementation. However, proposed pathways require evaluation for feasibility, cost-effectiveness, clinical utility and equity before wider adoption.

KEYWORDS: Tuberculosis; post-tuberculosis lung disease; screening; early detection; spirometry; chest radiography; resource-limited settings; National Tuberculosis Elimination Programme; pulmonary rehabilitation.

© 2026 Author(s). Published by IMJRS under CC BY 4.0 License

1. INTRODUCTION

Tuberculosis remains a major cause of preventable morbidity. For many patients, the end of treatment is treated as the endpoint of care; however, previous pulmonary TB can leave persistent airway, parenchymal, pleural and vascular abnormalities. Post-tuberculosis lung disease (PTLD) may present with chronic cough, sputum production, dyspnoea, haemoptysis, exercise limitation, abnormal lung function or radiological changes. These consequences may affect quality of life, employment and subsequent healthcare use.[1,2]

International clinical standards recommend clinical evaluation at the end of TB treatment, with assessment adapted to the setting and available resources.[1] Yet a full assessment using chest imaging, spirometry, exercise testing and quality-of-life measures may be difficult to deliver in many high-burden settings. The implementation question is therefore not simply which test detects PTLD most accurately, but how to identify people needing further assessment without overwhelming limited services.

This review focuses on pragmatic screening and early detection, particularly in resource-limited settings and the potential relevance to India. It distinguishes screening—which identifies people who may need further evaluation—from diagnostic assessment, which characterises impairment and excludes ongoing or recurrent disease.

2. Review approach and scope

This manuscript presents a narrative review informed by consensus-based clinical standards, major reviews on post-tuberculosis lung disease (PTLD), systematic evidence concerning pulmonary function following tuberculosis (TB) treatment, and emerging research on screening approaches in resource-limited settings. The review was developed to provide a clinically relevant synthesis of existing evidence and to identify potential approaches for the assessment and follow-up of individuals completing TB treatment. It is not intended to constitute a systematic or scoping review. Accordingly, no claim of exhaustive database coverage, formal risk-of-bias assessment, or PRISMA-compliant study selection is made.

The primary focus is on adults who have completed treatment for pulmonary TB, recognising that children, individuals treated for extrapulmonary TB, and patients with complex comorbidities may require appropriately adapted assessment and follow-up pathways. The proposed recommendations are intended to inform potential service-design strategies for post-TB respiratory care and should not be interpreted as replacements for national TB programme guidance, established clinical protocols, or individual clinical judgement.

3. What should screening aim to detect?

PTLD is a heterogeneous spectrum rather than a single disease. Relevant abnormalities include airflow obstruction, restrictive impairment, reduced gas transfer, bronchiectasis, fibrosis, residual cavities, pleural thickening and, in selected patients, pulmonary vascular disease. Some people have radiological changes without major symptoms; others report substantial dyspnoea despite limited findings on a plain chest radiograph.[1,2]

Screening should identify people who need one or more of the following: evaluation for recurrent or persistent TB; assessment for another treatable respiratory condition; objective measurement of lung function or exercise capacity; management of bronchiectasis or other complications; pulmonary rehabilitation; and longitudinal follow-up.

© 2026 Author(s). Published by IMJRS under CC BY 4.0 License

3.1 Screening is not diagnosis

A positive symptom screen or abnormal walk test does not establish PTLD. Conversely, a negative symptom screen cannot reliably exclude subclinical physiological or structural impairment. A screening pathway must therefore include a defined next step, including diagnostic evaluation, referral criteria and safety-net advice.

4. Who should be screened and when?

The end of TB treatment is a practical entry point because patients are already in contact with TB services and treatment response can be reviewed. International clinical standards recommend clinical evaluation at treatment completion, adapted to the setting and available resources.[1] Follow-up schedules should also be consistent with regimen-specific national guidance; for people treated for drug-resistant TB, WHO operational guidance describes structured post-treatment monitoring for recurrence.[5] For programmes with limited diagnostic capacity, a brief clinical review can be universal while more resource-intensive tests are prioritised according to symptoms, risk and clinical findings.

4.1 Suggested timing

- At treatment completion: record symptoms, functional limitations, treatment history, relevant comorbidities and available end-of-treatment imaging or microbiology.
- Earlier during treatment: assess persistent or worsening symptoms promptly rather than waiting for treatment completion.
- After treatment: arrange follow-up for people with persistent symptoms, abnormal tests, recurrent infections or established structural lung disease.

A single end-of-treatment review may miss symptoms that emerge later. Patients should be advised to return for new or worsening breathlessness, persistent cough, haemoptysis, fever, weight loss or increased sputum.

5. A tiered screening pathway for resource-limited settings

A tiered pathway can preserve access to basic case-finding while concentrating scarce tests on people most likely to benefit. The pathway below is a proposed framework for local adaptation and prospective evaluation; it is not a validated prediction rule.

5.1 Tier 1: brief assessment for all pulmonary TB treatment completers

- Ask about persistent or recurrent cough, sputum, breathlessness, wheeze, chest discomfort, haemoptysis and exercise limitation.
- Assess ability to walk usual distances, climb stairs, work and perform daily activities.
- Record smoking, biomass-fuel and occupational exposures; previous TB episodes; severe or cavitary disease if known; HIV, diabetes and pre-existing respiratory disease.
- Perform a focused respiratory examination and measure oxygen saturation where a pulse oximeter is available.
- Review treatment response and available microbiological or radiological findings; do not assume all persistent symptoms are PTLD.

© 2026 Author(s). Published by IMJRS under CC BY 4.0 License

5.2 Tier 2: basic objective assessment where available

- Chest radiography: useful to assess persistent or changing structural abnormalities and compare with earlier images, when available.
- Spirometry: an objective test for airflow obstruction and reduced forced vital capacity; a low FVC alone does not confirm restriction, which generally requires measurement of lung volumes. Testing should be performed by trained operators using equipment that meets technical standards, with quality assurance and appropriate reference equations.[7]
- Six-minute walk test (6MWT) or another standardised functional assessment: can help quantify exercise limitation and identify exertional desaturation where safe and feasible. The test should follow a standardised protocol, with appropriate screening for contraindications and documentation of distance and oxygen saturation.[8]
- Symptom or health-status questionnaire: can standardise patient-reported burden and support follow-up.

5.3 Tier 3: targeted diagnostic assessment

- Post-bronchodilator spirometry when airflow obstruction is suspected.
- Full lung volumes and diffusing capacity (DLCO) when available and clinically indicated.
- High-resolution CT for unexplained symptoms, suspected bronchiectasis, complex fibrocavitary disease or complications not adequately characterised by chest radiography.
- Sputum molecular testing and culture when recurrent or persistent TB is suspected; additional microbiology guided by the differential diagnosis.
- Specialist evaluation for significant haemoptysis, hypoxaemia, suspected pulmonary hypertension, chronic pulmonary aspergillosis or severe functional impairment.

Urgent clinical assessment takes precedence over routine screening for patients with significant haemoptysis, severe breathlessness, hypoxaemia, chest pain or systemic features suggestive of active infection (Table 1).

Table 1: Proposed tiered screening and assessment pathway.

Tier	Who / purpose	Tools	Action
Tier 1: universal clinical review	All pulmonary TB treatment completers	Symptoms, functional history, risk factors, examination; SpO_2 if available	Reassure and safety-net if well; refer for further assessment if symptoms, signs or risk warrant
Tier 2: basic objective assessment	Symptomatic patients, abnormal examination or higher clinical concern; broader testing if locally feasible	Chest radiography, spirometry, 6MWT or standardised functional assessment, symptom/health-status questionnaire	Characterise impairment and determine whether targeted diagnostic or specialist assessment is needed
Tier 3: targeted diagnostics	Persistent, severe, unexplained or complicated presentations	Full PFTs/DLCO, HRCT, microbiology, echocardiography or specialist assessment as indicated	Confirm phenotype, exclude active/recurrent disease and initiate targeted management

6. Screening tools: strengths and limitations

6.1 Symptom screening

Symptom questions are inexpensive, quick and suitable for routine TB clinics. They can identify persistent cough, sputum, breathlessness and functional limitation, but symptoms are nonspecific and may arise from recurrent TB,

© 2026 Author(s). Published by IMJRS under CC BY 4.0 License

asthma, COPD, cardiac disease, anaemia, deconditioning or other conditions. Symptom-based screening is therefore best used as a first-stage triage tool rather than a stand-alone diagnostic test.

6.2 Spirometry

Spirometry provides objective evidence of airflow obstruction and may show a low forced vital capacity (FVC). A reduced FVC on spirometry does not, by itself, establish restrictive ventilatory impairment; confirmation generally requires measurement of total lung capacity. The 2025 systematic review and meta-analysis by Ratnakumar and colleagues found lower spirometric measures among people with previous pulmonary TB than among controls, although between-study heterogeneity was high.[3] Spirometry requires equipment, trained personnel, quality control, infection-prevention procedures and interpretation using appropriate reference standards.[7] A normal result does not exclude bronchiectasis, reduced diffusing capacity (DLCO) or all forms of PTLD.

6.3 Chest radiography

Chest radiography is relatively accessible in many district-level settings and can identify fibrosis, volume loss, cavities, pleural abnormalities and other pathology. Its interpretation is strengthened by comparison with earlier images. Residual abnormalities do not necessarily correlate with symptoms or functional impairment; radiography should not be the sole measure of disease severity.

6.4 Six-minute walk test and functional assessment

The 6MWT is a practical measure of submaximal exercise capacity and can reveal functional limitation or oxygen desaturation. It requires a suitable walking course, standardised instructions, trained staff and appropriate safety assessment.[8] Results can be influenced by age, height, comorbidities, motivation and non-respiratory limitations; the test is not specific for PTLD.

6.5 Questionnaires and combined screening

Validated symptom or health-status questionnaires can improve consistency, document patient-reported outcomes and support monitoring. However, score thresholds should not be imported into new populations without validation. A 2026 American Thoracic Society (ATS) conference abstract described a Ugandan study of adults assessed at TB cure. Among 302 participants enrolled, 186 were eligible for lung-function testing. The study evaluated the St George's Respiratory Questionnaire for COPD (SGRQ-C) symptom-domain thresholds and six-minute walk distance (6MWD) impairment against spirometry-defined airflow impairment. An SGRQ-C symptom score of ≥25 alone had 69% sensitivity and 48.1% specificity; 6MWD impairment alone had 62% sensitivity and 71% specificity. An either-positive rule increased sensitivity to 80% but reduced specificity to 36%, whereas a both-positive rule had 47% sensitivity and 82% specificity.[4] These preliminary findings apply to the study population and spirometry-based outcome and should not be interpreted as a validated rule for all PTLD phenotypes or populations.

Table 2: Comparison of potential screening tools.

Tool	Advantages	Limitations	Best role
Symptom/risk checklist	Low cost; feasible at routine TB visits	Nonspecific; may miss asymptomatic impairment	Universal first-stage screen
Pulse oximetry	Portable; identifies resting hypoxaemia	May be normal despite PTLD; exertional measurement needs protocol	Basic triage and safety assessment
Chest radiography	Widely established; shows	Radiation; access and	Targeted structural

© 2026 Author(s). Published by IMJRS under CC BY 4.0 License

	structural abnormalities	interpretation vary; structure does not equal function	assessment
Spirometry	Objective assessment of airflow and FVC	Needs equipment, trained operators and quality assurance	Core objective test for airflow assessment where feasible
6MWT	Measures functional capacity; may reveal desaturation	Space, staff and safety needs; not disease-specific	Functional assessment; may inform rehabilitation planning
HRCT / full PFTs	Detailed phenotyping	Higher cost, access constraints; CT radiation	Selected complex or unexplained cases

7. Differential diagnosis and microbiological safety

A screening programme must not mislabel recurrent or active TB as PTLD. New or worsening cough, haemoptysis, fever, night sweats, weight loss, increased sputum or radiological progression should trigger assessment according to current national TB diagnostic algorithms. Sputum molecular testing and culture should be used when indicated, with drug-susceptibility testing as appropriate. Regimen-specific post-treatment monitoring guidance should be followed, particularly for people treated for drug-resistant TB.[5] Depending on presentation, differential diagnoses may include bacterial infection, chronic pulmonary aspergillosis, nontuberculous mycobacterial disease, COPD, asthma, malignancy, cardiac disease and pulmonary vascular complications.

The term PTLD should not delay urgent evaluation. Clinical services need explicit referral pathways for red-flag symptoms, not only a routine end-of-treatment checklist.

8. Risk stratification: whom to prioritise when tests are scarce?

Where universal spirometry or imaging is not feasible, prioritisation can use clinical concern rather than an unvalidated numerical score. Factors that may justify a lower threshold for objective testing or referral include persistent respiratory symptoms; severe or cavitary pulmonary TB; recurrent TB; abnormal end-of-treatment imaging; prior respiratory disease; smoking or substantial biomass exposure; HIV or other important comorbidity; low oxygen saturation; repeated respiratory infections; and marked limitation in daily activity. These factors are not a validated prediction model, and their relative predictive value may vary by population.

A risk-based strategy should avoid inequity. Women, older adults, people with disabilities, rural residents and patients with limited ability to travel may face barriers to referral. Programmes should monitor who is screened, who completes diagnostic evaluation and who receives care.

9. Implications for India and NTEP

India's National Tuberculosis Elimination Programme (NTEP) offers an established programmatic contact point for reaching people completing TB treatment. An ICMR–National Institute for Research in Tuberculosis policy brief has highlighted the importance of long-term follow-up after TB treatment and recommended that NTEP prioritise strategies to address post-treatment morbidity and mortality.[6] This policy context supports the relevance of post-TB care, but it should not be interpreted as evidence that universal PTLD screening is currently mandated under NTEP. A feasible implementation model could begin with a standardised symptom and functional assessment at treatment completion, documented referral triggers, and district-level access to spirometry and chest radiography where available. More advanced tests and rehabilitation could be provided through referral networks. The proposed service model should be checked against the latest applicable NTEP guidance before implementation.[9]

© 2026 Author(s). Published by IMJRS under CC BY 4.0 License

9.1 Practical implementation priorities

- Create a brief end-of-treatment lung-health checklist embedded in routine TB records.
- Train TB programme staff to recognise persistent symptoms and red flags, without asking them to diagnose PTLD.
- Map district access to radiography, spirometry, sputum testing and respiratory specialists.
- Use standard referral criteria and track referral completion.
- Link screening to actual care: diagnostic confirmation, treatment of identified conditions, rehabilitation when indicated and follow-up.
- Pilot the pathway in diverse districts before wider implementation.

9.2 Digital support

Electronic TB records could capture symptoms, oxygen saturation where available, referral decisions and outcomes. Simple prompts may reduce missed assessments, but digital tools cannot replace clinical judgement or create access to tests that are not available. Data governance, confidentiality and interoperability should be planned from the outset.

10. Implementation research priorities

- Prospectively validate brief symptom screens and combined symptom–functional algorithms in diverse populations, including Indian TB survivors.
- Compare universal spirometry with risk-targeted spirometry for diagnostic yield, equity, costs and downstream outcomes.
- Determine the feasibility, acceptability and reliability of end-of-treatment chest radiography and functional testing at primary and district levels.
- Assess the sensitivity of low-cost approaches for different PTLD phenotypes, not only airflow obstruction.
- Measure referral completion, time to diagnosis, uptake of rehabilitation, quality of life and patient costs.
- Include children, adolescents, people treated for drug-resistant TB and people with extrapulmonary TB in appropriately designed studies.
- Evaluate whether screening improves patient-important outcomes rather than merely increasing detection of abnormalities.

Screening programmes should be judged by the complete cascade—coverage, positive screens, diagnostic completion, actionable findings, treatment or rehabilitation uptake, patient outcomes, cost and equity—not by the number of screens performed alone.

11. DISCUSSION

The evidence supports a need to assess lung health after pulmonary TB, but the best screening strategy in low-resource settings remains unsettled. International clinical standards provide a framework for end-of-treatment assessment and rehabilitation,[1] while systematic evidence confirms that previous pulmonary TB is associated with persistent spirometric impairment.[3] A recent major review also describes the broad structural, airway and pulmonary vascular manifestations of PTLD.[2] The main implementation challenge is translating this recognition into a pathway that is affordable, reliable and linked to effective care.

© 2026 Author(s). Published by IMJRS under CC BY 4.0 License

No single screening tool can identify all PTLD phenotypes. Symptoms are accessible but nonspecific; spirometry measures only part of respiratory physiology; chest radiography describes structure but not function; and the 6MWT measures functional capacity without identifying the cause. A tiered combination is therefore more defensible than reliance on a single test. However, the exact sequence and thresholds should be tested prospectively rather than assumed to be optimal.

Emerging symptom-based screening research is promising but preliminary.[4] In the Ugandan conference abstract, an either-positive SGRQ-C/6MWD approach increased sensitivity at the expense of specificity, whereas requiring both abnormalities improved specificity but reduced sensitivity. These operating characteristics illustrate the importance of defining the purpose of screening: a high-sensitivity first stage may be acceptable if confirmatory services are available, whereas limited downstream capacity may require a more selective referral threshold. Neither approach should be adopted as a universal threshold without external validation and evaluation across different PTLD phenotypes.

Important limitations in the evidence include heterogeneity of PTLD definitions, varied timing of assessment, different lung-function methods, limited longitudinal data and underrepresentation of some populations. This narrative review does not provide a systematic estimate of diagnostic accuracy or a formal evidence certainty assessment. A formal systematic or scoping review could be undertaken as a separate project using a reproducible search and selection protocol.

12. CONCLUSION

Screening for PTLD in resource-limited settings should be organised as a tiered pathway from end-of-treatment clinical review to targeted objective testing, diagnostic confirmation and appropriate care. Symptom screening is a practical first step but cannot diagnose or exclude PTLD. Spirometry, chest radiography and functional assessment provide complementary information, while HRCT, full pulmonary function tests and microbiological investigations should be reserved for appropriate indications. For India, integration with NTEP could improve recognition of post-TB morbidity if screening is linked to referral, treatment, rehabilitation and outcome monitoring. The proposed pathway requires local validation, implementation research and assessment of cost-effectiveness before routine national adoption.

REFERENCES

1. Migliori GB, Marx FM, Ambrosino N, et al. Clinical standards for the assessment, management and rehabilitation of post-TB lung disease. Int J Tuberc Lung Dis, 2021; 25(10): 797-813. doi:10.5588/ijtld.21.0425. PMID: 34615577.
2. Meghji J, Auld SC, Bisson GP, et al. Post-tuberculosis lung disease: towards prevention, diagnosis, and care. Lancet Respir Med, 2025; 13(5): 460-472. doi:10.1016/S2213-2600(24)00429-6. PMID: 40127662.
3. Ratnakumar S, Hayward SE, Denneny EK, et al. Post-pulmonary tuberculosis lung function: a systematic review and meta-analysis. Lancet Glob Health, 2025; 13(6): e1020-e1029. doi:10.1016/S2214-109X(25)00105-6. PMID: 40412395.
4. Muzoora C, Lai PS, et al. Symptom-Based Screening for Post-Tuberculosis Lung Disease in Resource-Limited Settings. Am J Respir Crit Care Med, 2026; 212(Suppl 1): aamag162.6804. doi:10.1093/ajrccm/aamag162.6804. Conference abstract.
5. World Health Organization. WHO consolidated operational handbook on tuberculosis. Module 4: treatment and care. Geneva: World Health Organization, 2025. ISBN: 978-92-4-010814-1.

© 2026 Author(s). Published by IMJRS under CC BY 4.0 License

6. Indian Council of Medical Research–National Institute for Research in Tuberculosis. Long Term Follow-up of Treated Tuberculosis Patients. Policy Brief. Chennai: ICMR-NIRT, 2021 Sep.
7. Graham BL, Steenbruggen I, Miller MR, et al. Standardization of spirometry 2019 update. An official American Thoracic Society and European Respiratory Society technical statement. Am J Respir Crit Care Med, 2019; 200(8): e70-e88. doi:10.1164/rccm.201908-1590ST. PMID:31613151.
8. ATS Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories. ATS statement: guidelines for the six-minute walk test. Am J Respir Crit Care Med, 2002; 166(1): 111-117. doi:10.1164/ajrccm.166.1.at1102. PMID: 12091180.
9. Central Tuberculosis Division, Ministry of Health and Family Welfare, Government of India. Guidelines: National Tuberculosis Elimination Programme [Internet]. New Delhi: Government of India; accessed, 2026 Oct 30. Available from: https://tbcindia.mohfw.gov.in/guidelines/

© 2026 Author(s). Published by IMJRS under CC BY 4.0 License