

The Burden of Tuberculosis in India: A Journey from Ancient Times to Modern Era

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Abstract:

Tuberculosis (TB), caused by *Mycobacterium tuberculosis*, has an age-old presence in India, the earliest written mention of the disease recorded 3,300 years ago. The known Ayurvedic surgeon Susruta in 6th century BCE elaborated the symptoms and effects of TB (1). Since time immemorial TB has inflicted a significant impact on the economy, social perceptions and growth of this country. This review article delves into the history of TB in India, tracing its trajectory from ancient times to the modern era. TB continues to pose a significant threat to public health in India, presenting substantial challenges to healthcare systems and communities. The progress in diagnosis and treatment as not been sufficient to curtail the impacts of TB which is taking a heavy toll on individuals and the nation as a whole. It is one of the biggest health crisis the country has been facing.

Introduction:

TB, an ancient scourge with a global penetration, finds its first written mention in the historical records of India (<https://www.cdc.gov/tb/worldtbdays>). Ancient Indian texts such as Atharv veda not only describes the symptoms and aftermath of TB but also suggests a range of Ayurvedic medicines to ease the discomfort (2). Additionally, skeletal remains from archaeological sites reveal evidence of TB infection in ancient populations.

India framed and followed a Revised National Tuberculosis Control Program (RNTCP) and implemented directly observed treatment short course (DOTS) therapy in the 90s. Initial success of this program led the world to believe that the country which has been under burden of majority of global TB cases has finally found a way to control its health and economic burden. However, the whole picture emerged a decade later which was terrifying owing to the recrudescence of the disease in a drug-resistant form (3). India shares the highest TB load for a single country, approximately one-fourth of the global burden. Emergence of Drug resistance (DR) strains in India is a major challenge as the socioeconomic conditions of majority of population has allowed the Drug-resistant strains to bloom owing to malnourishment and incomplete course of treatment. The future of the country's end TB strategy is hanging by a thread as the DR-TB challenge is unprecedented. 27% of global DR-TB cases have been recorded in India (4). India has announced an ambitious goal, the National Strategic Plan (NSP) to end TB by 2025, 5 years ahead of the global target. This requires a multifaceted approach spanning across extensive awareness strategies, comprehensive diagnosis and follow up

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treatment plans, improved nourishment and sanitation and a check on social stigma.

Epidemiology of TB driven by socioeconomic strata

India conducted a National Prevalence Survey (2019-2021) and observed an overwhelming 31 per cent tuberculosis infection burden among individuals above 15 years of age (5). The prevalence of TB is higher in densely populated, poorly sanitized area. Impact of TB is disproportionate and is driven by the socio-economic strata. Its profound and deadly impacts are observed in low-income groups which are often associated with overcrowding and malnutrition which contribute towards exacerbating the burden of TB in these marginalized communities. Majority of TB patients in India suffer from undernutrition. This combination is potentially lethal. Nutrition has proved to be a very important factor in fight against TB. In a study, baseline bodyweight was identified as a risk factor for death from TB, and gaining weight during the first two months of therapy with nutritional support was linked to a significantly lower risk of dying from the disease (6). Since the most vulnerable groups are disproportionately affected by the disease, it intensifies the already-existing health disparities and feeds the poverty cycle. The indirect costs of TB, such as lost wages, transportation costs, and a worse standard of living, put additional strain on impacted households and obstruct efforts to eliminate poverty. It often compels the victim to leave the treatment in between which ultimately paves way for emergence of DR strains which further complicates the efforts to control TB. Co-infection with HIV/AIDS and diabetes mellitus also contributes to the TB burden in India, posing additional challenges for diagnosis and management. A comprehensive study about prevalence of resistant strains by Lohiya et al (7) showed that Any Drug Resistance (ADR) in new patients was 24.9% while in previously treated patients it was 58.4%. MDR prevalence was skewed towards previously treated patients (26.7%) while new patients countered for only 3.5%. cases. Highest drug resistance was observed against Isoniazid followed by streptomycin. The overall trend showed an increasing manifestation in new patients. Prevalence of MDR was 5.1% among paediatric and 18.8% among HIV-TB co-infected patients (7).

Challenges in Diagnosis and Treatment and Future directions:

It has been noted that inadequate research setup and resource constraints are associated with a high disease burden. India has a number of obstacles when it comes to diagnosing tuberculosis (TB), including poor access to high-quality diagnostic instruments, long wait times for medical attention, and underreporting of cases, especially in underprivileged areas (8). Treatment adherence remains a significant issue, with factors such as medication side effects, stigma, and lack of social support contributing to poor outcomes. The emergence of drug-resistant TB strains necessitates more robust surveillance systems and improved access to second-line drugs. Despite substantial progress in tuberculosis control, India continues to face formidable challenges, including the emergence of drug-resistant strains, inadequate healthcare infrastructure, and socio-economic disparities. Addressing these challenges requires a multi-pronged approach, encompassing improved diagnostics, expanded access to treatment, strengthened healthcare systems, and intensified efforts to address socio-economic determinants of health.

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TB has been a burden to the Indian society for ages. The battle against the disease has been categorized into three periods: the early period, which preceded the development of x-rays and chemotherapy; the post-independence period, which saw the creation and implementation of national TB control programmes; and the current period, which is marked by the continuation of the TB control programme with assistance from the WHO (9). Presently, the DOTS (directly observed treatment-short course) programme in India is the world's largest programme in terms of patients started on treatment and is growing at the quickest rate. It is also the second largest programme in terms of population coverage. The spread of HIV infection, inadequate primary healthcare infrastructure in rural areas of many states, unregulated private health care that leads to the widespread and irrational use of first- and second-line anti-TB drugs are the main obstacles to the control of TB in India. Another growing danger to the eradication of TB is multidrug-resistant tuberculosis (MDR-TB), which is brought about by inadequate or failing tuberculosis control programmes (9).

Current Strategies and Interventions:

The National TB programme, then pilot project of India against TB, was examined for its effectiveness and shortfalls in 1992 by the Government of India in collaboration with World Health Organization and Swedish International Development Agency. It was observed that the funding was insufficient, management was unregulated, diagnosis heavily relied on x-ray, treatment regimen was compromised and the records of treatment outcomes were incomplete. The review report concluded that diagnosis success was as low as 30%. Of the diagnosed patients, only 30% of were treated successfully. This led the Government of India to lay down a revised strategy and launch of the Revised National TB Control Programme (RNTCP) followed (10). The RNTCP aims to improve case detection, treatment outcomes, and surveillance. Efforts to enhance TB diagnosis through the use of molecular diagnostics, such as GeneXpert, and the expansion of directly observed treatment, short-course (DOTS), have shown promising results. Additionally, initiatives to address social determinants of health, such as poverty alleviation programs and nutritional support, are integral to comprehensive TB control efforts.

The first national anti-tuberculosis drug resistance survey, India 2014–2015 under the aegis of WHO was launched on 6 September 2014 in New Delhi. The analysis of its findings provided a base for formulation of future strategies against drug resistance. India developed a National Strategic Plan (NSP) which proposes to attain a TB free India by year 2025, 5 years ahead of the global target. The vision of the strategy was a TB-Free India with zero deaths, disease and poverty due to TB (11). Currently, India's TB control programme focuses only on the detection and medical treatment of active cases. Drug treatment alone is not sufficient to prevent re-activation of the disease in a population which hosts many individuals who harbour latent TB infection. Improving the nutritional status of the society along with anti-TB drugs is the most effective strategy for controlling TB (12). A perfect blend of improved biological and social therapies will be needed to eradicate tuberculosis. A pro-poor patient-centered care model that includes financial, psychological, and nutritional support as well as universal health coverage and social protection is required for India's TB elimination

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strategy. It also needs to converge with multi-sectoral initiatives to address poverty, undernutrition, unsafe housing, and indoor pollution. (13).

Conclusion:

India still faces a significant challenge from the TB epidemic, one that calls for ongoing support from the public sector, medical professionals, and local communities. To achieve the objective of TB elimination, it is imperative to address the socio-economic drivers of TB, develop the healthcare infrastructure, and allocate resources to research and innovation. India can significantly lower the incidence of TB and enhance the health and well-being of its people by implementing a comprehensive strategy that incorporates biological, social, and economic initiatives. The long-lasting effects of TB on public health, society, and the economy are demonstrated by the disease's history in India. Throughout history, TB has presented significant obstacles that have required coordinated efforts to eradicate and control. Current investigations are concentrated on enhancing diagnostic tools, creating novel medications, and comprehending the fundamental causes of treatment resistance. Effective translation of research findings into solutions is contingent upon collaborative relationships among academic institutions, government agencies, and non-governmental groups.

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