# DRUG-RESISTANT TUBERCULOSIS: LOCAL AND GLOBAL PERSPECTIVES

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**Abstract**

This research explores about drug-resistant tuberculosis and the impact of TB worldwide. It is a well pronounced cause of death all over the globe, and the death is caused by untreated bacteria that destroys lung tissue. One of the main infectious causes of morbidity and mortality worldwide is s tuberculosis (TB), and the resistant strains of the disease pose a serious risk to public health across the world. Disease control initiatives have been made more difficult by the rise of largescale drug-resistant tuberculosis (XDR) and multidrug resistant tuberculosis (MDR), especially in low and middle-income nations.

The respiratory organs are the primarily affected by tuberculosis (TB), a chronic infectious illness caused by Mycobacterium tuberculae that can also affect the lymph nodes, bones, and meninges. Even though tuberculosis is preventable and treatable, it is still one of the directing diseases in the world, especially in low and middle-income nations. The illness is contracted by inhaling airborne droplets from sick people. Fatigue, night sweats, pyria, weight reduction, and a chronic cough are some of the early signs. Clinical assessment, radiographic results, sputum smear microscopy, culture, and quick molecular testing are used to make the diagnosis. First-line anti-TB medications are given in combination during a six-month period as part of standard treatment. Treatment and control efforts are made more difficult by the advent of drug-resistant strains, such as extensively drug-resistant TB (XDR-TB) and multidrug-resistant TB (MDR-TB), which is a serious public health problem. Improved living circumstances, early diagnosis and treatment of active cases, and the Bacillus Calmette–Guérin (BCG) immunization are examples of prevention measures. Through improved monitoring, coordinated public health measures, and research into novel vaccines and treatments, global programs like the WHO's End TB Strategy seek to lower the incidence and death of TB.

**Keywords:** Airborne droplets, Endemic, Cell-mediated immunity, Lymphadenitis, Reactivation TB, Granuloma , Tubercle, Caseating necrosis, MDR-TB, XDR-TB,prevention, treatment , drug resistance , tuberculosis.

## I. INTRODUCTION

Tuberculosis, one of the oldest disease which affect humans, and it is major cause of death worldwide[13].It is caused by bacteria of Mycobacterium tuberculosis complex, and majorly it affect lungs and other area of body like spine,brain and kidneys[6]. If properly treated then it can be curable in virtually all cases and if untreated ,the disease may be fatal within 5 years.Transmission take place by airborne.Mycobacteria belong to Mycobacteriaceae and other Actinomycetales.It is rod shaped, no spore forming ,thin aerobic measuring by 0.5micro meter by 3 micro meter. Basically they are neutral on gram's staining[10].

Mycobacterium tuberculosis is the bacterium that causes tuberculosis (TB), a chronic infectious illness[6]. Although pulmonary TB mostly affects the lungs, extrapulmonary TB can also move to the kidneys, spine, lymph nodes, and brain[12]. For ages, tuberculosis has plagued mankind and continues to rank among the world's major infectious agents in terms of fatality rates, even exceeding HIV/AID[8]. The World Health Organization (WHO) reports that millions of new cases of tuberculosis are recorded each year, with low- and middle-income nations bearing the brunt of this burden[13].

The illness is extremely infectious, particularly in crowded or poorly ventilated environments, since it is spread by airborne droplets that are emitted when an infected person coughs, sneezes, or talks[12]. After being inhaled, M. tuberculosis can lie dormant in the body for years, resulting in latent tuberculosis infection (LTBI)[6]. When the immune system is compromised, this infection can then develop into active illness .In clinical terms, TB manifests as exhaustion, night sweats, fever, chest discomfort, prolonged coughing, and inexplicable weight loss. Despite the availability of efficient diagnostic methods and curative treatments, poverty, malnutrition, limited access to healthcare, and the emergence of extensively drug-resistant (XDR) and multidrug-resistant (MDR) strains of the disease make tuberculosis (TB) a serious public health concern[8].

Bacillus Calmette-Guérin (BCG) vaccine, early identification, efficient treatment, and public health campaigns that break the chain of transmission are the main focuses of global TB control efforts. In order to achieve the WHO's "End TB Strategy," which aims to eradicate tuberculosis as a global health hazard by 2035, more research, public awareness, and international collaboration are necessary[7]. Acid fastness is mainly by high content of mycolic acids, long chains

cross –linked fatty acids and another molecule in cell wall, lipoarabinomannan.

Complete genome sequence has 4043 gens encoding 3993 proteins and 50 genes encoding RNAs.

WHO has reported more than 5 million new cases in 2005[7].

Our educational department are spreding awareness regarding tuberculosis and their consequences of damage in lungs , bones , joints ,brain .

II. RESEARCH METHODOLOGY

**Data collection methods :**

Quantitative data : are from WHO ,The European Centre for disease prevention and control (ECDC), The organisation for Economic Co- operation and development(OECD), Global fund.

**Search Strategy:**

WHO Records pertaining to TB Case Finding, Screening, and Search Recommendations for systematic screening for active TB . Module 2 of the WHO Operational Handbook: Screening: Systematic TBI Screening . Recommendations for augmented TB case-finding and isoniazid prophylactic treatment for individuals with HIV Enhancing active case-finding for TB (WHO, study of the South-East Asia area) . WHO unified guidelines for screening for tuberculosis in high-risk groups, which include using instruments like chest examinations . **Geographical distribution :**

Globally, tuberculosis (TB) continues to rank among the most common infectious causes of illness and mortality. The World Health Organization's (WHO) 2024 Global Tuberculosis Report estimates that 10.6 million people contracted TB in 2023, that 1.3 million of those who were HIV-negative died from the disease, and that 167,000 of those who were HIV-positive died. The illness still poses a major hazard to public health, especially in poorer nations, despite tremendous advancements in its control during the last few decades.

Although TB is present everywhere in the world, its prevalence is not uniformly distributed. The six areas that make up the worldwide TB burden are Africa, Americas, the Eastern Mediterranean, Europe, South-East Asia, and the Western Pacific, according to the World Health Organization (WHO).

The WHO South-East Asia Region has the greatest number of TB cases (about 45% of the global total), with India alone responsible for around 28% of it. The Western Pacific Region contributes about

18%, with China and the Philippines being major contributors; the Americas, Eastern Mediterranean, and European regions together account for the remaining proportion; and the African Region bears about 23% of cases, primarily due to high rates of HIV co-infection and limited healthcare resources. The WHO's End TB Strategy objectives, which call for a 90% decrease in TB incidence and a 95% reduction in fatalities by 2035 compared to 2015 levels, cannot be met at the current rate of decline in the worldwide incidence rate of TB, which has been decreasing gently—by around 1.5–2% annually.A resurgence in incidence and death occurred between 2020 and 2022 as a result of the COVID-19 pandemic's severe disruption of TB control efforts, which decreased case discovery and postponed treatment commencement in many countries.

An increasing problem is the rise of extensively drug-resistant TB (XDR-TB) and multidrug-resistant TB (MDR-TB). Globally, there were around 410,000 new MDR/RR-TB cases reported in 2023.

Countries like India, China, Russia, and Pakistan have the greatest rates of medication resistance. MDR-TB treatment success is still much lower (approximately 60%) than that of drug-susceptible TB (about 85%).

One of the key risk factors for TB is still HIV. Compared to people without HIV, persons living with HIV have a 16–18 times higher risk of developing active TB. The largest proportion of TB/HIV co-infection occurs in Sub-Saharan Africa, where integrated HIV-TB management initiatives are crucial to lowering mortality. All age groups are impacted by tuberculosis, although the most prevalent age group is adults between the ages of 15 and 54, who make up the economically active portion of the population. With around 56% of all TB cases occurring in men, men are more likely than women to be infected, while 11% of cases worldwide occur in children under the age of 15.

TB cases in KYRGYZSTAN

In Kyrgyzstan, one of the 30 nations the World Health Organization (WHO) has designated as having a high burden of multidrug-resistant tuberculosis (MDR-TB), tuberculosis (TB) continues to be a significant public health problem. Despite notable advancements in recent years, tuberculosis remains a major source of illness and mortality nationwide.

Kyrgyzstan reported an expected 6,000 new and relapse TB cases in 2023, which translates to an incidence rate of almost 87 cases per 100,000 people, according to the WHO Global Tuberculosis Report 2024. The estimated TB mortality rate among those living with HIV was around 0.7 per 100,000, whereas the estimated TB mortality rate (without included HIV) was approximately 8 deaths per 100,000 population.

Drug-resistant TB continues to be one of the nation's most significant problems. One of the nations with the highest rates of MDR-TB and rifampicin-resistant TB (RR-TB) is Kyrgyzstan. MDR/RR-TB was expected to account for 56% of previously treated patients and 30% of new TB infections in 2023. Because of this high percentage of resistance, managing tuberculosis has become more difficult, and the necessity for second-line treatment regimens—which are more expensive and linked to more adverse effects—has grown.

Although the frequency of HIV among TB patients in Kyrgyzstan is still low, at about 1% to 2%, co-infection with HIV also adds to the burden of TB. In order to guarantee early detection and combination medication, the nation has made strides in integrating TB and HIV care.

Kyrgyzstan's National Tuberculosis Program (NTP), which is funded by the Global Fund to Fight AIDS, Tuberculosis and Malaria, emphasizes patient-centered treatment, universal drug susceptibility testing, early case identification, and the growth of quick

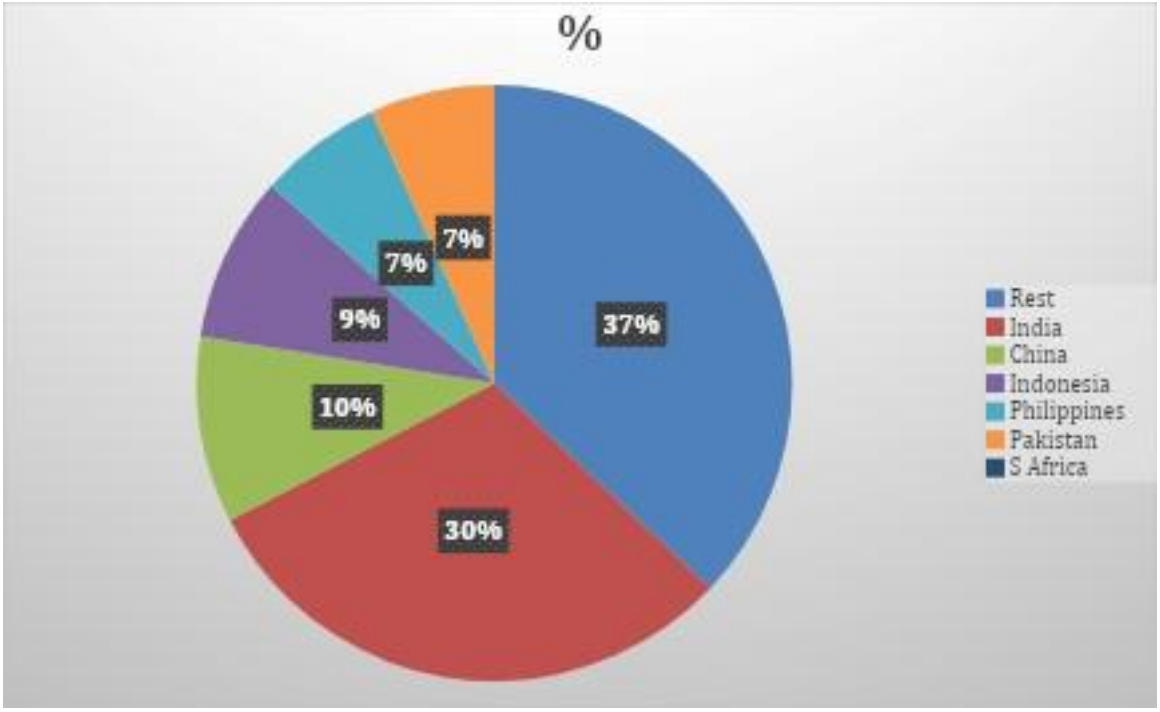
diagnostic techniques like GeneXpert MTB/RIF. In order to lower TB incidence and death through better treatment results, infection control, and preventative efforts, the government has also embraced the WHO End TB Strategy.

In the survey we conducted personally among the people of Kyrgyzstan of different ages and we found that highest rate of Tuberculslosis in men is at the age 18-35 years

In this pie chart we can see that India suffered more compare to other country.

III. RESULTS AND DISCUSSION

*Tuberculosis cases in world*




**Result of survey**

Total number of people in world are affected by Tuberculosis: 1 crore , in India total people are suffering from Tuberculosis : 26.9 lakh. In Kyrgyzstan total people are suffering from Tuberculosis: 4018 in 2022 compared to 2021 it decreased by 3891 and in 2020 it decreased by 3518. And death are fell from 1.6 million in 2017 to 1.5 million in 2018.

So, according to WHO India has largest number of TB patient in the world and countries which suffer least from TB are New Zealand, Canada, Australia, United States.

| Country | Estimated TB cases | % |
|---|---|---|
| India | 2.8 million | 26% |
| Indonesia | 1.1 million | 10% |
| China | 734,000 | 6.8% |
| Philippines | 734,00 | 6.8% |
| Pakistan | 681,000 | 6.3%% |
| Nigeria | 507,000 | 4.6%% |
| Bangladesh | 379,000 | 3.5% |
| Democratic republic of the congo | 335,000 | 3.1% |
| Myanmar | 331,000 | 3.1% |
| Vietnam | 314,000 | 2.9% |

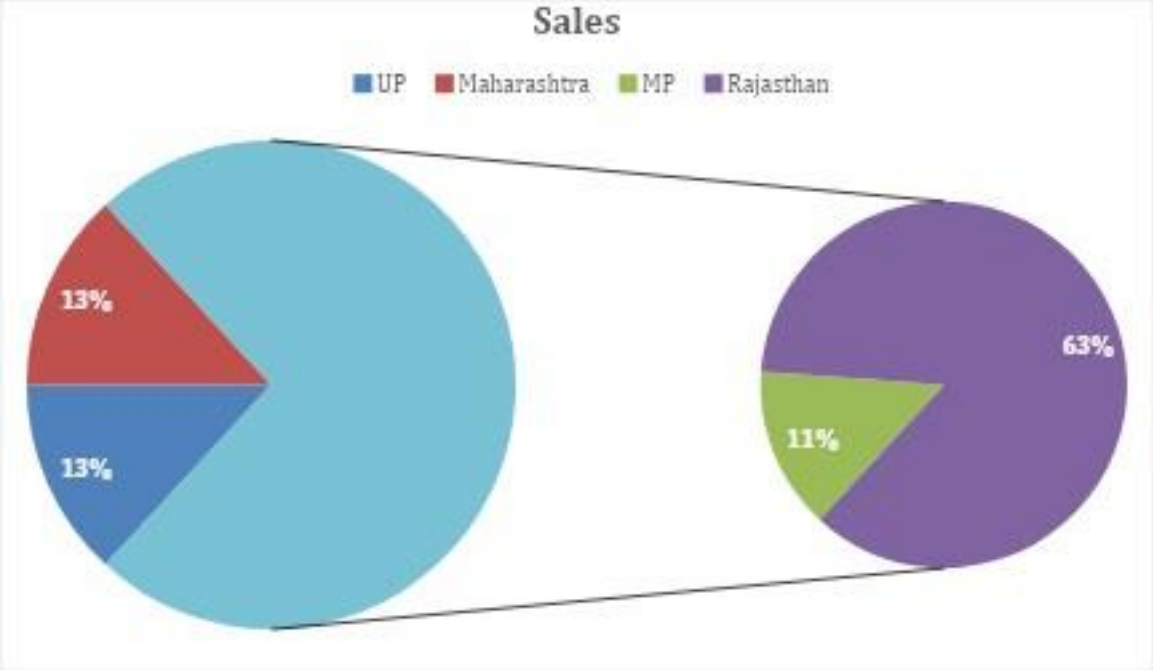
By this table we conclude that,we found that, WHO Global Tuberculosis Report 2024, India accounted for 26% of all TB cases worldwide in 2023, with an estimated 2.8 million cases.

Pakistan (681,000 cases, 6.3%), China (734,000 cases, 6.8%), the Philippines (734,000 cases, 6.8%), and Indonesia (1.1 million cases, 10%) are among the other high-burden nations. Significant contributions to the global TB burden are also made by African nations including the Democratic Republic of the Congo (335,000 cases) and Nigeria (507,000 cases). Over 70% of all TB cases globally occur in the top 10 nations combined, underscoring the epidemic's regional focus.

Characteristics

| Age(years) | Number | Percentage |
|---|---|---|
| <14 /14 | 1,401 | 17.5 |
| 15-29 | 2,569 | 32.1 |
| 30-44 | 2,287 | 28.6 |
| >45/451 | 1,744 | 21.8 |

| Sex | Number | Percentage |
|---|---|---|
| Male | 4,362 | 54.5 |
| Female | 3,639 | 45.5 |




| State | Number of cases |
|---|---|
| Uttar Pradesh | 6.8 lakh (680,000) |
| Maharashtra | 6.8 lakh (680,000) |
| Madhya Pradesh | 5.5 lakh (550,000) |
| Rajasthan | 5 lakh (500,000) |
| Bihar | 5.1 lakh (510,000) |

Uttar Pradesh: the state most impacted in India

Santosh Medical College/Hospital in Ghaziabad (UP) which has maximum number of patient which suffer from TB. According to State level data we found there is 2181 cases per 100,000 population in 2022 .And the treatment rate is increased by 69% in 2017 to 86% in 2022. And in UP there are some district which has more patient compare to others like Agra (which affected more last year there are 30,965 cases ) and Lucknow (there are 28,283 cases seen in 2023).

Uttar Pradesh is India's most populous state, home to over 240 million people, or nearly 18% of the country's total population; • Urban centers such as Lucknow, Kanpur, Varanasi, and Allahabad are densely populated, with many people living in cramped housing conditions. Person-to-person transmission is increased by high population density.

Malnutrition and Poverty A sizable portion of the population of Uttar Pradesh is socioeconomically disadvantaged, and poverty breeds malnutrition, which impairs immunity. In addition to slowing treatment recovery and increasing vulnerability to co-infections like HIV or respiratory infections, malnutrition increases the risk that a person may develop active TB illness from a latent TB infection. Malnutrition slows treatment recovery and increases vulnerability to co-infections such as HIV or respiratory infections. Malnourished people are also more prone to develop from latent TB infection to active TB illness.

Restricted Medical Access approximately 75% of UP's population lives in rural regions with poor access to primary healthcare. There are sometimes no well-equipped TB testing facilities, labs, or qualified medical personnel in many communities. In addition to a lack of knowledge about early TB symptoms, which leads to late presentation, delayed diagnosis lets infected people go longer without treatment, raising the risk of transmission.

Drug-resistant TB prolongs the infectious period and necessitates more extensive, expensive, and time-consuming therapy with poorer success rates.

**Occurrence of cases and mortality**

The state recorded a 19.0% decline in TB fatalities between 2019 and 2020, with 3,496 fewer deaths. Out of all Indian states, Uttar Pradesh reported the most TB cases in 2023—624,490. Improvements in TB detection and treatment results are seen in the death rate, which has been decreasing despite the large number of notifications.

Uttar Pradesh (UP) had the greatest number of TB cases recorded in 2023, with almost 624,490 cases reported, more than any other Indian state. However, the sources cited do not readily give particular statistics on TB-related death and survival rates in UP.

An estimated 2.8 million new and relapse cases of tuberculosis were recorded in India in 2023, accounting for around 26% of the worldwide TB burden. | In 2022, India's case fatality ratio (CFR) for tuberculosis was at 12.3%. When UP's reported cases are compared to this national CFR, an estimated 77,000 TB-related fatalities are predicted for the state in 2023. According to a research on treatment results, out of 134 TB patients in the rural Jalaun area of Uttar Pradesh, 86.6% were cured or finished their treatment, while 5.2% passed away while receiving it. If comparable treatment success rates are assumed, extrapolating these numbers to UP's 2023 caseload indicates that around 540,000 people may have survived TB.

About 2.51 million (25.1 lakh) of the anticipated 2.7 million (27 lakh) TB cases in India in 2023 were detected and treated.

- The incidence of tuberculosis has decreased from 237 cases per 100,000 people in 2015 to around 195 cases per 100,000 in 2023. This indicates a decrease of around 17.7% throughout that time frame. TB mortality has also decreased. Deaths were around 28 per 100,000 in 2015; by 2023, that number had dropped to about 22 per 100,000.
- Treatment coverage has significantly improved: in 2015, around 72% of projected TB patients were being identified and placed on treatment; by 2023, this had grown to 89%. This represents a decrease of approximately 21.4% over the same time. A significant portion of the worldwide TB burden is caused by India.

It was responsible for around 26% of all TB cases and fatalities worldwide in 2023. Drug-resistant TB is also prevalent in India. According to recent statistics, India has a significant impact on the number of MDR/RR-TB infections worldwide. In 2023, India accounted for over 27% of all MDR/RR-TB cases worldwide.

**Some plans are currently running in India;**

1-Pradhan Mantri TB Mukt Bharat Abhiyaan (PMTBMBA): Is was launch in September 2022

2-National TB Elimination programme (NTEP)

3-Nikshay Poshan Yojana launched in 2018

4-Universal Drug Susceptibility testing – every TB patient is tested for drug resistance 5-Nikshay Sampark-it is online platform for tracking and management.

**DOTS –**

- A worldwide approved tuberculosis control strategy is DOTS (Directly Observed Treatment, Short-course). It is recommended by World Health Organization (WHO) to ensure that patients adhere to a complete course of anti-tb treatment under qualified doctors.
- Key parts of DOTS includes:

1. Political commitment and financial support
2. Identification of cases using quality-assured bacteriology
3. Standard treatment plan
4. Directly observed therapy
5. Routine observation and reporting

## IV. Conclusion

As per the survey we are concluding that TB is a complex condition that is influenced by many risk factors. And we are also see that the TB is maximum occur in younger (under 5 age) and older (65age) because of weak immune system.

For management of TB various approach includes; general principles are (early diagnosis, assess drug susceptibility , monitor ), supportive care , drug management and public health measures Globally, tuberculosis (TB) is one of the most important infectious diseases, presenting major obstacles to healthcare systems, socioeconomic development, and public health. Millions of people are afflicted with tuberculosis (TB), which is mostly caused by Mycobacterium tuberculosis. Although it usually affects the lungs, it can also cause extrapulmonary illness that affects the lymph nodes, bones, meninges, and other organs. Even though tuberculosis is treatable and curable, it is still one of the infectious illnesses that kills the most people; in 2023, there were an anticipated 10.8 million new cases and 1.25 million deaths globally. Since poverty, malnutrition, overcrowding, inadequate sanitation, and limited access to high-quality treatment are socioeconomic factors, the illness disproportionately affects low- and middle-income nations.With almost 26% of all cases, India has the biggest TB burden in the world. States like Uttar Pradesh, Maharashtra, Madhya Pradesh, Rajasthan, and Bihar are the main contributors. Inadequate healthcare infrastructure, high migration rates, poverty, hunger, and high population density all contribute to the spread of tuberculosis and make treatment compliance more difficult. More than 624,000 cases and a projected 77,000 fatalities were recorded in Uttar Pradesh alone in 2023, underscoring the critical need for focused interventions in high-burden areas.

Multidrug-resistant TB (MDR-TB) and extensively drug-resistant TB (XDR-TB) are serious challenges in TB control that arise from inadequate therapy, non-adherence, and inappropriate treatment. Treatment for drug-resistant TB is more involved, expensive, and time-consuming; it is also frequently linked to increased morbidity and decreased cure rates. TB susceptibility is further increased and therapy is made more difficult when co-infection with HIV, diabetes, and other immunocompromising diseases occurs. In communities, transmission persists because social stigma and ignorance continue to postpone diagnosis and treatment. TB treatment necessitates a comprehensive, patient-centered strategy. Timely intervention requires

early detection by routine sputum smear and culture testing, systematic screening of high-risk individuals, and sophisticated molecular diagnostics like GeneXpert MTB/RIF. To improve results, it is essential to provide second-line medications for drug-resistant TB, manage co-morbidities, provide nutritional support, and ensure effective treatment adherence through directly observed therapy (DOTS) programs. Long-term TB reduction is based on prevention, which includes public health education, infection control techniques, better living circumstances, and Bacillus Calmette–Guérin (BCG) immunization.

The goal of national and international initiatives like India's National Tuberculosis Elimination Programme (NTEP) and the WHO End TB Strategy is to drastically lower TB incidence and death by 2035. The goal of national and international initiatives like India's National Tuberculosis Elimination Programme (NTEP) and the WHO End TB Strategy is to drastically lower TB incidence and death by 2035. Collaboration across sectors, including social welfare, housing, nutrition, and health, as well as strong political commitment and enough resources, are necessary to meet these goals. Particularly in high-burden environments, research into new TB vaccines, shorter and more efficient treatment regimens, and quick diagnostics is still essential to accelerating progress.

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