

# TUBERCULOSIS CASE FINDING IN THE PUBLIC SECTOR IN TAMIL NADU – TRENDS AND EXPERIENCES FROM 2015 TO 2022

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## Abstract

**Background:** Tuberculosis continues to be an important cause of mortality and morbidity in Tamil Nadu. The Government of Tamil Nadu has been implementing the National Tuberculosis Elimination Programme with the aim of achieving the End TB targets by 2025.

**Objectives:** The present article aims to describe the case finding activities undertaken in Tamil Nadu and the resultant changes. In addition, it explores the impact of the COVID-19 pandemic on TB case finding.

**Methods:** Secondary data available in the various registers and reports (paper-based and digital) within the NTEP were consolidated for the calculation of indicators relevant to case finding. The trends in such indicators over the period of 2015-2022 were mapped and represented.

**Results:** The presumptive TB examination rate has increased by 69% from 2015 to 2022. Annual case notification rate in the public sector has declined by 19% overall for the state. The NNT (number needed to test to diagnose one case of TB) for smear microscopy has nearly doubled and NNT for NAAT has increased by 80%. Presumptive TB examinations which were severely impacted by the COVID-19 pandemic have significantly improved in 2022

**Conclusions:** The stagnation or decline in TB notifications despite increased presumptive TB examinations suggests an overall declining trend of the tuberculosis epidemic in Tamil Nadu. The gains need to be consolidated and built upon in the coming years leading up to 2025 to push for TB elimination.

**Key words:** Tuberculosis, case finding, COVID-19, NTEP, notification, number needed to test (NNT)

## INTRODUCTION

The state of Tamil Nadu has one of the highest epidemiological transition levels (0.26) in India.<sup>1</sup> Despite this, tuberculosis continued to be one of the top 10 causes of years of life lost (7th in males and 11th in females) and among the top 15 causes of disability-adjusted life years in 2019.<sup>2</sup>

Early detection of the disease and prompt initiation of effective treatment continue to be the strongly recommended mainstay for TB infection prevention and control.<sup>3</sup> The National Strategic Plan for TB elimination in India aims to achieve the Sustainable Development Goals (80% reduction in tuberculosis incidence, 90% reduction in tuberculosis mortality, and zero households incurring catastrophic health expenses due to tuberculosis) for 2030<sup>4</sup> by the year 2025. Keeping in line with this, the Government of Tamil Nadu has been implementing the National TB Elimination Programme (erstwhile Revised National TB Control Programme – RNTCP) with the aim of a TB-free Tamil Nadu.

Tuberculosis is diagnosed primarily through 3 modalities – sputum smear microscopy, chest X-ray, and WHO-recommended molecular diagnostics (WRMDs; CBNAAT and Truenat). According to the Technical and Operational

Guidelines, all presumptive TB should be offered at least sputum smear microscopy and chest X-ray. WRMDs should be offered upfront to key populations such as PLHIV, children, presumptive EP-TB, etc. for diagnosis of TB. However, in line with the priority target of diagnosing 90% of all TB using WRMDs by 2030,<sup>5</sup> there is a push to offer WRMDs universally to all presumptive TB. Providing chest X-rays to all presumptive TB is essential to complete the diagnostic cascade.

The current paper aims to characterize the landscape of TB case finding in Tamil Nadu state from 2015 to 2022.<sup>6</sup> The objectives are to describe the progress of TB case finding in the public sector in Tamil Nadu and the effect of the COVID-19 pandemic on case finding along with recovery in the aftermath. In addition, it maps the programmatic developments which contributed to the changes.



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## METHODOLOGY

**STUDY DESIGN :** We conducted an analysis of tuberculosis surveillance data reported in Tamil Nadu state from 2015 to July/August 2022.

**STUDY AREA :** Tamil Nadu state is in the southernmost part of mainland India, covering an area of 130,058 square kilometers and having a projected population of 813.8 lakhs. The population density was 555 persons per square kilometer and the population sex ratio (defined as the number of females per 1000 males) was 995 in 2011. The literacy rate stands at 80.3%. Nearly half the population is urban (48.5%), out of which 8% (2.8 million) live in slums.

The state consists of 38 administrative districts and 42 health unit districts (HUDs).

TB care services are delivered in Tamil Nadu through a 3-tier health directorate system – Directorate of Public Health and Preventive Medicine, Directorate of Medical and Rural Health Services and Directorate of Medical Education providing primary, secondary and tertiary care respectively. There are 35 NTEP districts, each of which is subdivided into TB units (which typically correspond to health blocks). Five of these 35 districts are located within Chennai. Each TB unit has public sector peripheral health institutions (PHIs) and private sector hospitals/clinics/labs/pharmacies under its purview. In the public sector, there are medical colleges, district headquarters hospitals, sub-district hospitals, block primary health centers, primary health centers and health sub-centers – these public sector facilities are termed as peripheral health institutions (PHIs). Out of these, some PHIs are equipped as designated microscopy centers. In addition, there are a total of 140 Truenat machines and 75 CBNAAT machines. The vast infrastructure of the NTEP is manned and supported at the district level by a team of DTO, DPC, TO, DPPMC, DRTB & TB-HIV coordinator and at the field level by STS, STLS, TB-HV and LTs.

**STUDY POPULATION :** All identified presumptive TB and diagnosed TB cases reported to the government system during the study period constituted the study population.

## CASE DEFINITIONS

1. Presumptive TB: a person with any of the symptoms and signs suggestive of TB, such as cough for 2 weeks or more, fever for 2 weeks or more, significant weight loss, hemoptysis, etc.

2. TB case: may either be –

a. Microbiologically confirmed TB: a presumptive TB case from whom a biological specimen is positive for acid-fast bacilli, or positive for *Mycobacterium tuberculosis*

on culture, or positive for tuberculosis through a rapid diagnostic molecular test,

b. Clinically diagnosed TB: a presumptive TB case that is not microbiologically confirmed but has been diagnosed with active TB by a clinician based on X-ray abnormalities, histopathology, or clinical signs with a decision to treat the patient with a full course of anti-TB treatment.

3. Notification/Notified TB case: a TB case that has been diagnosed and reported to the public NTEP system.

**SOURCE OF DATA :** 1) Annexure-M: monthly report regarding the performance of sputum microscopy prepared at the level of peripheral health institutions and consolidated at levels of TB unit, district, and state for a month, quarter, and year. This report contains the number of new adult out-patients, presumptive TB tested, presumptive TB who test positive, etc.

2) CBNAAT indicator report: monthly report regarding the performance of CBNAAT machines submitted by each CBNAAT site for each machine. This report is also consolidated at the level of district and state for a month, quarter, and year. It contains details on total tests conducted on CBNAAT, presumptive TB tested on CBNAAT, presumptive TB who test positive, etc.

3) Truenat indicator report: monthly report regarding the performance of Truenat machines submitted by each Truenat site for each machine. This report is also consolidated at the level of district and state for a month, quarter, and year. It contains details on total tests conducted on Truenat, presumptive TB tested on Truenat, presumptive TB who test positive, etc.

4) Nikshay: Nikshay is the digital case-based reporting system of the National Tuberculosis Elimination Programme. Notification registers containing detailed line lists of all TB patients diagnosed within the state and reported to the government NTEP system were downloaded for the period from 2017 to August 2022. For the number of patients diagnosed in the public sector in 2015, data was downloaded from archived Epicenter reports.

5) India TB reports: Numbers of notified TB (public, private and total) for the year 2016 were obtained district-wise from the India TB report 2017.

## ANALYSIS

All the data sources except the India TB reports were available as Microsoft Excel files. Analysis of the data was done in Microsoft Excel 365. The following indicators were calculated:

1) Annual case notification rate (ACNR): number of TB

cases notified per lakh (100,000) population,

2) Presumptive TB examination rate (PTBER): number of individuals with presumptive TB who were examined for diagnosis of TB per lakh (100,000) population,

3) Number needed to test to diagnose a case of TB (NNT): number of presumptive TB that need to be tested to diagnose a case of TB,

4) Proportion of presumptive TB offered a molecular test for diagnosis: proportion of presumptive TB tested on NAAT (CBNAAT/Truenat) out of total presumptive TB

The above indicators were calculated for each district and for Tamil Nadu state from 2015/2016 (NAAT for diagnosis of TB was introduced in 2016 – therefore presumptive TB includes those tested on NAAT from 2016 only) to 2022. For 2022, data from January to July/August were taken and annualized to give the indicator for the whole of 2022.

Estimates of the population done by the Central TB Division were taken for calculations. The five NTEP districts of Chennai were counted as a single district for the purpose of this study. Hence, 31 districts will be represented instead of 35.

A four-quadrant graph with PTBER (x-axis) and ACNR (y-axis) was prepared, depicting the performance of the state for the 8 years (2015 to 2022) with PTBER ranging from 0 to 2400 per lakh population and ACNR ranging from 0 to 160 per lakh population. The four-quadrant graph compares the PTBER and the ACNR for each year and places the state in any of the following 4 quadrants: bottom left (low PTBER and low ACNR), top left (low PTBER and high ACNR), top right (high PTBER and high ACNR) and bottom right (high PTBER and low ACNR).

## RESULTS

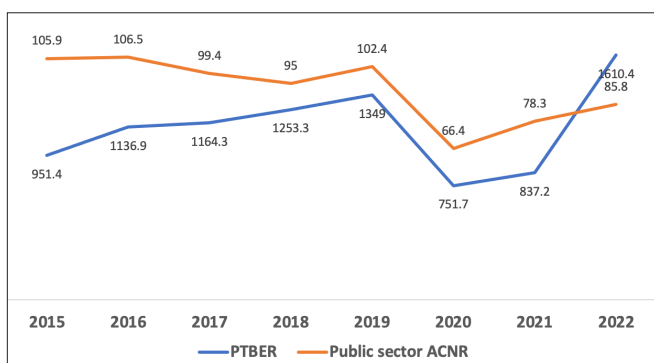


Figure 1: Trend of PTBER and public sector ACNR - 2015 to 2022

The PTBER has increased by 69% from 2015 to 2022. Out of the 31 districts, 29 districts show an increase in the PTBER, ranging from 10% to 207%. This increase in testing

was accompanied by a decline in public sector ACNR in 26 out of the 29 districts over the same period. ACNR in the public sector has declined by 19% overall for the state - the decline in ACNR was as high as 34-40% in some districts.

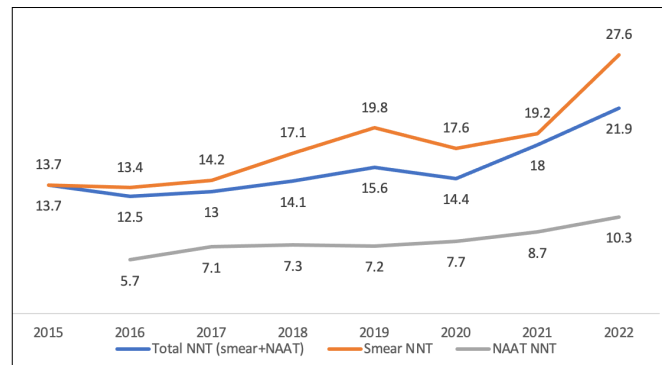


Figure 2: Trend in NNT (number needed to test to diagnose a case of TB) by technology

Total NNT (both NAAT and smear microscopy) increased in 29 districts from 2015 to 2022, leading to a nearly 60% increase for the state. Similarly, the NNT for smear microscopy nearly doubled and NNT for NAAT increased by 80%.

## Impact of and recovery from the COVID-19 pandemic and mitigation measures

From 2019 to 2020, the PTBER decreased in all the districts of Tamil Nadu (a decline ranging from 18% to 67%). The overall decline at the state level was 44.3%. This was accompanied by a decline in the public sector ACNR in all the districts (ranging from 25% to 50%) with a 35% decline for the state.

In 2021, 7 out of the 31 districts reported a further decline in PTBER while the remaining districts showed an increase. In 2022, nearly all districts show an increase in PTBER - one district which doubled its PTBER from 2020 to 2021 reported a decline. The state showed an increase in PTBER of 19% overall in 2022 compared to pre-pandemic levels. A return to or an increase over the pre-pandemic PTBER levels was reported in 19 out of 31 districts, with an overall increase in PTBER of 19% in the state over 2019 levels.

The public sector ACNR concomitantly increased by up to 37% in all but 2 districts from 2020 to 2021 while it further increased by up to 24% in all but 4 districts from 2021 to 2022. The public sector ACNR for Tamil Nadu state increased by 18% and 10% respectively over the same periods. However, a return to 2019 levels is yet to be noticed – public sector ACNR remains 16% lower.

Figure 3 shows that Tamil Nadu moved from the top left quadrant (low PTBER and high ACNR) in 2015-17 to top right (high PTBER and high ACNR) in 2018-19 followed by a

major drop to the bottom left quadrant (low PTBER and low ACNR) in 2020 and 2021. This was followed by a recovery in 2022 to place the state in the top right quadrant.

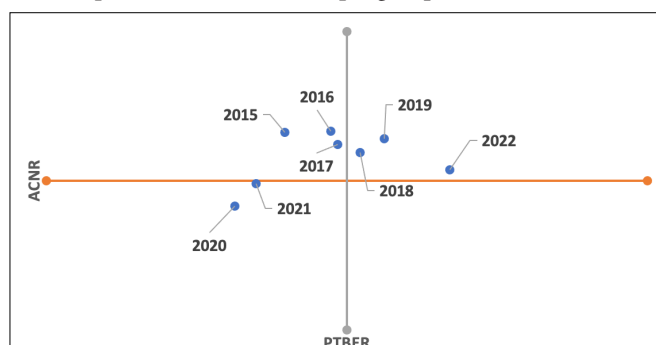


Figure 3: PTBER vs ACNR - 4-quadrant graph showing progress from 2015 to 2022

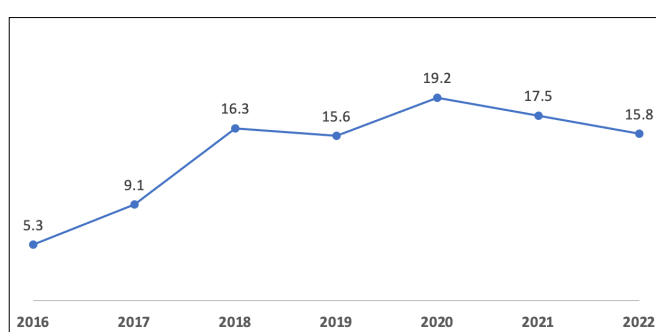


Figure 4: Proportion of presumptive TB offered upfront NAAT for diagnosis of TB

## DISCUSSION

TB case finding in Tamil Nadu has undergone a paradigm shift in the last 7 years. To decentralize the availability of TB diagnostic services, a 137% increase in the number of DMCs was completed in 2018 – the number was increased from 837 to 1984. Currently, nearly 75% of the public sector health facilities (1984 out of 2678) in the state are DMCs. With the introduction of WHO-recommended molecular diagnostics (WRMDs) for the diagnosis of TB since 2016, the laboratory system for high-quality TB diagnosis and drug resistance testing has expanded rapidly. This expansion of molecular diagnostics occurred in 3 rounds from 2016 to 2019 with supply of GeneXpert CBNAAT machines by the Central TB Division. Subsequently, Truenat MTB/MTB-Rif machines were supplied from the third quarter of 2020 onwards. Initially, the eligibility for presumptive TB using molecular diagnostics was limited to PLHIV. Subsequently, in 2017, it was decided to expand the eligibility to key populations such as extra-pulmonary TB and children. This has led to the increase in provision of NAAT upfront for diagnosis of TB from 5.3% of all presumptive TB in 2016 to around 16.3% in 2018 and a peak of 19.2% in 2020, as seen

in figure 4. For the period 2018-2022, this proportion has stagnated between 15% and 20%.

For culture and drug susceptibility testing, in addition to the two existing Intermediate Reference Laboratories (IRLs) in Chennai and Madurai, 3 more culture and drug susceptibility (C&DST) laboratories are being established in Tiruchirapalli, Coimbatore and Kancheepuram.

Table 1 : Active case finding in Tamil Nadu

Year	Total screened for TB symptoms	Total presumptive TB identified	Total diagnosed TB
2017	3014361	90722	3184
2019	1125471	39233	1657
2020	655610	22994	1308
2021	308147	21028	1215

Systematic active case finding among vulnerable populations and in the community was started in 2017. Nearly 175000 presumptive TB have been identified from 2017 to 2021 because of active case-finding efforts and nearly 7500 TB patients have been diagnosed. In July 2020, a targeted case finding campaign was launched with a focus on contacts of TB patients, PLHIV, line-listed NCD patients (especially uncontrolled diabetics and chronic kidney disease patients) and line-listed ILI/SARI patients who have been prescribed home/institutional quarantine. This targeted case finding campaign aided the recovery of TB case finding post the first COVID-19 lockdown.

The introduction of mobile diagnostic units equipped with digital X-ray machines in 2022 has been a shot in the arm for the completion of TB diagnostic cascade, especially during active case finding.

The stagnation or decline in TB notifications despite increased presumptive TB examinations suggests a strong recovery from the disastrous impact of the COVID-19 pandemic. Thus, through augmented case finding activities supported by political and administrative commitment, the gains made till 2022 need to be consolidated and built upon in the coming years leading up to 2025 to push for focused TB elimination processes.

## Way Forward

- 1) Re-orientation of strategies based on findings of the Tamil Nadu TB prevalence survey,
- 2) Inter-sectoral collaboration for TB case finding,
  - a. TB-free workplace policy,
  - b. TB-free Panchayats,
  - c. School health,
  - d. Tribal health.
- 3) Health systems approach for TB elimination:
  - a. Integration of TB services within Makkalai Thedi

Maruthuvam and TB surveillance within TN-Population Health Registry

b. Decentralization of TB service delivery to Health and Wellness Centers (HWCs)

HWCs may be designated as TB diagnostic centers (TDCs) and may act as sputum collection spokes in a structured hub-and-spoke model with DMCs and NAAT labs serving as hubs.

c. Planned and systematic expansion of Programmatic Management of TB Preventive Therapy (PMTPT) services to the entire state

4) Systematic active case finding in mapped vulnerable populations using highly sensitive screening and diagnostic algorithms with assistance of computer-aided diagnostics (CAD) and artificial intelligence,

5) Re-invigoration of private sector engagement with adoption of FAST (Find, Assess, Support, Treat) and/or similar tailor-made models in all districts.

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## Abbreviations used :

ACNR – Annual Case Notification Rate

CBNAAT – Cartridge Based Nucleic Acid Amplification Test

COVID 19 – Corona Virus Disease – 19

DPC – District Programme Coordinator

DPPMC – District Public Private Mix Coordinator

DRTB – Drug Resistant Tuberculosis

DTO – District Tuberculosis Officer

EP -TB – Extra Pulmonary Tuberculosis

HUD – Health Unit District

LT – Lab Technician

MTB – Mycobacterium Tuberculosis

MTB Rif – Mycobacterium Tuberculosis Rifampicin gene

NAAT- Nucleic Acid Amplification Test

NNT – Number Needed to Test

NTEP – National Tuberculosis Elimination Program

PHI – Peripheral Health Institution

PLHIV – People Living with Human Immunodeficiency Virus

PTBER – Presumptive Tuberculosis Examination Rate

STS – Senior Treatment Supervisor

STLS – Senior Treatment Laboratory Supervisor

TB – Tuberculosis

TB HIV – Tuberculosis – Human Immunodeficiency Virus

TB HV – Tuberculosis Health Visitor

TO – Treatment Organizer

WHO – World Health Organization

WRMD – WHO Recommended Molecular Diagnostics