Quick Response Code:

Viewpoint

Innovations triggered by India's bold vision to end tuberculosis

In March 2018, the Prime Minister of India, Mr Narendra Modi announced in the Delhi End Tuberculosis (TB) Summit that India had decided a target of ending TB five years ahead of the 2030 global Sustainable Development Goal, *i.e.*, by the year 2025[1]. This bold vision coming from the highest leadership in India was a turning point in the fight against TB in the country. The TB response in India no longer remained a responsibility of the national TB programme alone, but it transformed towards a whole-of-the-government and whole-of-the-society response. Funding for TB programme increased, and several innovative tools and approaches were developed and implemented in India's response against TB[2].

Ending TB is a daunting task considering the huge burden in India, continued presence of the disease for centuries and slow declines in the incidence and mortality. However, TB is a disease that can be prevented, diagnosed and treated, so it is unacceptable that so many people die of TB. Few decades ago, richer countries in western Europe, North America, Australia and Japan have brought down their burden of TB substantially[3]. In 2021, 10.6 million people in the world developed active TB and 1.6 million died of it, a staggering mortality of 16 per cent[4]. TB kills more people than any other single infectious agent apart from COVID-19 in recent years (2020-2021). India is the highest TB burden country, accounting for 28 per cent of global TB incidence and 33 per cent of deaths[4]. In 2021, the World Health Organization (WHO) estimated that 2.8 million people in India developed TB and 0.5 million died of it[4].

Seemingly impossible targets unlock new ideas, promote business-unusual and bring in innovations at its best. This is what started to happen in India before the COVID-19 pandemic, but there were major setbacks during the two peak years of the pandemic (2020-2021)[5]. In 2022, the TB response in India seems to have bounced back and is now well poised for a final push towards ending TB. The Global Plan to End TB 2023-2030 identifies the priority actions and finances needed to end TB globally despite the setback due to the COVID-19 pandemic[6]. It identifies a comprehensive set of interventions to prevent, diagnose and treat TB and identifies the research needs. These globally identified priority actions need to be fast tracked in India because of India's bold and ambitious target. How fast India can move towards ending TB will depend on continued political commitment, adequate financing and the pace at which innovations can be developed, introduced and scaled up.

One of the major challenges is that many people with TB are either not diagnosed or treated, or their diagnosis is delayed. This is an important contributor to TB deaths and ongoing transmission[7]. Several innovations have developed in India to address this challenge. Access to diagnostic services has improved through innovative models of engagement with private healthcare sector and expanding the network of sites with rapid molecular tests[8]. To detect TB early, even at the sub-clinical stage, systematic active case finding campaigns are being implemented and focussed on pre-delineated vulnerable populations and hotspots[9]. New tools for TB screening and diagnosis have developed in India such as rapid molecular tests (Truenat by Molbio and *Mycobacterium tuberculosis* PCR test kit by Mylab) and artificial intelligence (AI)-aided chest X-ray reads by qure.ai[10-12]. Further research is ongoing on innovations in testing specimen other than sputum for the diagnosis of TB and on faster and easier methods for genome sequencing. Mobile diagnostic vans have been designed with onboard AI-enabled ultra-portable hand-held X-rays and rapid molecular tests for community-based TB screening and diagnosis. Drones have been piloted to carry the specimen and drugs to the remote areas of the country[13]. Cough detection apps are in advanced stages of research to prompt people to

seek care for their cough and to assist health workers to triage people with cough for TB testing[14,15].

In the area of TB treatment, India was one of the first countries to research and use digital adherence tools, particularly the medication sleeve-based mHealth solution called 99DOTS[16]. India is also planning to scale up the short six-month treatment course for drug-resistant TB called BPaL containing bedaquiline, pretomanid and linezolid after conducting a research study in India (unpublished) to compliment international evidence.

For prevention, there are several candidate TB vaccines under research with five candidates in phase 3 clinical trials. Two of these five candidate vaccines in phase 3 clinical trials are being researched in India – the recombinant BCG vaccine called VPM1002 of Serum Institute of India and the inactivated mycobacterial vaccine called immuvac (MIP) of Indian Council of Medical Research and Cadila Pharmaceuticals[17]. A new effective vaccine has significant potential for impact as shown by Arinaminpathy *et al*[18] in a paper in this issue of the IJMR. While waiting for a new effective vaccine India needs to scale up TB Preventive Treatment (TPT) using primarily the short 12-dose '3HP' regimen to all eligible contacts, people living with HIV and other population groups at-risk. To address hesitancy of people and care providers to start TPT a 'test-and-treat' approach could be considered with TPT offered to people who test positive for TB infection. In this context, India has now developed a new and much improved skin test for TB infection called C-TB or Cy-TB test manufactured by Serum Institute of India[19].

Data are keys to guide the TB response, and in this context, India's Nikshay system which further evolved in recent years is unique in the world in terms of its capabilities for real-time online handling of patient management data as well as programme data[20]. India has also designed several new innovations in measuring TB burden and developing targets for States and districts using the smart and unconventional methods such as by using drug sales data[18].

To support patients and their families, a new initiative was launched in September 2022 called the Prime Minister's TB Free India Campaign[21,22]. It calls for individuals and organizations to adopt TB patients which means providing them monthly food baskets, vocational training and support for ancillary diagnosis and treatment. This is an innovation to break stigma,

create awareness and bring in crowd funding through an all-of-society approach.

The COVID-19 pandemic was a huge setback to India's TB response, but there were also several lessons learnt[23]. Virtual programme management, community and home-based care, use of digital tools, testing at scale, contact tracing at scale and the priority given to airborne infection prevention and control are some of the lessons learnt. TB and COVID-19 have many similarities, both being airborne and droplet infections affecting primarily the respiratory system. The TB programme infrastructure and human resources contributed to the COVID-19 response because of these similarities. Considering the huge burden of TB in India and the ambitious vision to end TB by 2025, TB deserves even more urgency than COVID-19 in terms of faster research, quick regulatory approvals of new tools and aggressive scale up of interventions. Going forward, as the world and India embark on Pandemic Preparedness and Response, India should invest further on its TB programme to ensure that it has all the capacity, tools and innovations needed to become a launchpad to fight any future new airborne infection outbreak. India's G20 Presidency in 2023 is an opportunity to push for G20 leadership and investments in innovations that have the dual purpose of defeating TB as well as preparing the world to face future pandemics.

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