

A Narrative Review on Tuberculosis Disease Transmission, Treatment, Prevention, Emergency Care, and Vaccine Allocation in Second Highest Populated Country (India)

Jyoti¹, Ravinder Kaur^{2,3,*}

Abstract

*Tuberculosis, an airborne illness caused by *Mycobacterium tuberculosis*, is a highly contagious disease primarily impacting the lungs, though it can also affect other body parts, excluding hair and nails. There are two main types of tuberculosis: pulmonary tuberculosis (PTB), which targets the lungs, and extrapulmonary tuberculosis (EPTB), which involves other areas such as lymph nodes, bones, joints, and the nervous system. The theme for World Tuberculosis Day in 2024 is 'Yes! We can end TB', emphasizing the global commitment to eradicate this lethal disease through continuous efforts and educational campaigns.*

Keywords: Tuberculosis, airborne disease, pulmonary, lymph node, elimination

INTRODUCTION

Tuberculosis (TB) remains a considerable worldwide health issue, posing a significant burden on both health and mortality globally. To address this issue, the World Health Organization (WHO) has implemented and expanded three key public health strategies (DOTS [Directly Observed Therapy Shortcourse], Stop TB, and End TB) on a global scale. These strategies have had a notable epidemiological impact, reducing the incidence of new cases and fatalities. However, the emergence and spread of TB/HIV co-infection and multidrug-resistant TB have impeded progress toward the goal

of TB elimination by 2050. More endeavors are required to hasten the yearly reduction in TB incidence rates on a global scale. This requires strong political commitment and the implementation of both global and national strategies aligned with evidence-based recommendations for TB diagnosis, treatment, and prevention. Furthermore, there is a demand for research and development efforts focused on improving the tools currently used to fight TB. The development of new rapid diagnostic methods, an updated and efficacious therapeutic arsenal, and an effective preventive vaccine could offer solutions to address the current epidemiological challenges posed by TB [1].

*Author for Correspondence

Ravinder Kaur

E-mail: ravinderkaurb79@gmail.com

¹Vice Principal, Department of Community Health Nursing, Adesh Nursing College, Village- Mohri, Teh- Shahabad, Kurukshetra, Haryana, India

²Assistant Professor, Department of Obstetrics and Gynecology Nursing, Adesh Nursing College, Village- Mohri, Teh- Shahabad, Kurukshetra, Haryana, India

³PhD Scholar, Department of Department of Obstetrics and Gynecology Nursing, Nirwan University Jaipur, Rajasthan, India

Received Date: May 08, 2024

Accepted Date: May 15, 2024

Published Date: May 20, 2024

Citation: Jyoti, Ravinder Kaur. A Narrative Review on Tuberculosis Disease Transmission, Treatment, Prevention, Emergency Care, and Vaccine Allocation in Second Highest Populated Country (India). International Journal of Emergency and Trauma Nursing and Practices. 2024; 2(1): 7–13p.

Despite some advancements in global TB control, the present annual reduction in TB incidence of 2% per year is insufficient to achieve the desired

outcomes. To effectively tackle this issue, new approaches to diminish the reservoir of people with latent infections—potential sources of new TB cases—are critical. Yet, there is a lack of precise knowledge about the size and risk associated with this group. Present diagnostic methods, including the tuberculin skin test and interferon-gamma release assays, fall short in determining who will develop active TB. Additionally, the therapeutic options available are not ideally suited for the scale of intervention that might be necessary [2].

India contributes to 26% of the world's TB burden, in other words, for every 100 people with TB in the world, 26 are from India (Table 1).

Difference Between TB Infection and TB Disease

Many individuals unknowingly carry the TB bacteria within their bodies after inhaling it; this condition is known as TB infection. Individuals with the infection typically remain asymptomatic, do not experience illness, and are unable to spread the disease. In the majority of instances, a robust immune system can efficiently control the bacteria. However, in approximately 10% of those who carry the bacteria, it multiplies and leads to active TB disease, which can affect anyone.

How TB Spreads

TB is transmitted through the air when an individual with pulmonary TB coughs, spits, or sneezes, releasing droplets that contain TB bacteria. Being an airborne disease, anyone who breathes in these bacteria can become infected with tuberculosis.

Symptoms of Pulmonary TB

Cough more than 2 weeks, fever more than 2 weeks, loss of appetite, weight loss, bloodstream sputum, chills, night sweats, and chest pain are symptoms of pulmonary TB. Symptom of TB in lymph node TB is swelling of the lymph nodes. In bone TB, symptoms are pain and swelling in the joints; spinal cord TB symptom is neck stiffness; brain TB symptom is, disorientation; intestine TB symptom is recurrent diarrhea, and pericardial TB symptom is shortness of breath. Symptoms of TB in children are fever and cough for more than 2 weeks and failure to weight gain, loss of weight, and history of contact with infected TB case.

DIAGNOSIS

The WHO advises using rapid molecular diagnostic tests as the first diagnostic step for anyone showing symptoms of tuberculosis. Recommended tests include the Expert MTB/RIF Ultra and Truenat assays, which are noted for their high accuracy and contribute significantly to the early detection of both TB and drug-resistant strains. To detect individuals with latent infections, healthcare providers may utilize either a tuberculin skin test (TST) or an interferon gamma release assay (IGRA). Diagnosing forms of TB that are resistant to multiple drugs, as well as TB associated with HIV, can be both complex and costly. Additionally, diagnosing TB in children presents particular challenges [3].

NTEP: National TB Elimination Programme (Formerly RNTCP) in India

TB is the leading cause of death among all communicable diseases, fifth leading cause of death among all diseases. Nearly 26 lakh people infected every year, and around 5.4 lakh die because of this disease every year. India has pledged to eliminate TB within its borders by the year 2025. Our goal is to achieve a tuberculosis-free India, eradicating all TB-related deaths, illnesses, and poverty associated with the disease.

Table 1. Tuberculosis (TB) burden record.

TB Record	India	World
Number of people diagnosed with TB every year	26 lakhs	99 lakhs
Number of people who die of TB every year	5.04 lakhs	15.14 lakhs

National Strategic Plan to End TB (2017 to 2025)

- Find all persons with TB, including in the private sector, difficult-to-reach areas, and diagnose TB at the earliest.
- Administer high-quality anti-TB medications to all TB patients and ensure that everyone adheres to the prescribed treatment regimen until completion.
- Prevent the emergence of TB in susceptible population and stop catastrophic expenditure due to TB by all.
- Establish a supportive environment through the development of policies, programs, institutions, and human resources (Figure 1).

Organizational Structure of NTEP: State Level

NTEP at state level is headed by department of health and family welfare followed by secretary of health and family welfare and then Mission Director-National Health Mission (MD-NHM) followed by director health services. Under director health services is state TB officer. The state TB officers observe state TB cell and STDc (sexual transmitted diseases cell) and nodal drug-resistant (DR) TB center. Intermediate reference laboratory (IRL) and state drug store headed by STDc and state TB cell manage the department of MO-STCs (Medical Officer of State TB Control Society), APO (Assistant Programme Officer), state account officer, state PPM (public private mix) coordinator, TB-HIV coordinator, DR-TB coordinator, state ACSM (advocacy communication and social mobilization) officer and TO-procurement (Figure 2).

Organizational Structure of NTEP: District Level

Director collector or district magistrate is the head of the department on district level followed by chief medical or health officer, health officer supervised district TB officer. There are different departments headed by district TB officers like TB unit, etc.

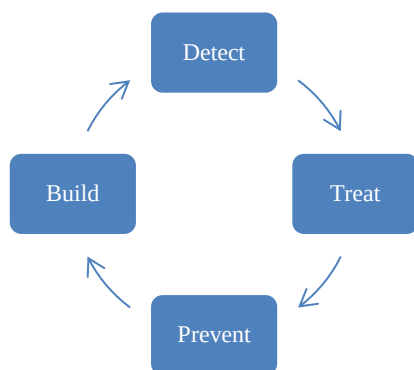


Figure 1. The four steps of National Strategic Plan to End TB (2017 to 2025).

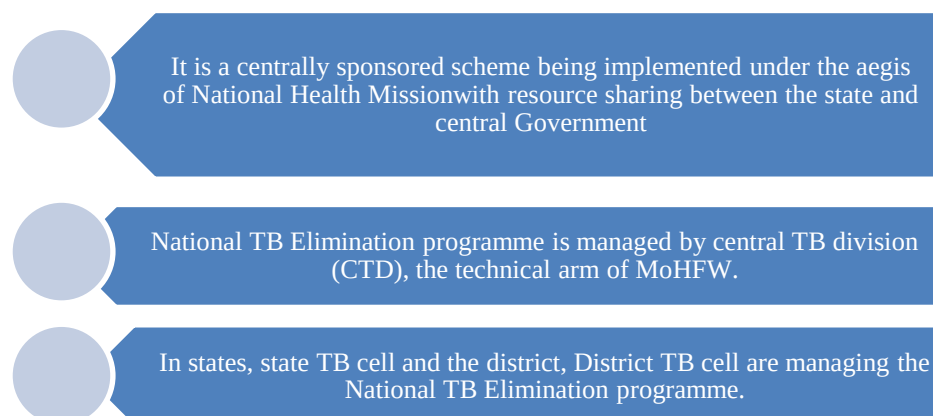


Figure 2. Organizational structure of National TB Elimination Programme (NTEP).

TB Forums

TB Forum is a committee in which the programme officials and community members sit together and discuss how to improve the TB programme and services. The chairperson of TB forum at each level is the highest official in-charge of health. At district level, district collector/magistrate is the chairperson. TB chairpersons are members of TB forum at all levels. Community members can share their suggestions, concerns, requirements etc. in this committee.

Composition of TB Forum

The TB Forum includes corporate sector, TB Champions, NTEP and State AIDS Control Society (SACS) officials, public health institute, patient support group, and civil society organizations [4].

BCG Vaccination

The BCG (Bacille Calmette-Guérin) vaccine, a live vaccine derived from a weakened strain of the bovine tuberculosis bacillus, *Mycobacterium bovis*, is the sole licensed vaccine for tuberculosis. Introduced in 1921, it remains among the most widely administered vaccines worldwide. Despite its extensive utilization, approximately 9 million new TB cases still arise annually.

A Testament to the BCG's Limited Effectiveness

The BCG vaccine provides 80% protection against tuberculosis for up to 15 years and is more effective in preventing severe forms of TB in children. However, its efficacy diminishes in individuals over 35 years of age and in equatorial regions, where environmental mycobacteria are prevalent. A typical treatment regimen combines isoniazid with rifampin, pyrazinamide, and ethambutol [5].

Multidrug-resistant tuberculosis (MDR-TB), which resists isoniazid and rifampicin, poses a notable challenge in controlling the TB epidemic. There have been promising developments in the pharmacological treatment of MDR-TB in recent years. New and repurposed medications have demonstrated effective bactericidal and sterilizing effects against *Mycobacterium tuberculosis*. Furthermore, several all-oral short treatment regimens for MDR-TB have shown favorable outcomes [6].

The 2020 guidelines for the programmatic management of TB preventive treatment mark the inaugural release within the framework of WHO's consolidated TB guidelines (Module 1 – Prevention). These consolidated guidelines will systematically organize all TB recommendations over time and will be accompanied by corresponding modules within a consolidated operational handbook [7].

PREVENTION

Individuals residing in the same household as someone with active pulmonary TB face an elevated risk of TB infection and development of the disease. These individuals are given priority for contact tracing and tuberculosis preventive treatment (TPT) [8].

Below are essential measures you must implement to prevent the transmission of TB bacteria to others:

- Make sure to always cover your mouth and nose when you cough or sneeze. Consuming warm drinks may help some people reduce coughing.
- Limit your time in shared spaces at home, like the bathroom or kitchen. There is no need to wear a mask around household members with whom you live.
- Refrain from allowing visitors into your home, except for healthcare professionals. Avoid visiting others as well.
- Use fans or open windows to enhance airflow within your residence. You can also spend time outdoors without wearing a mask.
- The most efficient approach to treating TB is directly observed therapy (DOT). Your doctor and public health nurse will explain DOT, where a healthcare worker administers your TB medication while observing you. Inform them of any issues or questions you have about your medication.

- Avoid going to work, school, places of worship, libraries, or public venues like grocery stores and post offices.
- Refrain from using public transportation, including buses, taxis, trains, and airplanes.
- Attend all medical appointments as scheduled. Your physician will track your progress and assess the effectiveness of your TB treatment. Missing appointments can prolong the time it takes to cure TB.
- Wear a special face mask provided by your doctor or nurse when visiting clinics or hospitals.
- Your doctor or public health nurse will guide you on when it is safe to stop wearing a mask and return to your regular activities. If you have any concerns or questions about TB or your treatment, consult your doctor or public health nurse [9].

Myths About Tuberculosis

Everyone With TB Is Infectious

It is important to clarify that individuals with TB can only spread the infection when they exhibit symptoms. Therefore, those with latent TB infections cannot transmit the disease. Additionally, transmission of TB occurs primarily when the bacteria are present in the lungs or throat; if located in other body parts like the kidneys or spine, transmission is unlikely. Typically, individuals with TB become non-infectious roughly 2 to 3 weeks after beginning treatment.

TB Is Genetic

Previously, it was mistakenly thought that TB was inherited from parent to child. This belief likely originated from observations that family members often contracted the disease simultaneously. It is now understood that the close living conditions of household members facilitate the airborne transmission of the bacteria among them.

There Is No Cure for TB

Contrary to misconception, TB is curable. For latent TB infections, the typical remedy involves the antibiotic isoniazid, taken once daily for a duration of 6 to 9 months. In cases of active TB infection, a regimen combining several antibiotics—usually isoniazid, rifampin, pyrazinamide, and ethambutol—is prescribed for a period ranging from 6 to 12 months.

TB Only Affects People in Low-Income Countries

It is a misconception that TB is confined to specific areas; it can actually occur globally. Nonetheless, TB tends to be more common in certain regions.

TB Spreads Through Shaking Hands

TB transmission does not occur through activities like handshaking, sharing food or drinks, touching bed linens or toilet seats, kissing, or sharing toothbrushes. The bacteria are transmitted only when an individual with an active infection in their lungs or throat coughs, sneezes, talks, or sings.

TB Is Always Fatal

Untreated TB can be deadly, but with contemporary medical advancements, doctors can effectively treat the disease [10].

Emergency Care for Tuberculosis

Emergency care for TB involves prompt and effective interventions to address urgent medical needs and prevent further transmission of the disease. Here are some key aspects of emergency care for TB:

1. **Rapid Diagnosis:** Early diagnosis is crucial in emergency TB care to initiate treatment promptly and prevent the spread of the disease. Rapid diagnostic tests such as GeneXpert MTB/RIF can provide results within hours, enabling healthcare providers to quickly confirm TB infection and its drug resistance profile.

2. *Isolation and Infection Control*: Patients suspected or confirmed to have TB should be isolated in well-ventilated rooms to minimize the risk of transmission to others. Healthcare workers should adhere to strict infection control measures, including wearing personal protective equipment (PPE) such as masks, gloves, and gowns, to prevent exposure to TB bacteria.
3. *Initiation of Treatment*: Emergency care for TB involves initiating appropriate treatment as soon as possible to prevent the progression of the disease and reduce the risk of complications. Standard treatment regimens for drug-susceptible TB typically include a combination of antibiotics such as isoniazid, rifampicin, pyrazinamide, and ethambutol. In cases of drug-resistant TB, individualized treatment regimens based on drug susceptibility testing are necessary.
4. *Monitoring and Supportive Care*: Patients receiving emergency care for TB should be closely monitored for treatment response and potential adverse effects of medication. Supportive care measures such as nutritional support, symptom management, and counseling may also be provided to improve patient outcomes and adherence to treatment.
5. *Contact Tracing and Screening*: In emergency TB situations, contact tracing and screening of close contacts are essential to identify individuals who may have been exposed to TB and to prevent further transmission of the disease. Close contacts should be evaluated for TB infection and offered preventive therapy if indicated.
6. *Collaboration and Coordination*: Effective emergency care for TB requires collaboration and coordination among healthcare providers, public health authorities, and other stakeholders. Multidisciplinary teams should work together to ensure timely diagnosis, treatment initiation, and follow-up care for TB patients.
7. *Community Engagement*: Engaging communities in TB prevention and control efforts is vital for raising awareness, reducing stigma, and promoting early detection and treatment-seeking behavior. Community-based organizations, peer support groups, and educational campaigns can play a significant role in mobilizing community resources and support for TB care.

In summary, emergency care for tuberculosis involves a comprehensive approach that prioritizes rapid diagnosis, isolation and infection control, prompt initiation of treatment, monitoring and supportive care, contact tracing and screening, collaboration and coordination among stakeholders, and community engagement. By addressing urgent medical needs and preventing further transmission of the disease, emergency TB care contributes to improved patient outcomes and public health.

DISCUSSION

Despite over 90 years of vaccination efforts and six decades of chemotherapy, TB still ranks as the deadliest infectious disease globally, surpassing HIV/AIDS in mortality rates, according to WHO reports from 2015 and 2016. In 2022, there were approximately 1.13 million TB-related deaths among individuals without HIV (with an uncertainty interval of 1.02–1.26 million), and around 167,000 deaths among those with HIV (uncertainty interval: 139,000–198,000). This total of roughly 1.3 million deaths nearly returns to the numbers reported in 2019. Yet, the actual decrease in the overall mortality due to TB from 2015 to 2022 amounted to merely 19%, significantly below the target set by the End TB strategy for 2025, which aims for a 75% reduction between 2015 and 2025.

CONCLUSION

TB can be prevented and treated effectively. It is estimated that one-fourth of the world's population carries TB bacteria, with approximately 5% to 10% of these individuals eventually developing symptoms and the disease itself. In pursuit of the 2025 TB elimination goal, the government has implemented various measures, such as proactively searching for cases among at-risk and co-morbid groups, conducting screenings at health and wellness centers, and urging private healthcare providers to report all cases of TB.

REFERENCES

1. Sotgiu G, Sulis G, Matteelli A. Tuberculosis – a World Health Organization perspective. *Microbiol Spectr*. 2017; 5 (1). doi: 10.1128/microbiolspec.TNMI7-0036-2016.

2. World Health Organization. Tuberculosis (TB) [Online]. Available at <https://www.who.int/news-room/fact-sheets/detail/tuberculosis> [Accessed on May 7, 2024].
3. Esmail H, Barry CE 3rd, Young DB, Wilkinson RJ. The ongoing challenge of latent tuberculosis. *Philos Trans R Soc Lond B Biol Sci.* 2014; 369 (1645): 20130437. doi: 10.1098/rstb.2013.0437.
4. Chapman HJ, Lauzardo M. Advances in diagnosis and treatment of latent tuberculosis infection. *J Am Board Fam Med.* 2014; 27 (5): 704–712. doi: 10.3122/jabfm.2014.05.140062.
5. Padda IS, Muralidhara Reddy K. Antitubercular Medications. [Updated June 3, 2023]. In: StatPearls [Online]. Treasure Island, FL, USA: StatPearls Publishing; 2024. Available at <https://www.ncbi.nlm.nih.gov/books/NBK557666/>
6. Espinosa-Pereiro J, Sánchez-Montalvá A, Aznar ML, Espiau M. MDR tuberculosis treatment. *Medicina (Kaunas).* 2022; 58 (2): 188. doi: 10.3390/medicina58020188.
7. World Health Organization. WHO Consolidated Guidelines on Tuberculosis: Module 1: Prevention: Tuberculosis Preventive Treatment [Online]. Available at <https://www.who.int/publications-detail-redirect/9789240001503> [Accessed May 7, 2024].
8. Salazar-Austin N, Mulder C, Hoddinott G, Ryckman T, Hanrahan CF, Velen K, Chimoyi L, Charalambous S, Chihota VN. Preventive treatment for household contacts of drug-susceptible tuberculosis patients. *Pathogens.* 2022; 11 (11): 1258.
9. Minnesota Department of Health. Home Respiratory Precautions for Patients with Potentially Infectious Tuberculosis. [Online]. Available at <https://www.health.state.mn.us/diseases/tb/basics/factsheets/homeresp.html> [Accessed May 7, 2024].
10. Newman T. Medical Myths: All About Tuberculosis. [Online]. Medical News Today. March 24, 2021. Available at <https://www.medicalnewstoday.com/articles/medical-myths-all-about-tuberculosis>