Ministry of Health and Family Welfare
Government of India

Initiatives under National TB Elimination Programme and opportunities of mathematical modelling for informed decisions

National Workshop on Modelling
IIT Bombay
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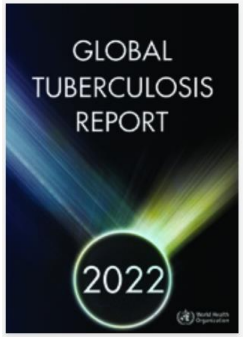
Government of India

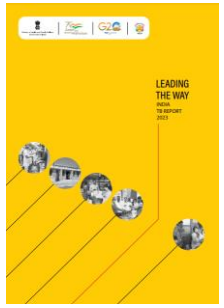
Outline

- Burden and programmatic overview
- TB data systems (Ni-kshay) - Rich & Real time data repository
- Modelling efforts up till now & gaps
- Modelling - way forward
- Summary

Do you know how many people develop TB & how many people die of TB every year in our country?



Tuberculosis – Disease Burden



Estimates of TB Burden (2021)	Global*		India#			
	Number (in lakh)	Rate (per 1,00,000 population)	Number (in lakh)		Rate (per 1,00,000 population)	
			2021	2022	2021	2022
TB incidence	106	134	27.7	27.5	197	196
HIV-negative TB mortality	14	17	3.38	3.24	24	23

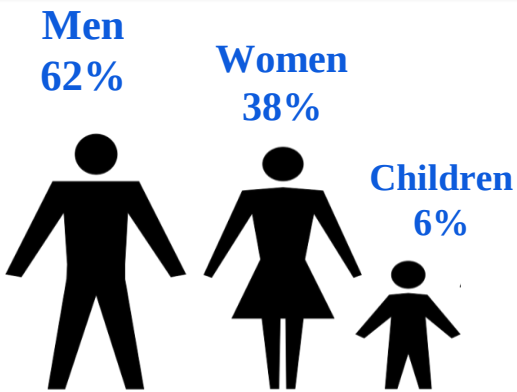
***Source**: Global TB Report 2022 (https://www.who.int/teams/global-tuberculosis-programme/tb-reports/global-tuberculosis-report-2022)
#**Source**: India TB Report 2023 (https://tbcindia.gov.in/showfile.php?lid=3680)

TB disease burden in India

- Estimated incidence rate of TB[#] → **197 cases / lakh population**
- Estimated TB cases in 2021 in India[#] → **27.7 lakh**
- Reported TB cases* → **24 lakh (2019) → 18 lakh (2020) → 21.35 lakhs (2021) → 24.2 lakhs (2022)**

2% **HIV-Positive**

2.5 % **Drug Resistant**



15-45 years of age 65%

BPL **69%**

Urban **20%**

Urban Slum **13%**

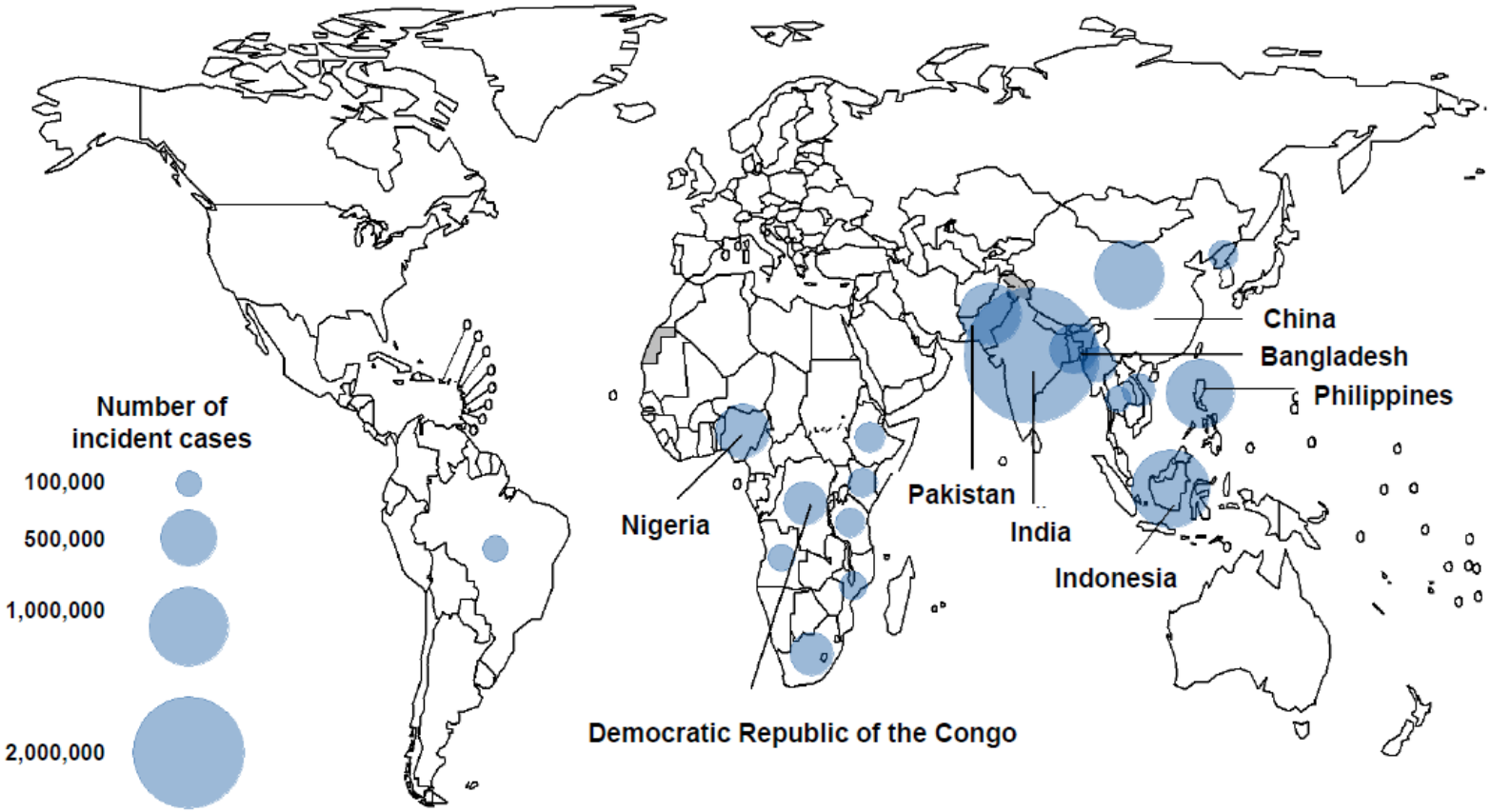
Tribal **9%**

Rural **58%**

#Source: India TB Report 2023 (https://tbcindia.gov.in/showfile.php?lid=3680)
* Programmatic data

8 countries, 68% of global cases in 2021

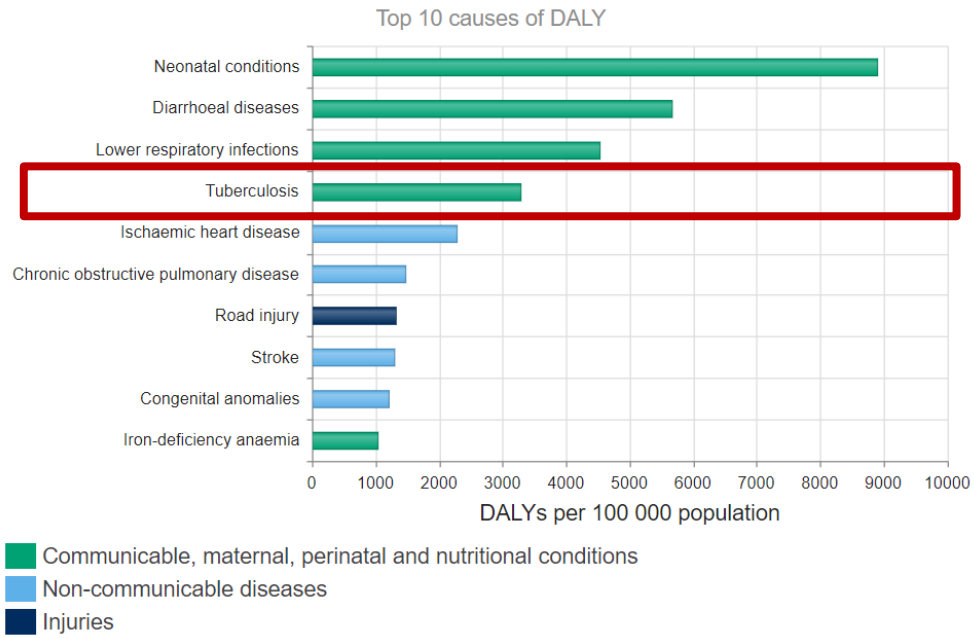
87% in 30 high TB burden countries



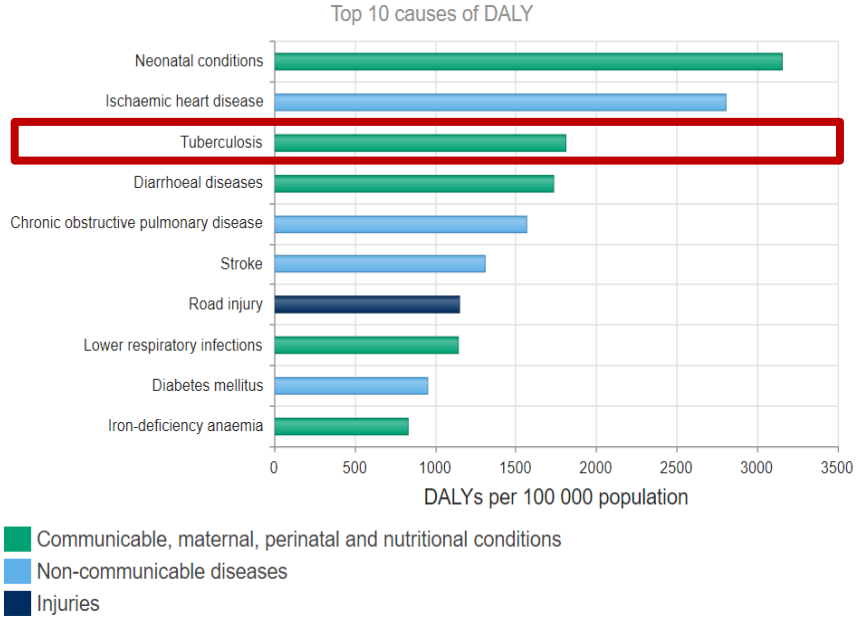
World Health Organization

Tuberculosis (DALY): Comparison with other diseases in India

2009



2019



Source: *https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates/global-health-estimates-leading-causes-of-dalys*

NATIONAL TB PREVALENCE SURVEY (2019-2021) - INSIGHTS

Burden of TB - High

All forms of TB in all ages

312

Per lakh population

Adult Micro confirmed Pulm TB

316

Per lakh population

People affected by TB

Male > Female

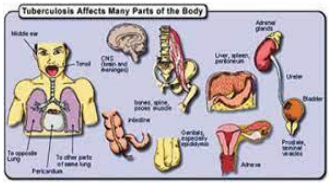
472 > 154

Per lakh population

Older age group >55 years

588

Per lakh population



NATIONAL TB PREVALENCE SURVEY - INSIGHTS

How many TB cases are there for every TB patient notified

Prevalence : Notification ratio

2.84

Prevalent part notified TB pt

Screening Tests

Chest X-ray – Additional yield

42.6%

481 cases out of 981 diagnosed cases had X-ray abnormality

Past H/O TB

Patients with past H/o TB

23.4%

Among those diagnosed 98

Interpretation:

- For every 2.8 TB cases prevalent in the community, 1 case gets notified and 1.8 cases get missed.
- Mere symptomatic screening may lead to missed cases
- Addition of diagnostic tests like Chest X ray adds to the yield
- Patients with past H/O TB contribute significantly to the total cases

NATIONAL TB PREVALENCE SURVEY 2021 - INSIGHTS

LTBI

Prevalence of latent TB infection

31.4%

Among total surveyed

TB Disease - more in persons with comorbidities

Malnourished	Diabetics	Smokers	Alcohol users
930	**511**	**853**	**726**
Per Lakh pop	Per Lakh pop	Per Lakh pop	Per Lakh pop

Interpretation:

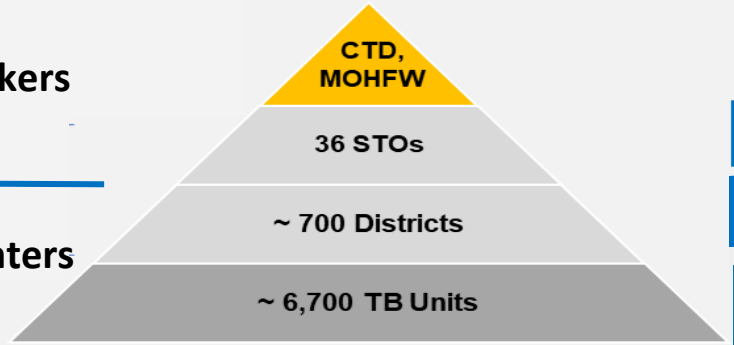
- Prevalence of latent TB infection is around 1/3rd of the population
- 31% of the survey participants have TB infection. There is a 10% lifetime chance of this infection converting into disease, with 60% of the probability being in first year
- Presence of co-morbidities has an impact of disease progression, severity, and treatment outcomes

Do you know who all are involved in National efforts of TB elimination in India and since when?

National TB Elimination Programme - stakeholders

Policy makers

Implementers



World Health Organisation

Donors (Global Fund, World Bank, USAID, BMGF)

Partners, Scientists, ICT solution developers

Technical Advisors

39,000 Public Health Institutions

1,50,000 Health and Welness Centres

Diagnostic Laboratories (NRL,IRL)

180000 Private health providers and Hospitals

27000 Private Labs

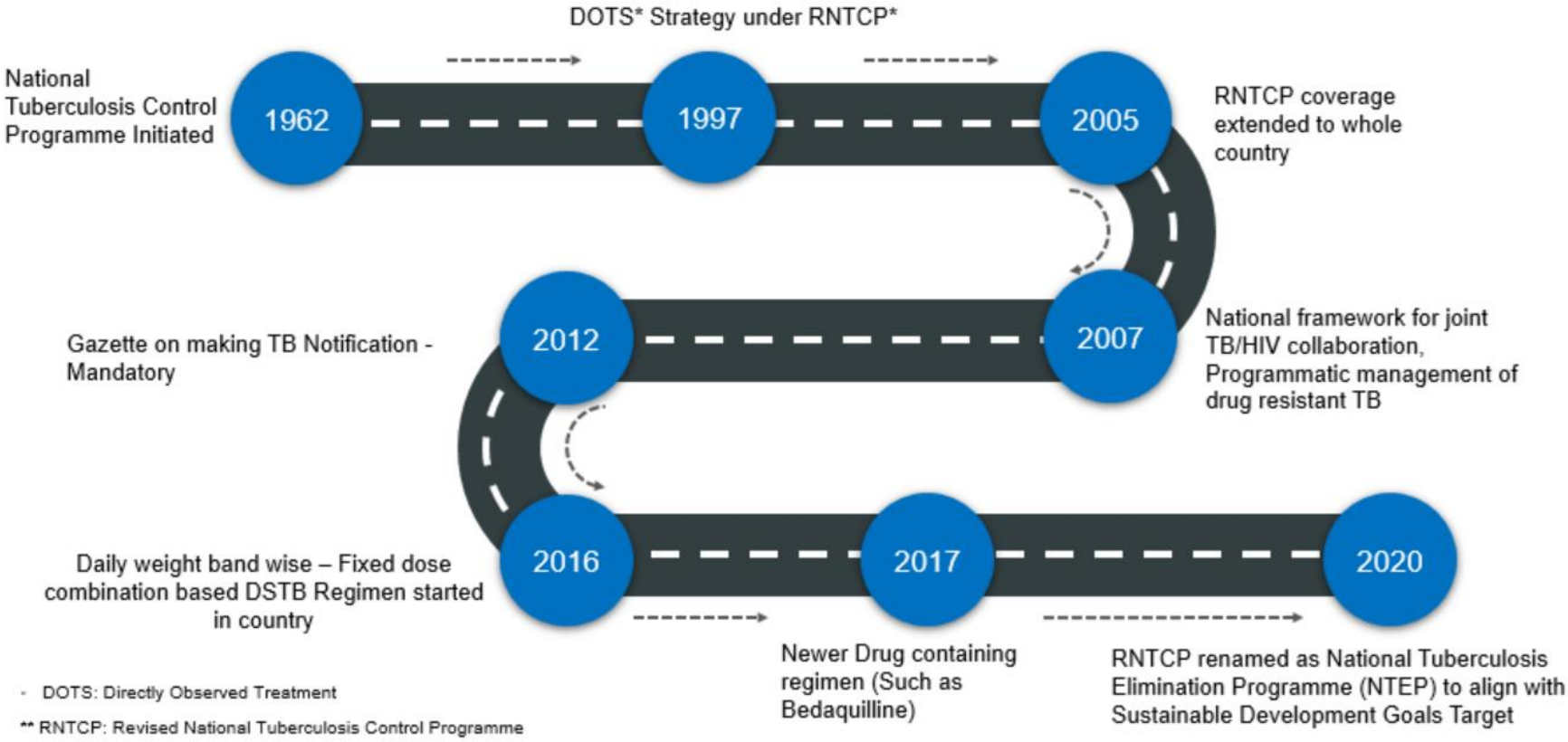
79000 Private chemist

Private Provider Support Agencies (PPSA)

Patients, contacts of patients & Vulnerable population & communities

(Staff (Public Health / PPSA) Treatment Supporters

Evolution of NTEP



- DOTS: Directly Observed Treatment

** RNTCP: Revised National Tuberculosis Control Programme

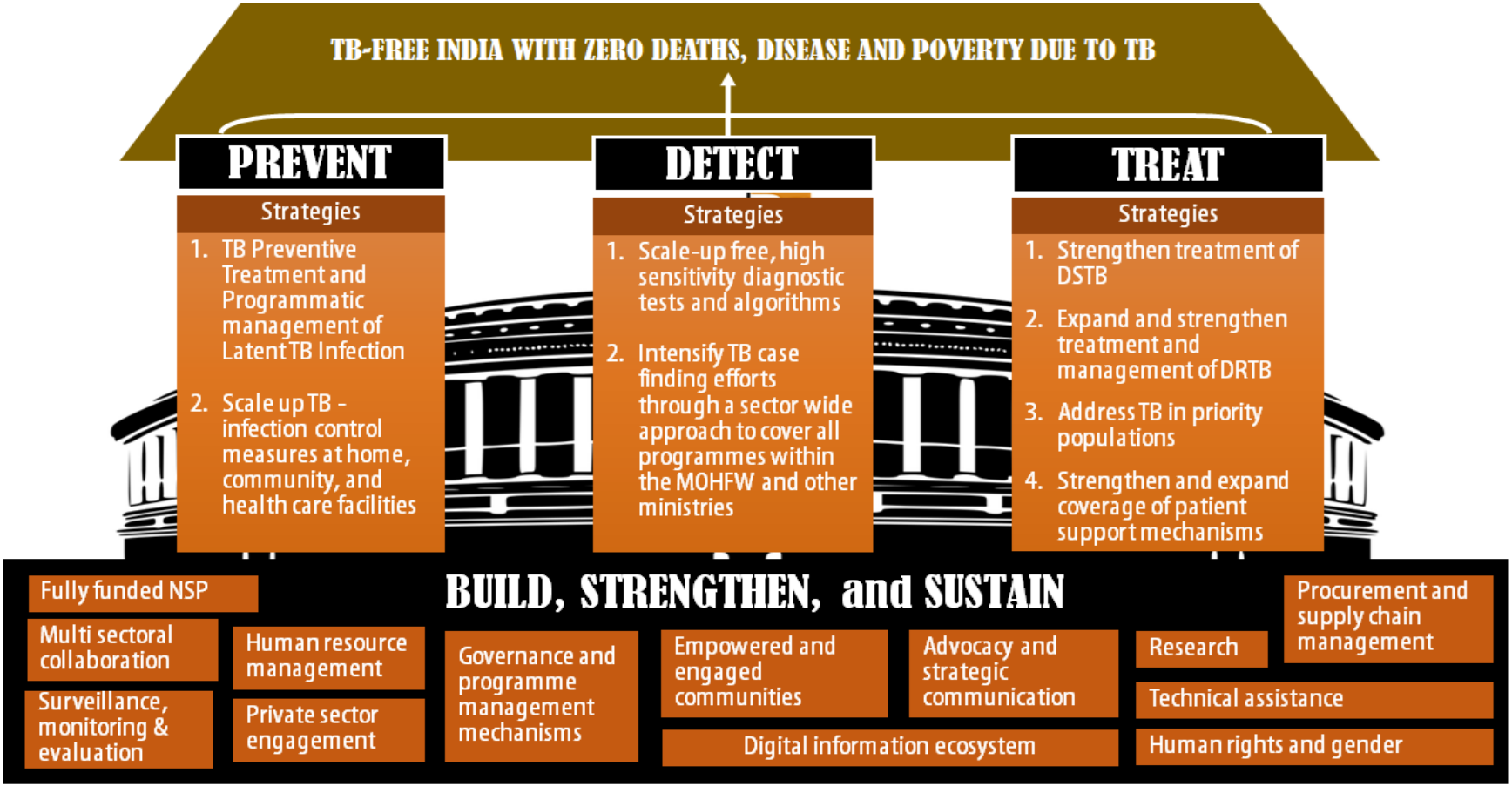
What do we want to achieve?
What does it mean when we say we want to End TB in India?

Vision: TB Free India

	Global End TB Targets	Global SDG TB Targets	TB Free India Targets
Indicators	**By 2035**	**By 2030**	**By 2025**
1. Reduction in number of TB deaths (compared to 2015)	**95%**	90%	**90% (3 per 1,00,000 population)**
2. Reduction in TB incidence rate (compared to 2015)	**90%**	80%	**80% (45 per 1,00,000 population)**
3. TB-affected families facing catastrophic costs due to TB	**0%**	0%	**0% (Zero catastrophic costs due to TB)**

With what strategies are we fighting against TB?

4 strategic pillars of the programme



Progress and achievements under the programme

How do we capture/monitor/measure our efforts?

Ni-kshay

- Digital health ecosystem
- Transaction based information system
- Follows - Life-cycle approach
- Decentralized till Peripheral health institutes (HWC and below)
- Supporting real time monitoring across levels

Reports | **Registers** | **Dashboards**

The TB patient life cycle on Ni-kshay

TB Preventive Treatment

Drug Resistant TB

Drug Susceptible TB

Screening

Diagnosis

Treatment details

Dispense Medicines & Adverse event reporting

Adherence support & follow-up

Bank details entry

Interaction

Treatment completion and long term follow-up

The utilization and uptake of Ni-kshay

1. **Enrolment** — **~ 17.2 million** persons enrolled
2. **Test** (Diagnosis/ Follow Up) — **~26.9 million** results captured
3. **Treatment** — **~12.1 million** patients registered
4. **Adherence** — **~ 1.4 million** put on IDAT

Ni-kshay User base	Count
Total users (all time)	~ 0.76 M
Monthly Active unique users	0.07 M

1. **Deduplication**
   0.25 million identified
2. **Patient Transfer**
   2 million transferred
3. **Direct Benefit Transfer**
   USD 251 million Incentive paid
4. **Communications**
   1.36 million SMS per month
5. **Task Lists**
   11 Task Lists across modules
6. **Reports & Dashboards**
   65 Reports, **07** Dashboards

Data- Cumulative since 2017

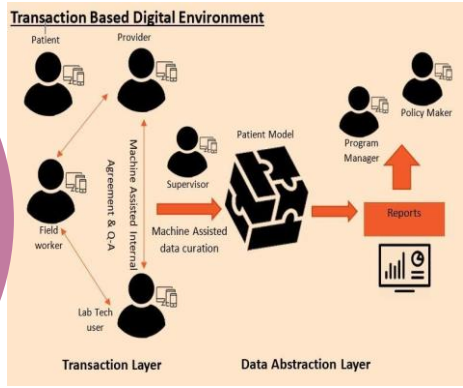
Ni-kshay: Patient and Information Management System

All sectors & decentralized reporting

Inter-operable Modular system

Transaction based information system

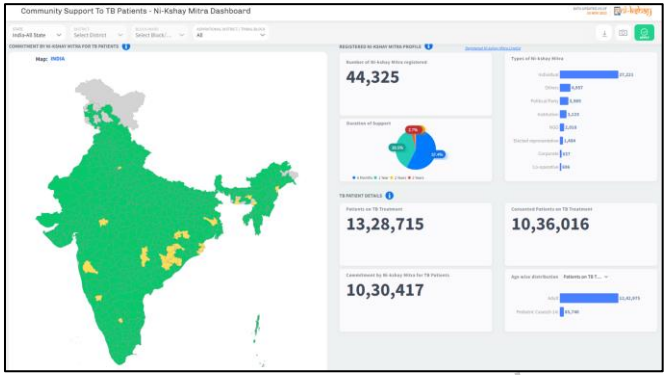
Real time surveillance system



The 360° utility of Ni-kshay

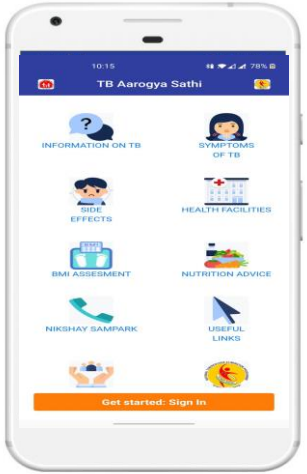
Beneficiary Interface

A mobile application with patient-facing interface empowering patients to access treatment details



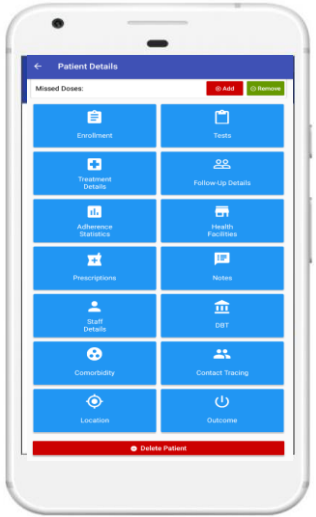
Programme Manager Interface

Access to Ni-kshay Dashboards and monthly Performance Reports to monitor performance



Staff Interface

A dedicated application for programme staff and healthcare workers notification of TB cases and management of all aspects of care cascade



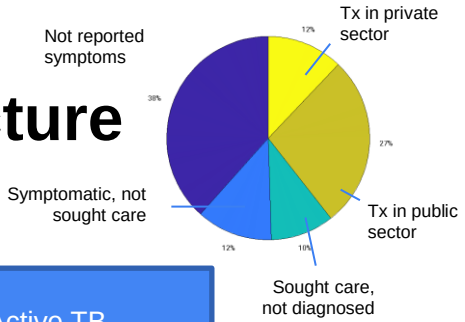
Summary: TB Surveillance activities in the country

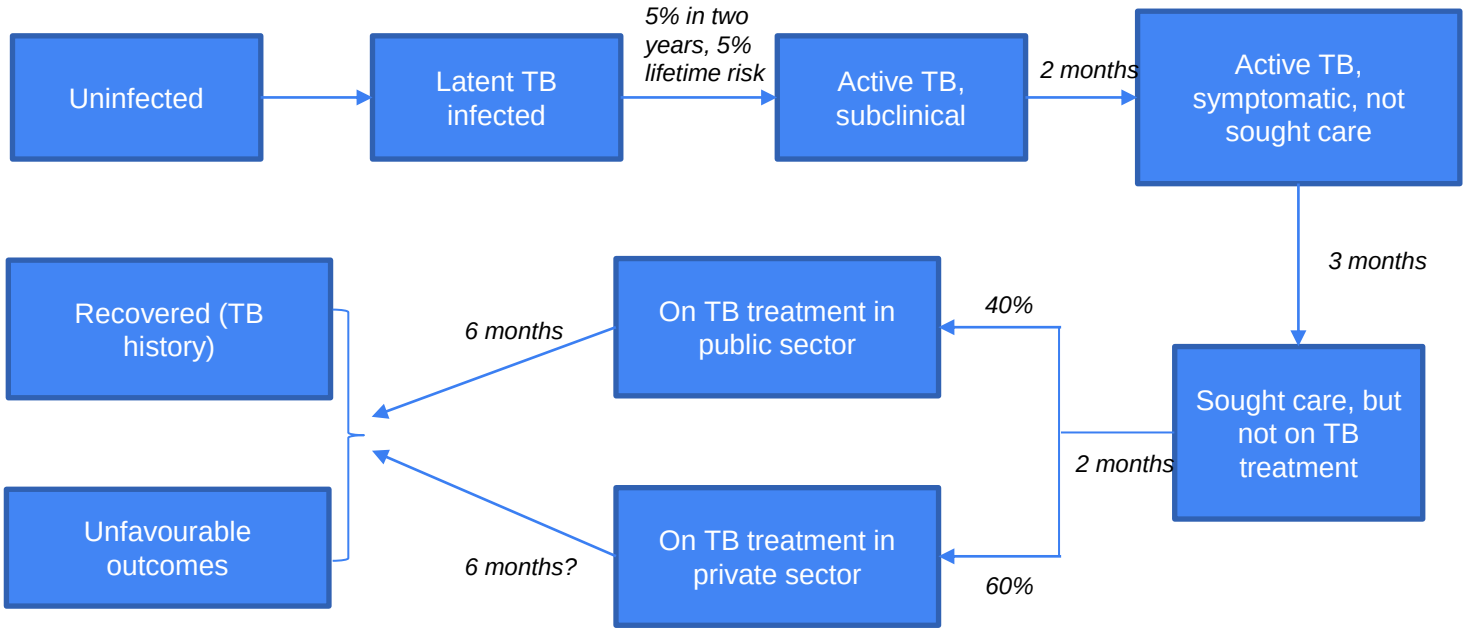
- **Passive surveillance system**
  - Get cases reported from health facilities (Ni-kshay)
- Active surveillance system
  - Search for information on cases from every source – hospitals, practitioners, labs, pharmacies (Ni-kshay)
- Advanced surveillance system (Active case finding)
  - Search for cases in the community in populations and geographies at risk for TB
- Predictive surveillance system (Vulnerability-based surveillance)
  - Predict TB risk of every individual in the community and keep them under surveillance
- **TB prevalence surveys**

TB Modelling can enrich all aspects of surveillance to provide informed insights

What are my gaps and what is the one which will give me high impact?

Turning cross section into a longitudinal picture





What is the current gap in the information collected under the programme? TB disease burden

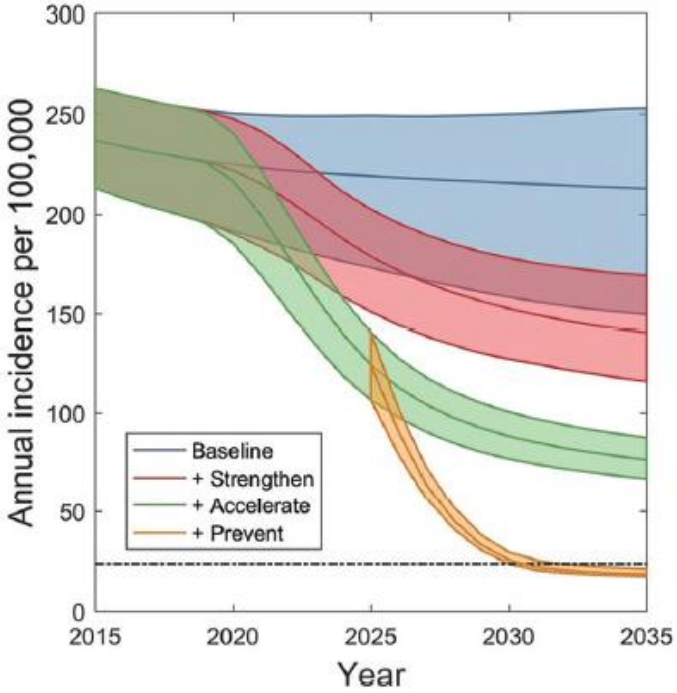
- Insights -> Can we get a fair idea of dynamics of entire pathway?
- Can programmatic data alone give this information?

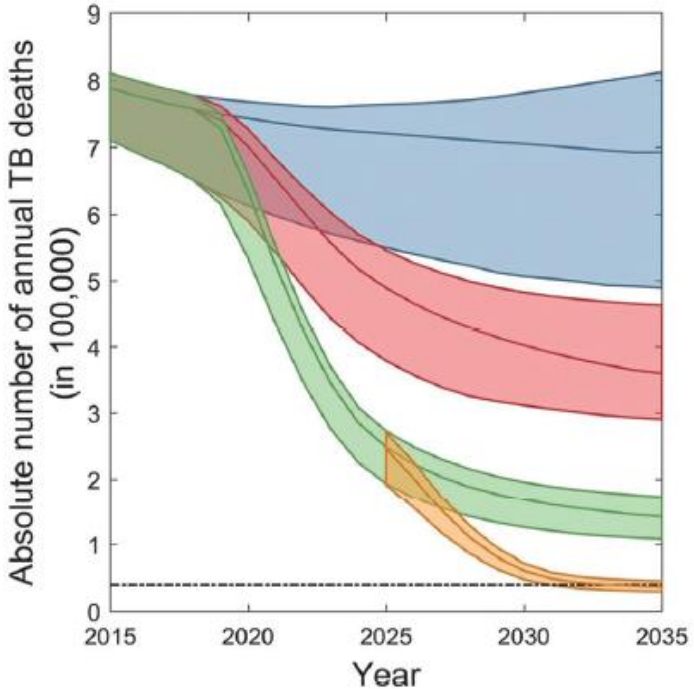
Questions that needs answers?

- **How to account for the real epidemiologic picture from programmatic data?**
- **What is the gap between reported and actual burden?**
- **How, Where and When should the programme prioritize interventions?**
- **How effective new diagnostic/treatment/technology interventions may be and where/when/how to place it in programmatic settings**

How NTEP is using modelling work for programmatic decisions?

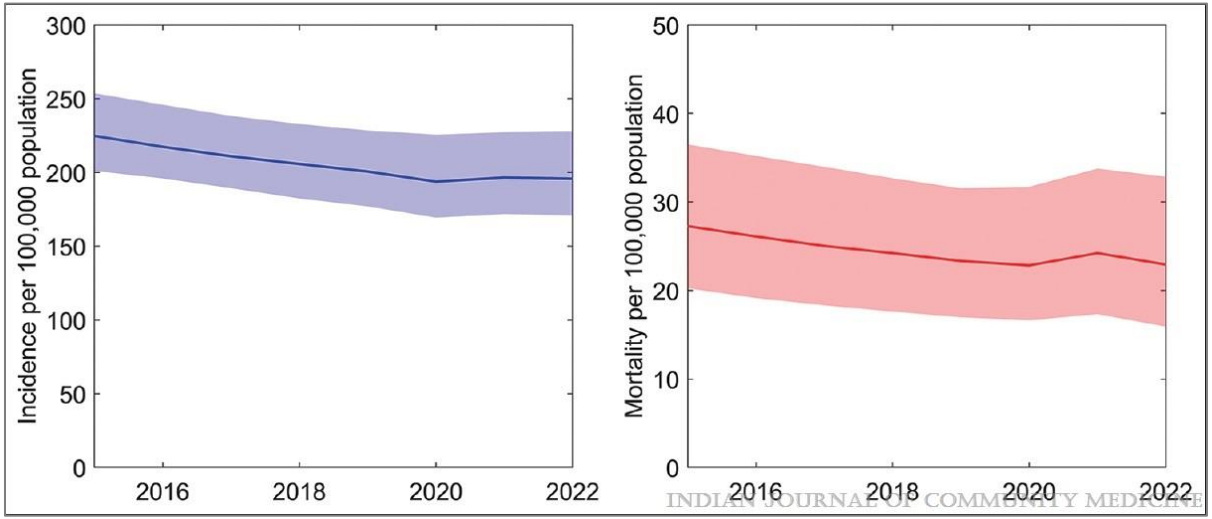
- **Devise interventions** under National Strategic Plan 2017-2025.





How NTEP is using modelling work for programmatic decisions?

- TB **Disease burden estimation** for the country

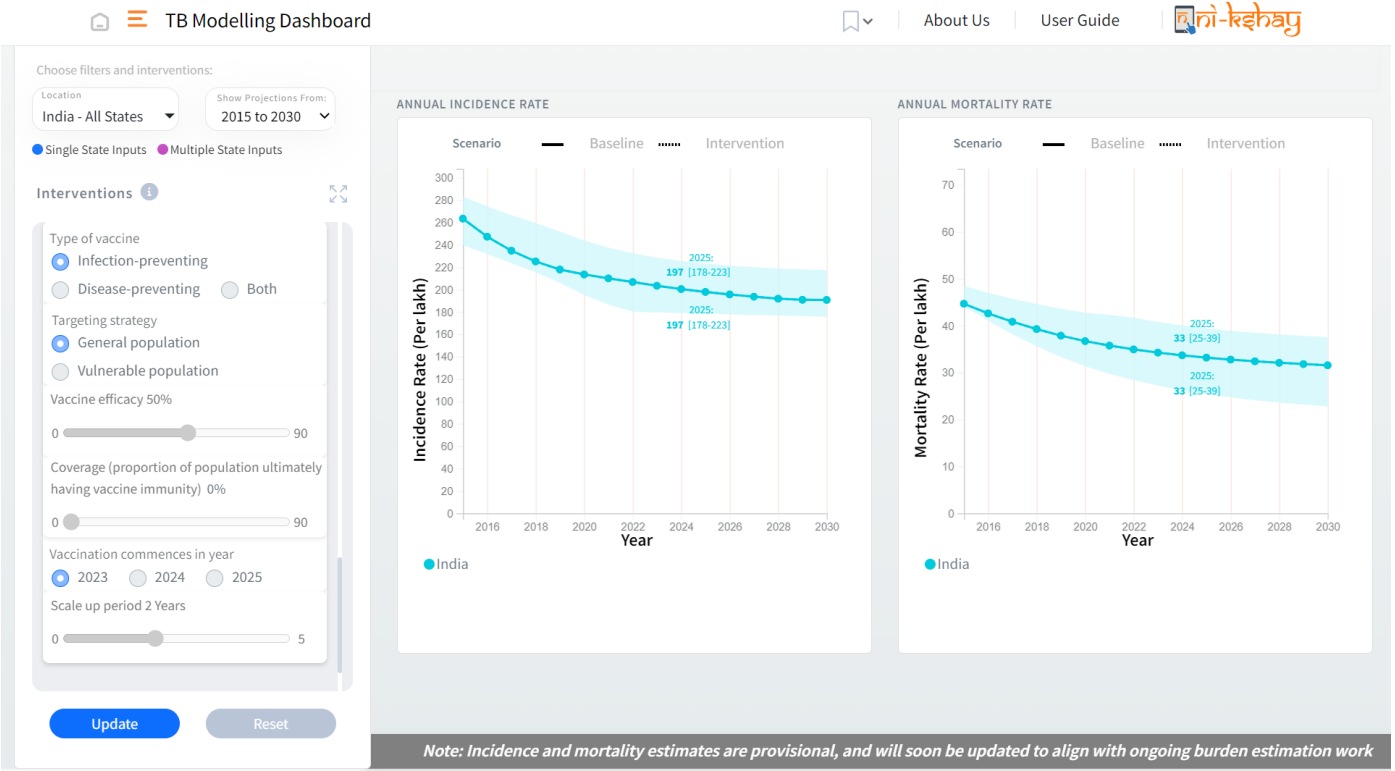


Estimated incidence and mortality rate from 2015 to 2022. Solid lines show the central estimate, while the shaded regions show the 95% credible intervals (CrI) of the estimates

Mandal, Sandip; Rao, Raghuram[1]; Joshi, Rajendra[1]. Estimating the Burden of Tuberculosis in India: A Modelling Study. Indian Journal of Community Medicine 48(3):p 436-442, May–Jun 2023. | DOI: 10.4103/ijcm.ijcm_160_23

How NTEP is using modelling work for programmatic decisions?

- Administrators and programme managers at state level - **identify priority interventions** as per local needs.



Once symptoms develop, delay before first careseeking (months) 3.9months

0.4 — 3.9

Improving TB care cascade

Improved Diagnostic Outcomes

Probability of successful TB diagnosis and treatment initiation, per visit to a provider in the public sector 59%

59 — 100

Reducing post-treatment relapse

Proportion of patients experiencing relapse in two years after treatment completion 0.07%

0 — 7

Differentiated care

Percent of patients dying while on treatment (programmatic conditions) 0.03%

0 — 3

TB Preventive Therapy

Per notified TB patient, average number of close contacts initiating (and completing) preventive therapy 0%

0 — 15

Update | Reset

Including asymptomatic TB

TRUE | FALSE

Vaccine

Type of vaccine

Infection-preventing | Disease-preventing | Both

Targeting strategy

General population | Vulnerable population

Vaccine efficacy 50%

0 — 90

Coverage (proportion of population ultimately having vaccine immunity) 0%

0 — 90

Vaccination commences in year

2023 | 2024 | 2025

Scale up period 2 Years

0 — 5

Note: Incidence and mortality estimates are provisional, and will soon be updated to align with ongoing burden estimation work

Modelling - Way forward

Plans ahead under the programme

- ❑ Why MATHEMATICAL modelling is emphasized? Reaching far and planning efficiently
- ❑ Which thematic areas would require the help and more focus?
- ❑ What is the outcome being expected?
- ❑ Decentralized planning - making geographies independent and efficient in their planning
- ❑ Strategic implementation assessing the epidemiological impact through modelling
- ❑ Building the roadmap for 2025

Scopes available for mathematical modelling

- Understanding the TB epidemiology better
- Help programme managers - design interventions (prevention/vaccine and its impact/private partnerships/Diagnostics/AI and its role/spatio-temporal modelling etc)
- Assessing the cost-benefit/efficiency - of the interventions (building investment case for the programme)
- Help real time evaluation of the changes in burden
- Serve as an advocacy tool to policy makers
- Capacity building of the in-house/in-country personnel (within/outside government)

Make India TB Free

Public health

The true glory of public health is the ability to see the faces and the lives behind the numbers

Thank you