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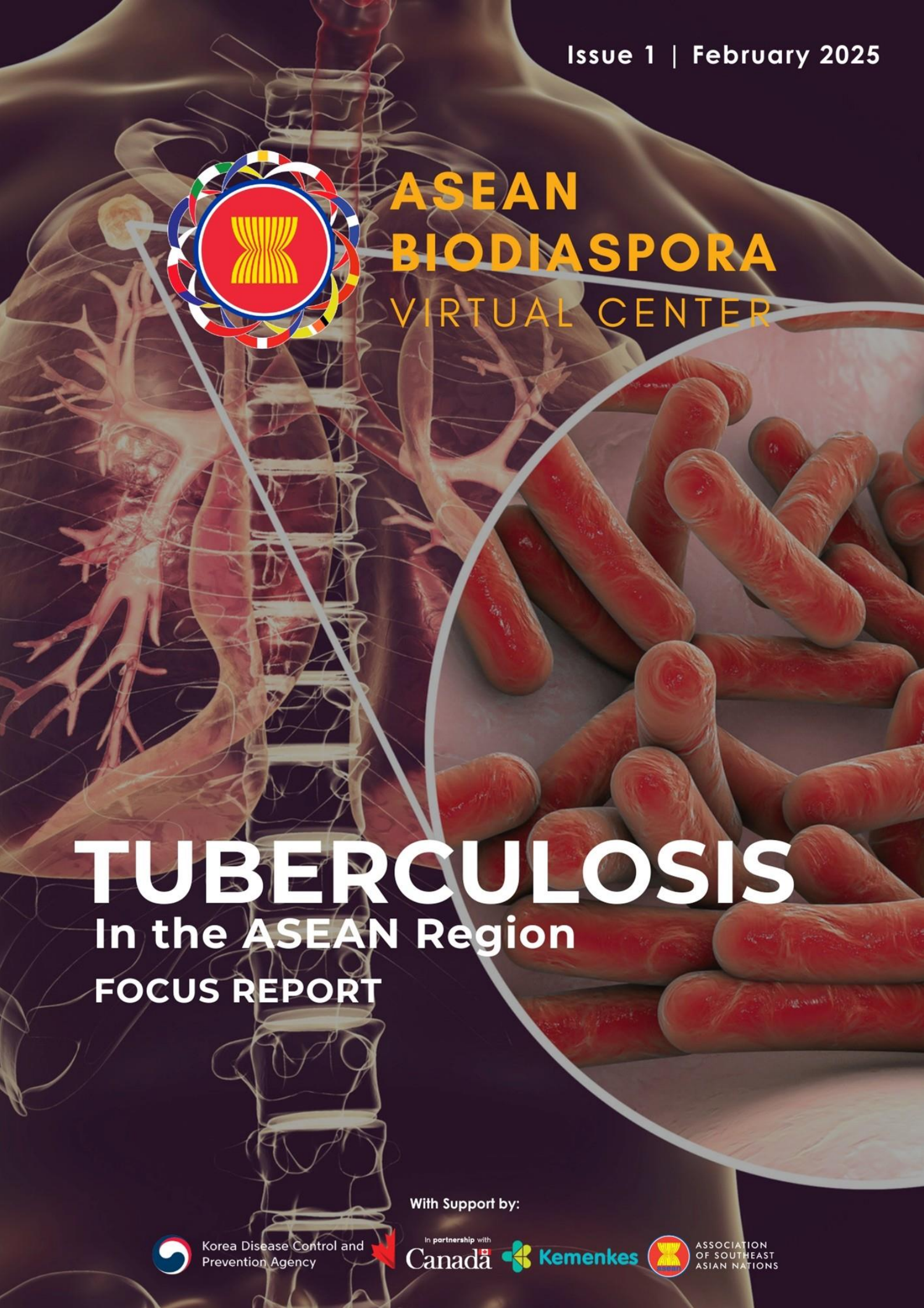
ASEAN BIODIASPORA VIRTUAL CENTER



TUBERCULOSIS

In the ASEAN Region

FOCUS REPORT

With Support by:

Korea Disease Control and Prevention Agency

In partnership with Canada

Kemenkes

ASSOCIATION OF SOUTHEAST ASIAN NATIONS

ASEAN BIODIASPORA VIRTUAL CENTER

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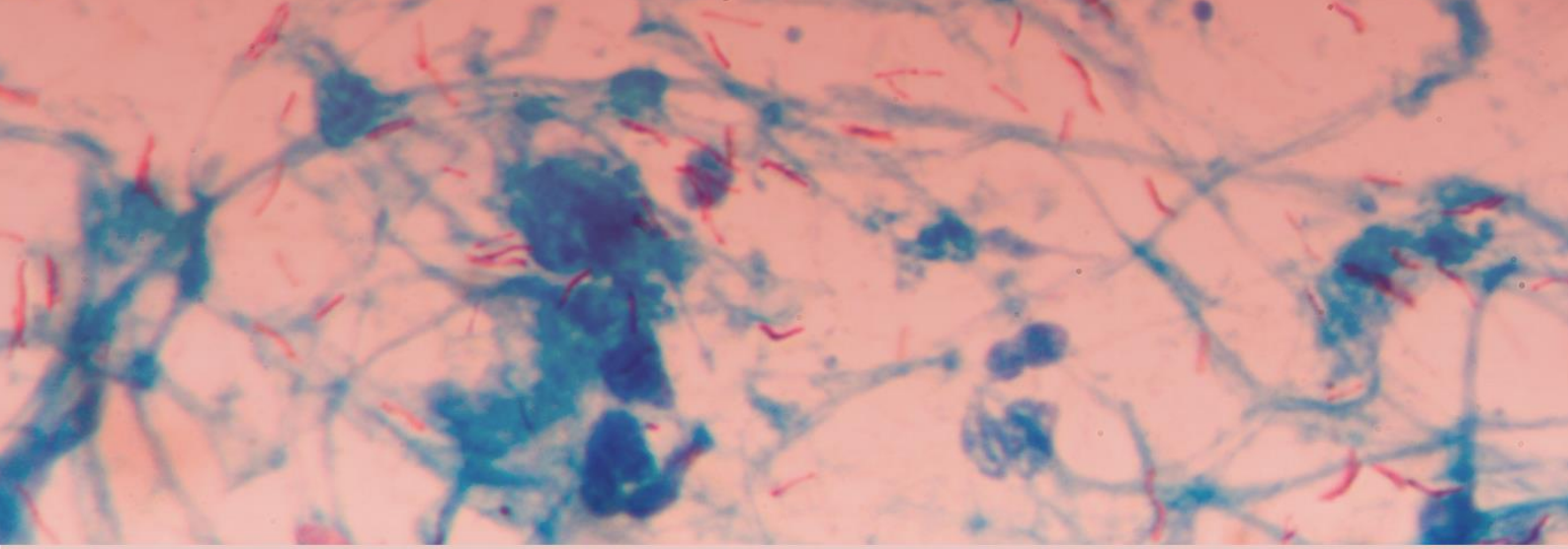
TUBERCULOSIS FOCUS REPORT



1 Introduction

Tuberculosis is a disease of the lungs, often caused by bacteria called *Mycobacterium tuberculosis*. It is transmitted from person to person through the air, when a person with infectious TB disease coughs, sneezes, talks, or sings. Tuberculosis remains a significant challenge in the ASEAN region, with all member states reporting cases and deaths annually. Global countries including ASEAN Member states have made commitments in The United Nations High-Level Meeting (UNHLM) in 2023 to implement actions to end TB.

This report provides an overview of tuberculosis, including its transmission, symptoms, and treatment, as well as current data on incidence and mortality. It also focuses on the regional situation within ASEAN, analysing the impact of the disease and the region's collective efforts to control it through surveillance, rapid response, and public health initiatives. Through this focus, the aim of the report aims to highlight the critical role of prevention and preparedness in reducing the burden of tuberculosis across vulnerable populations.

2 Methods

This report employs a comprehensive literature review to explore the global landscape of tuberculosis, with a particular focus on the ASEAN region. Data were collected from the established databases, namely PubMed, Embase and Scopus. Furthermore, data on the incidence of disease – including data published by the World Health Organization and ASEAN Member States – diagnostic criteria, preventative measures and policy strategies were collated from official reports and news sources on tuberculosis cases. This comprehensive approach enabled a detailed analysis of the current trends, patterns, and challenges associated with the management of tuberculosis within the ASEAN region.

3 Case Definition and Clinical Features

Case Definition

Tuberculosis (TB) is a disease with ancient origins, as evidenced by studies of human skeletons demonstrating its impact on humans dating back thousands of years (Babberis, et al, 2017). The causative agent of TB remained a mystery until Dr. Robert Koch identified the bacillus responsible, later named *Mycobacterium tuberculosis*, on 24 March 1882 (CDC, 2024).

The mode of transmission of tuberculosis is via aerosolised microdroplets, primarily produced when an individual with active tuberculosis coughs (Alzayer and Al Nasir, 2023). Additional activities that can generate these droplets include singing, shouting, and sneezing. The primary factor that elevates the risk of transmission is prolonged exposure, which is why it is frequently seen among family members and colleagues (Kurtuluş, 2020). Other environments where tuberculosis transmission is common include prisons, mines, and public transportation (Hanifa, 2009; Andrews, et al, 2014). Children under the age of five and individuals with HIV are particularly vulnerable to contracting the disease (Martinez, et al, 2021). While the disease primarily affects the lungs (pulmonary TB), it can also involve other parts of the body (extrapulmonary TB).

According to the diagnosis, the World Health Organization (WHO), the document entitled "Definitions and Reporting Framework for Tuberculosis - 2013 Revision", which was updated in December 2014 and January 2020, defines tuberculosis cases as detailed in Table 1 (WHO, 2020).

Table 1. Tuberculosis case definition

Case Definition	Description
Presumptive TB	A patient who presents with symptoms or signs suggestive of TB
Clinically diagnosed TB	A patient who does not meet the criteria for bacteriological confirmation yet has been identified as having active TB by a clinician or other healthcare professional who has opted to administer a full course of TB treatment. This definition encompasses cases diagnosed based on X-ray findings or indicative histological results, as well as extrapulmonary cases lacking laboratory confirmation. If a clinically diagnosed case is later determined to be bacteriologically positive—either before or after the initiation of treatment—it should be reclassified as bacteriologically confirmed.
Bacteriologically confirmed TB	A patient whose biological specimen is positive by smear microscopy, culture or WRD (such as Xpert MTB/RIF). All such cases should be notified, regardless of whether TB treatment has started.

Based on the anatomical site of the diseases, TB is defined as pulmonary tuberculosis (PTB) and extrapulmonary tuberculosis (EPTB), as shown in Table 2.

Table 2. Classification based on anatomical site of disease

Case Definition	Description
Pulmonary tuberculosis (PTB)	Any bacteriologically confirmed or clinically diagnosed case of TB involving the lung parenchyma or the tracheobronchial tree. a. Miliary TB is classified as PTB because there are lesions in the lungs. b. Tuberculous intra-thoracic lymphadenopathy (mediastinal and/or hilar) or tuberculous pleural effusion, without radiographic abnormalities in the lungs, constitutes a case of extrapulmonary TB. c. A patient with both pulmonary and extrapulmonary TB should be classified as a case of PTB.
Extrapulmonary tuberculosis (EPTB)	Any bacteriologically confirmed or clinically diagnosed case of TB that affects organs other than the lungs. This includes involvement of the pleura, lymph nodes, abdomen, genitourinary tract, skin, joints and bones, and meninges.

Classifications based on history of previous TB treatment are slightly different from those published previously. They concentrate solely on the history of previous treatment and do not rely on bacteriological confirmation or the specific site of the disease (WHO, 2010). The updated classification based on history of previous treatment is shown in Table 3 (WHO, 2020).

Table 3. Classification based on history of previous TB treatment

Case Definition	Description
New patients	Patients who have never been treated for TB or have taken anti-TB drugs for less than 1 month.
Previously treated patients	Patients who have received 1 month or more of anti-TB drugs in the past. They are further classified by the outcome of their most recent course of treatment as follows. a. Relapse patients have previously been treated for TB, were declared cured or treatment completed at the end of their most recent course of treatment, and are now diagnosed with a recurrent episode of TB (either a true relapse or a new episode of TB caused by reinfection). b. Treatment after failure patients are those who have previously been treated for TB and whose treatment failed at the end of their most recent course of treatment. c. Treatment after loss to follow-up patients have previously been treated for TB and were declared lost to follow-up at the end of their most recent course of treatment.

	Other previously treated patients are those who have previously been treated for TB but whose outcome after their most recent course of treatment is unknown or undocumented.
Unknown previous treatment history	Patients who do not fit into any of the categories listed above.

Determining and recording the patient's HIV status is critical for treatment decisions as well as for monitoring trends and assessing programme performance. The classification is shown in Table 4.

Table 4. Classification based on HIV status

Case Definition	Description
HIV-positive TB patients	Bacteriologically confirmed or clinically diagnosed cases of TB who have positive results from HIV testing conducted at the time of TB diagnosis or other documented evidence of enrolment in HIV care, such as enrolment in the pre-ART register or in the ART register once ART has been started.
HIV-negative TB patients	Bacteriologically confirmed or clinically diagnosed cases of TB who have negative results from HIV testing conducted at the time of TB diagnosis. Any HIV-negative TB patient subsequently found to be HIV-positive should be reclassified accordingly.
HIV status unknown TB patient	Bacteriologically confirmed or clinically diagnosed cases of TB who have no result of HIV testing and no other documented evidence of enrolment in HIV care. If the patient's HIV status is subsequently determined, he or she should be reclassified accordingly.

It is important to note that the registration categories for drug-resistant tuberculosis (DR-TB) vary slightly and are outlined in the Companion Handbook to the WHO Guidelines for the Programmatic Management of Drug-Resistant Tuberculosis (WHO, 2014). In terms of drug resistance status, TB cases are classified in categories based on drug susceptibility testing (DST) of clinical isolates confirmed to be *M. tuberculosis*.

Table 5. Classification based on drug resistance (WHO, 2022)

Case Definition	Description
Drug-susceptible TB (DS-TB):	A bacteriologically confirmed or clinically diagnosed case of TB without evidence of infection with strains resistant to rifampicin and isoniazid.
Monoresistant	Resistance to one first-line anti-TB drug only
Polydrug resistance	Resistance to more than one first-line anti-TB drug (other than both isoniazid and rifampicin)
Multidrug resistance	Resistance to at least both isoniazid and rifampicin.
Extensive drug resistance TB (XDR-TB)	TB caused by *M. tuberculosis* strains that fulfil the definition of MDR/RR-TB and that are also resistant to any fluoroquinolone and at least one additional Group A drug.
Pre-XDR-TB	TB caused by *Mycobacterium tuberculosis* (*M. tuberculosis*) strains that fulfil the definition of MDR/RR-TB and that are also resistant to any fluoroquinolone
Rifampicin-resistant TB (RR-TB)	TB caused by M. tuberculosis strains resistant to rifampicin. These strains may be susceptible or resistant to isoniazid (i.e. MDR-TB), or resistant to other first-line or second-line TB medicines. In these guidelines and elsewhere, MDR-TB and RR-TB cases are often grouped together as MDR/RR-TB and are eligible for treatment with MDR-TB regimens.

These categories are not entirely mutually exclusive. For example, when defining rifampicin-resistant TB (RR-TB), multidrug-resistant TB (MDR-TB) and extensively drug-resistant TB (XDR-TB) are also encompassed within that definition. Historically, the definitions of monoresistance and polydrug resistance have been restricted to first-line drugs. However, as new drug regimens emerge, it may become essential to categorize patients based on their resistance patterns to fluoroquinolones, second-line injectable agents, and any other anti-TB medications for which reliable drug susceptibility testing (DST) becomes available.

Transmission

Tuberculosis spreads person to person through the air (Figure 1). When a person with infectious TB disease (TB that can be spread) coughs, sneezes, speaks, or sings, tiny particles containing *M. tuberculosis* may be expelled into the air (CDC, 2019). These particles, called droplet nuclei, are about 1 to 5 microns in diameter—less than 1/5000 of an inch. Droplet nuclei can remain suspended in the air for several hours, depending on the environment. If another person inhales air that contains these droplet nuclei, infection may result from this transmission.

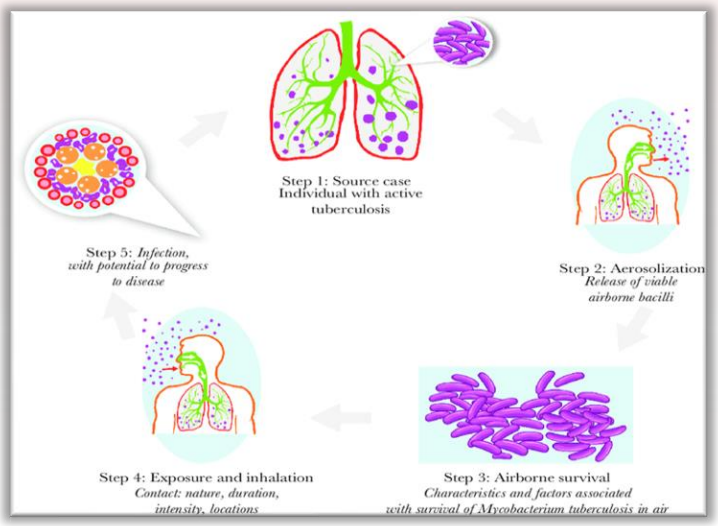


Figure 1. Transmission of Tuberculosis (Source: Nwoke, Chukwuebuka (Source: https://www.researchgate.net/publication/362701191_Critical_Appraisal_Focusing_on_Tuberculosis_Risks_among_Displaced_Persons_Do_We_Have_a_Smoking_Gun))

Not everyone who comes into contact with a person infected with tuberculosis (TB) will actually contract the bacteria. The likelihood of TB transmission is influenced by four key factors:

1. **Infectiousness of the TB patient**: How contagious the individual with TB is.
2. **Environment of exposure**: The setting in which contact occurred, which can affect the risk of transmission.
3. **Frequency and duration of the exposure**: How often and how long the person was exposed to the infectious TB patient.
4. **Susceptibility of the exposed individual**: The immune health and overall vulnerability of the person who has been exposed.

Risk Factors and Risk Groups

The tuberculosis (TB) epidemic is greatly impacted by socioeconomic factors and health-related risks like undernutrition, diabetes, HIV, alcohol use, and smoking (WHO, 2021). From the turn of the 20th century, TB cases and deaths started to decline in western Europe and North America because of growing incomes, reduced poverty, and improved housing and nutrition.

The WHO has created a framework for monitoring the Sustainable Development Goals (SDGs) related to TB, which includes 14 indicators with a relationship to TB incidence, under seven SDGs (WHO, 2021). Undernutrition and gross domestic product (GDP) per capita have a particularly clear relationship with TB incidence. In 2020, it was estimated that 1.9 million incident cases of TB globally were attributable to undernutrition, 0.74 million to HIV, 0.74 million to alcohol use, 0.73 million to smoking, and 0.37 million to diabetes.

In 2022, adult men (≥15 years) bore the highest TB burden with 5.8 million cases (55% of total), followed by adult women (3.5 million, 33%) and children (1.3 million, 12%). TB case notifications in 2022 represented 70% of estimated incidence overall, but varied by group: 72% for adult men, 75% for adult women, and 49% for children (0-14 years), with only 42% for children under 5 (WHO, 2023).

Clinical Presentation

Typically, tuberculosis is identified when an individual exhibiting symptoms consults a healthcare provider. However, there are occasions when TB is diagnosed during the evaluation of an unrelated medical issue. For instance, if a patient undergoes a chest X-ray due to trauma, the results may reveal unexpected signs of TB in the lungs. Additionally, TB disease can also be detected following a recent infection as part of a contact investigation. Symptoms of TB disease may vary depending on the part of the body affected (CDC, 2024a).

General symptoms of TB disease (in any part of the body) include:

Figure 2. General symptoms of TB

Tuberculosis primarily targets the lungs, resulting in what is known as pulmonary TB, which constitutes the majority of TB cases. The symptoms associated with pulmonary TB include:

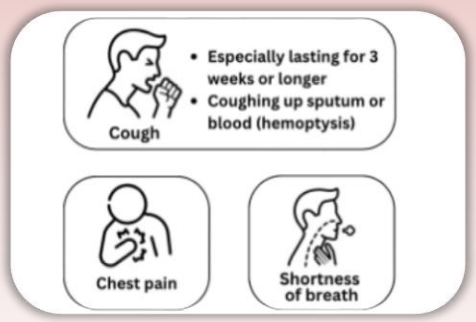


Figure 3. The symptoms associated with pulmonary TB

Extrapulmonary tuberculosis (TB) involves the infection of organs other than the lungs, potentially leading to symptoms that correspond to the affected area. The manifestations of extrapulmonary TB can vary widely based on which organ is involved. Common symptoms associated with this condition include:

a. Blood in the urine (may indicate TB disease of the kidney)
b. Headache or confusion (may indicate TB meningitis)
c. Back pain (may indicate TB disease of the spine)
d. Hoarseness (may indicate TB disease of the larynx)
e. Swollen glands (may indicate TB disease of the lymph nodes)
f. Swollen, painful joint (may indicate TB disease of the bone or cartilage)

In patients with systemic symptoms and a high risk of TB disease, extrapulmonary TB disease should be considered in the differential diagnosis.

Clinical Diagnostic

The WHO's End TB Strategy emphasizes the necessity of early tuberculosis diagnosis and universal drug susceptibility testing (DST), underlining the vital role of laboratories in the post-2015 period for the rapid and accurate detection of TB and drug resistance. Over the past 16 years, WHO has endorsed various new diagnostic technologies (WHO, 2024b).

Figure 4. Real-Time Polymerase Chain Reaction (PCR)

1. **Real-Time Polymerase Chain Reaction (PCR)**

These methods include technologies like Xpert® MTB/RIF and Xpert® MTB/RIF Ultra (produced by Cepheid), as well as Truenat™ (developed by Molbio). These automated tools offer an all-in-one solution that is ideal for use at the peripheral level and are currently among the most widely utilized diagnostics. They detect MTBC DNA and can identify mutations in the gene linked to rifampicin resistance. These tools rely on both software and hardware (such as computers) for result reporting and necessitate well-established laboratory networks and trained personnel to operate effectively.

2. **Moderate complexity automated nucleic acid amplification methods (NAATs)**

NAATs have the advantage of being largely automated following the sample preparation step. Moderate complexity automated NAATs may be used as an initial test for detection of TB and resistance to rifampicin and isoniazid simultaneously. They offer the potential for the rapid provision of accurate results and for testing efficiency where high volumes of tests are required daily. Hence, these technologies are suited to areas with a high population density and rapid sample referral systems.

3. Loop-mediated isothermal amplification (TB-LAMP)

TB-LAMP amplifies DNA at a constant temperature, unlike PCR, which necessitates a thermocycler. The amplified products can be detected visually using an ultraviolet (UV) lamp directly in the reaction tubes. This method requires only minimal equipment and can be utilized effectively at the most basic levels of laboratory facilities. However, the current technology does not allow for the detection of mutations in genes associated with resistance.

4. Antigen detection in a lateral flow format (biomarker-based detection) (LF-LAM)

LF-LAM assay is an immunocapture test designed to detect the antigen in urine. In certain populations, LF-LAM can be used alongside other approved TB diagnostic tests, offering a unique benefit as a point-of-care option. While the assay has limitations in sensitivity, it serves as a quick bedside rule-in test for individuals living with HIV, particularly in urgent situations where a swift TB diagnosis is essential for the patient's survival (WHO, 2022).

5. Low complexity automated NAATs

Automated nucleic acid amplification tests (NAATs) with low complexity are now available for detecting resistance to isoniazid and second-line anti-TB medications. This innovative diagnostic class is designed to serve as a reflex test for specimens confirmed to be positive for MTBC. They provide rapid drug susceptibility testing (DST) in intermediate and peripheral laboratories. The first product in this category can simultaneously identify resistance to isoniazid, fluoroquinolones, ethionamide, and amikacin. Results can be obtained in less than 90 minutes, significantly reducing the turnaround time compared to the current standard methods, which involve line probe assays (LPAs) and culture-based phenotypic DST.

6. Line probe assays (LPAs).

LPAs are a group of DNA strip tests capable of identifying MTBC DNA and assessing its drug resistance profile. These tests work by analyzing the binding patterns of amplicons (products of DNA amplification) to specific probes that target distinct regions of the MTBC genome, including common mutations associated with resistance to anti-TB medications and the corresponding wildtype DNA sequences.

LPAs are more technically intricate to conduct compared to the Xpert MTB/RIF assay. However, they are capable of identifying resistance to a wider array of first-line and second-line drugs and offer mutation-specific information for prevalent variants. These testing platforms are tailored for reference laboratory environments and are particularly relevant in countries with a high burden of tuberculosis. Results can be delivered within 5 hours.

7. Targeted next-generation sequencing (NGS)

This innovative testing approach utilizes technology that combines the amplification of specific genes with NGS, allowing for the detection of resistance to multiple drugs in a single test. Furthermore, targeted NGS can analyze entire genes to pinpoint specific mutations linked to resistance, potentially offering greater accuracy than the current WHO-recommended diagnostic tests (WRDs). Additionally, these new tests can identify resistance to both novel and repurposed drugs that are not included in existing molecular assays. As a result, this testing category holds significant promise for delivering comprehensive resistance detection tailored to contemporary treatment protocols. It is important to note that regulatory approval from national authorities or relevant organizations is necessary before these new diagnostic tests can be implemented.

4 Epidemiology

Global Situation

Tuberculosis remains a public health concern globally. In 2023, it is estimated that 10.8 million people (with a 95% uncertainty interval of 9.9 to 11.4 million) developed TB, an increase from the estimated 10.3 million in 2021 and 10.0 million in 2020 (WHO, 2024c). During the period, tuberculosis was responsible for approximately 1.30 million deaths worldwide (with a 95% uncertainty interval of 1.18 to 1.43 million). This figure represents a decline from the estimated 1.4 million deaths recorded in both 2020 and 2021, bringing the numbers close to those seen in 2019.

The global incidence rate of tuberculosis (TB) was estimated at 134 new cases per 100,000 population annually (95% uncertainty interval: 125–145). This represents a decrease of 8.7% from 2015, which is short of the World Health Organization's End TB Strategy goal of a 50% reduction by 2025. The disruptions caused by COVID-19 are projected to have led to nearly 500,000 additional TB-related deaths between 2020 and 2022, compared to what would have happened had the pre-pandemic trends continued.

Geographically, most people who developed TB in 2023 were in the WHO regions of South-East Asia (45%), Africa (24%) and the Western Pacific (17%), with smaller proportions in the Eastern Mediterranean (8.6%), the Americas (3.2%) and Europe (2.1%) (WHO, 2024d).

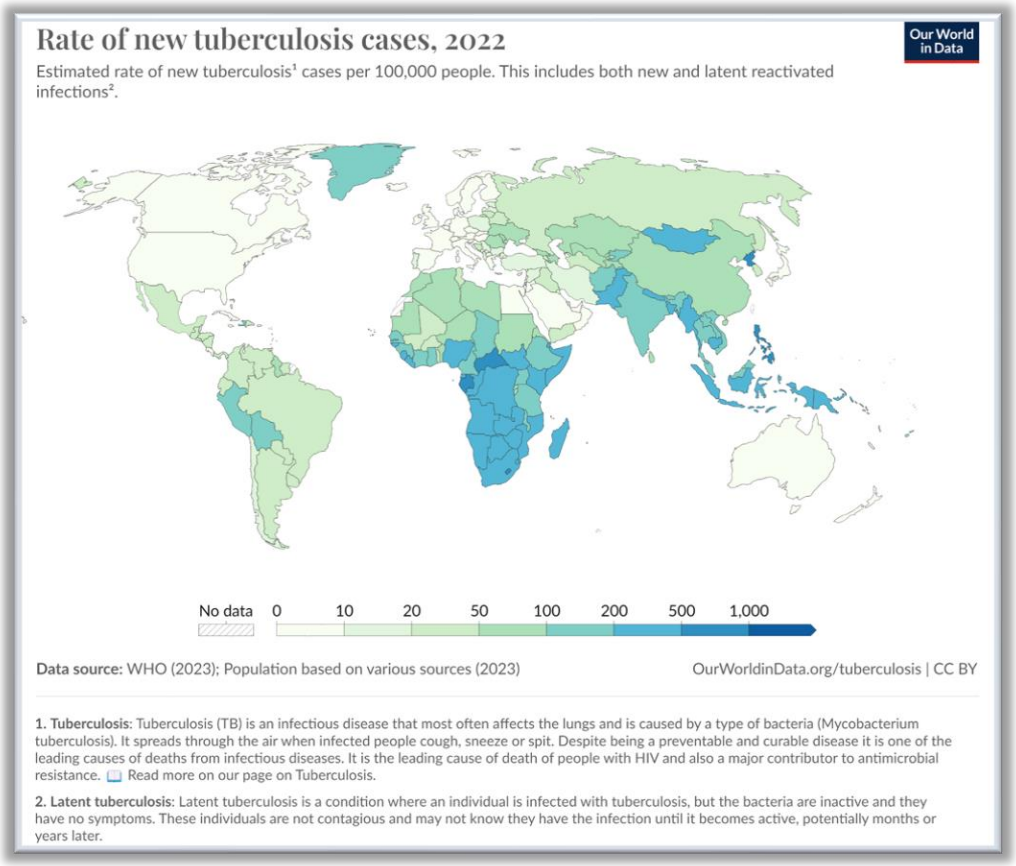


Figure 5. Rate of new tuberculosis cases, 2022
(Source: Our World in Data (https://ourworldindata.org/tuberculosis))

In 1998, the WHO created the first list of 22 high burden countries (HBCs) that accounted for about 80% of TB cases worldwide during the period (WHO, 2024d). Later, two more HBC lists were created for HIV-associated TB and MDR-TB. By 2015, WHO had three global HBC lists in use for TB, TB/HIV, and MDR-TB.

From 2015 to 2022, the overall reduction in TB-related deaths globally was 19%, far from the WHO's target of a 75% reduction by 2025 under the End TB Strategy (WHO, 2024c). However, progress has been more favorable in the African and European regions of the WHO, with 83 countries reporting reductions of at least 20%. Notably, 30 countries with a high burden of TB accounted for 87% of the world's total cases in 2023 (WHO, 2024d). Five countries accounted for 56% of the worldwide total: India (26%), Indonesia (10%), China (6.8%), the Philippines (6.8%) and Pakistan (6.3%).

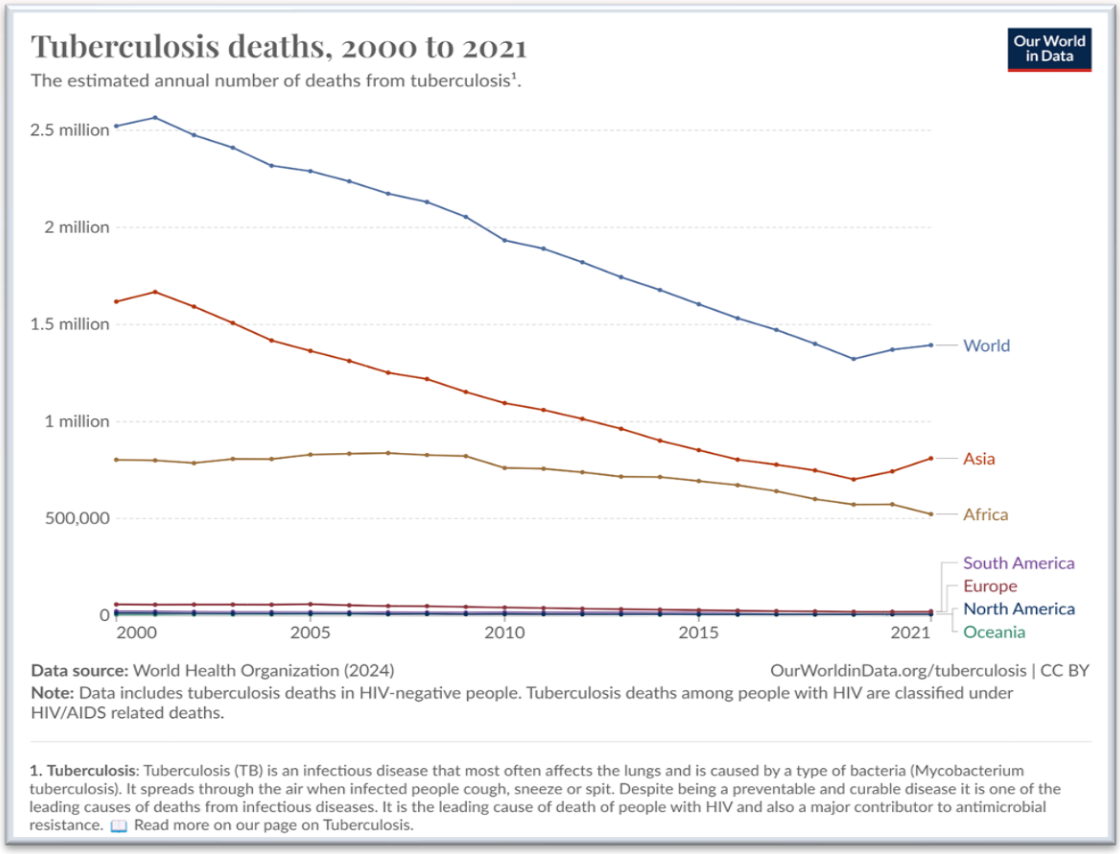


Figure 6. Tuberculosis deaths, 2000 to 2021
(Source:Our World in Data (https://ourworldindata.org/tuberculosis))

Burden of Tuberculosis in the ASEAN Region

Tuberculosis continues to represent a considerable challenge within the ASEAN region, with all member states reporting cases and deaths on an annual basis. Five countries—Indonesia, Myanmar, the Philippines, Thailand, and Viet Nam—are included in the WHO's list of 30 high TB burden countries for the 2021-2025 period (WHO, 2024d). The following section presents data on annual cases, deaths, and case fatality rates (CFR) for each ASEAN member state. These figures are derived from country reports and the WHO estimates processed by Our World in Data (OWID):

Brunei Darussalam

Figure 7 illustrates the fluctuations in tuberculosis cases within Brunei Darussalam over a half-decade, spanning from 2017 to 2022 (AIDS Data Hub, 2023). Initially, the nation experienced a surge in reported cases between 2017 and 2020, culminating in a peak of 314 cases. Subsequently, a downward trend in case numbers was observed in the ensuing years.

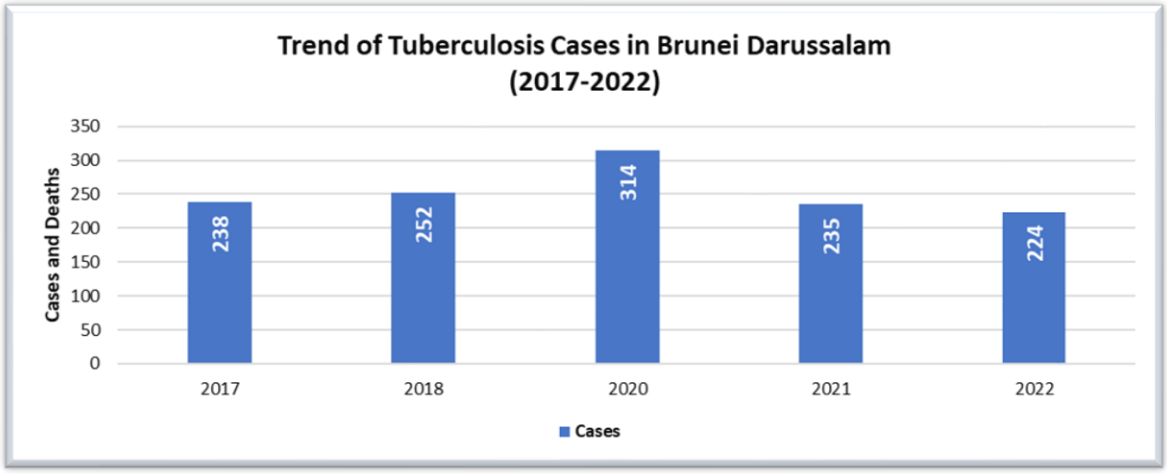


Figure 7. Trend of tuberculosis cases in Brunei Darussalam, 2017-2022
(Source: AIDS Datahub (https://www.aidsdatahub.org/))

Cambodia

Figure 8 illustrates the annual estimates of tuberculosis cases and deaths in Cambodia (Our World In Data, 2024). The figure shows a generally declining trend in both TB cases and deaths from 2010 to 2020, followed by an increase beginning in 2021. The CFR also shows a downward trend before stabilizing at around 7% between 2014 and 2020. However, starting in 2021, the CFR rises sharply to 9%, reflecting a shift in disease severity or mortality during this period.

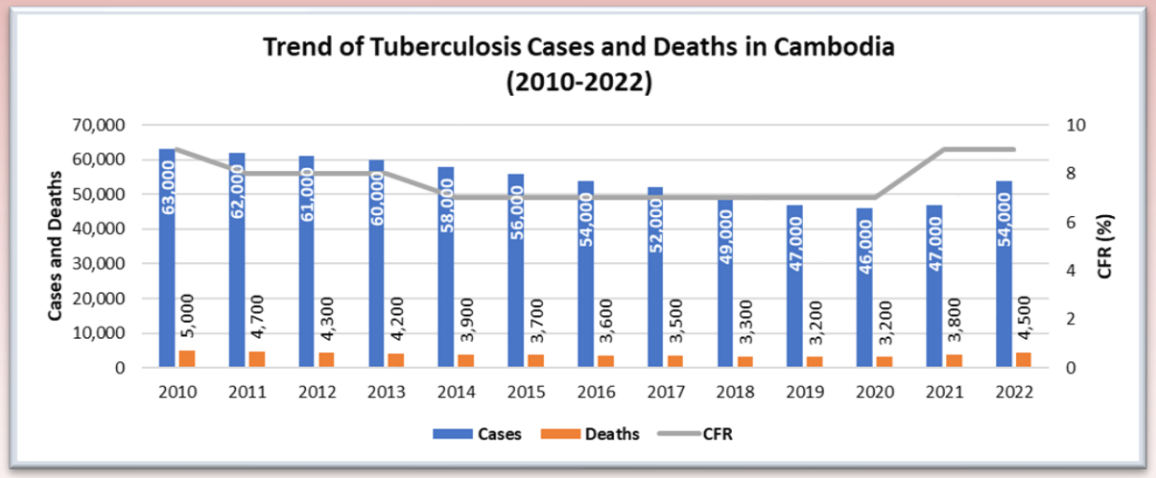


Figure 8. Trend of tuberculosis cases and deaths in Cambodia, 2010-2022
(Source:Our World in Data (https://ourworldindata.org/tuberculosis))

Indonesia

Figure 9 illustrates the fluctuating pattern of tuberculosis cases and deaths in Indonesia. From 2010 to 2013, case numbers remained stable, followed by a gradual rise between 2015 and 2018. A decline occurred thereafter, reaching the lowest point in 2020 (Ministry of Health Indonesia, 2024). However, cases resurged from 2021 onward, peaking in 2023. Fatality rates fluctuated between 13% and 20%, with the lowest recorded in 2010 and the highest in 2020.

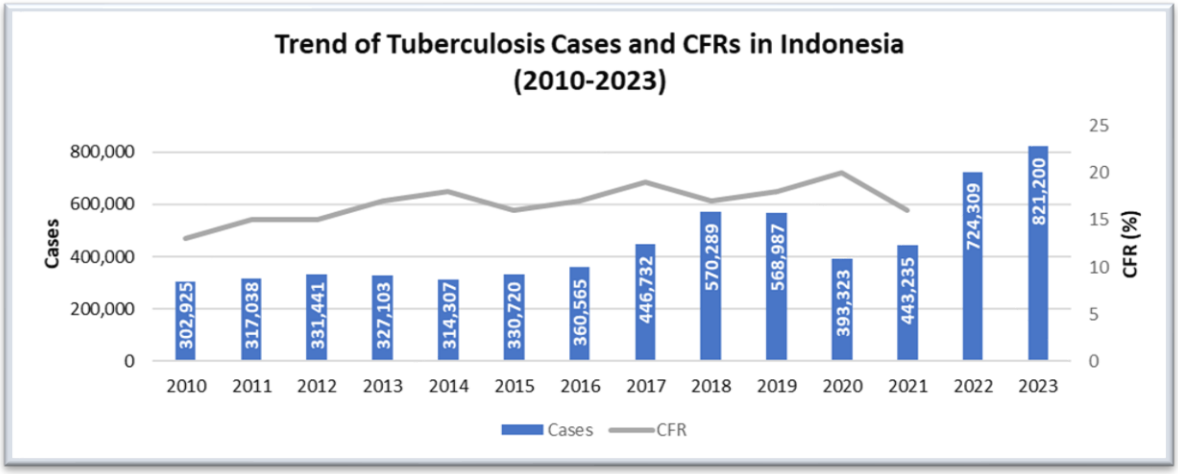


Figure 9. Trend of tuberculosis cases and fatality rates in Indonesia, 2010-2023
(Source: Ministry of Health Indonesia (https://www.tbindonesia.or.id/wp-content/uploads/2024/12/Laporan-Program-Penanggulangan-TBC-2023_Final.pdf))

Lao People's Democratic Republic

As demonstrated in Figure 10, there has been an upward trend in the number of tuberculosis cases in Lao PDR during the period 2015 to 2019 (Ministry of Health Lao, 2020). The country reported a total of 4,534 cases of tuberculosis, followed by gradual increases, peaking with 6,813 cases reported in 2019.

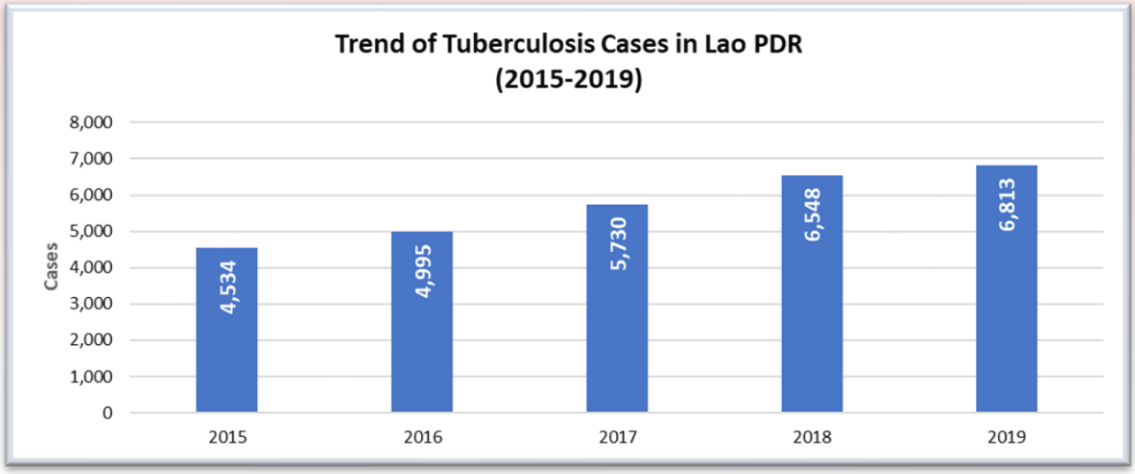


Figure 10. Trend of tuberculosis cases in Lao PDR, 2015-2019
(Source: Ministry of Health Lao (https://roasiapacific.iom.int))

Malaysia

As demonstrated in Figure 11, there has been a fluctuating yet overall increasing trend in the number of TB cases in Malaysia over the 14-year period, with a dropping trend from 2020 to 2021 and re-emerge since 2021, peaking in 2023 (Ministry of Health Malaysia, 2024). The number of deaths, indicated by the orange bars, ranged from 1,202 to 2,627. The CFR, on the other hand, exhibited a downward trend from 2010 to 2013, followed by an increasing trend to 2023, with a drop in 2019.

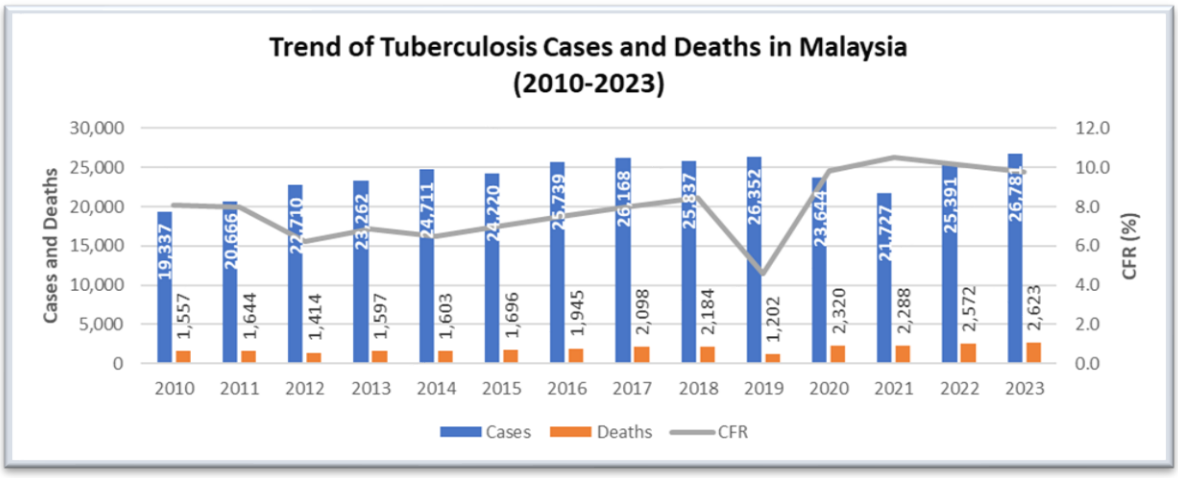


Figure 11. Trend of tuberculosis cases and deaths in Malaysia, 2010-2023
(Source: Ministry of Health Malaysia (https://www.moh.gov.my/))

Myanmar

Figure 12 presents the trend of tuberculosis cases in Myanmar from 2010 to 2019. The number of cases showed fluctuations, increasing from 137,403 in 2010 to a peak of 148,149 in 2012 (Ministry of Health Myanmar, 2020). Afterward, cases declined to 142,162 in 2013 and remained relatively stable until 2016. A more noticeable decrease occurred from 2017 onward, with cases dropping to 130,411 in 2017 and reaching 131,425 in 2019. The overall trend indicates a gradual decline in tuberculosis cases over the decade.

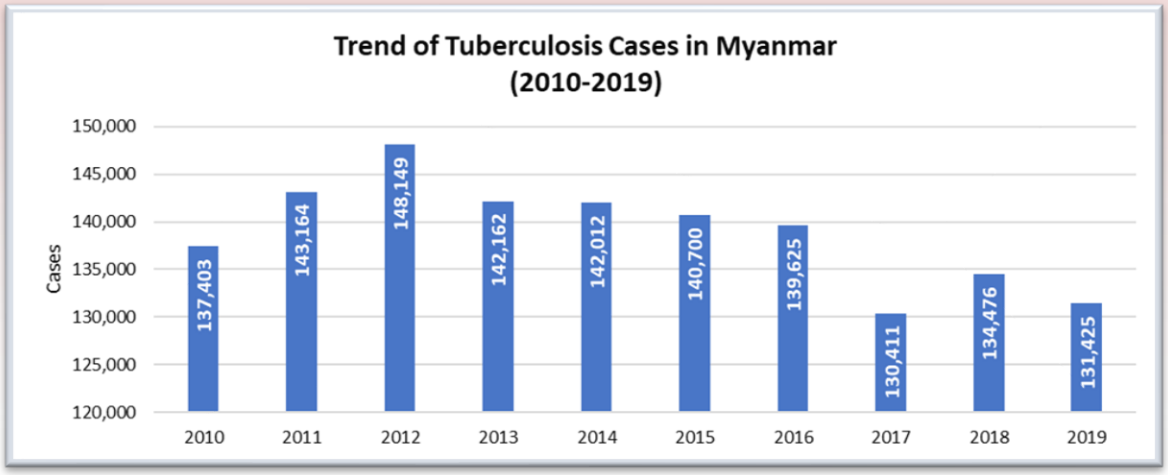


Figure 12. Trend of tuberculosis cases in Myanmar, 2010-2019
(Source: Ministry of Health Myanmar (https://ntpmyanmar.org/publication/presentation/))

Philippines

Figure 13 illustrates the annual estimates of tuberculosis cases and deaths in the Philippines (Our World In Data, 2024). Figure 10 shows a gradual increase in the number of TB cases from 503,000 in 2010 to 612,000 in 2019, followed by a slight decrease in 2020 and a significant increase in cases starting 2021. The orange bars, representing deaths, demonstrate a consistent and relatively low level throughout the observed period. The CFR remained at a low level of 5-7% during the entire period.

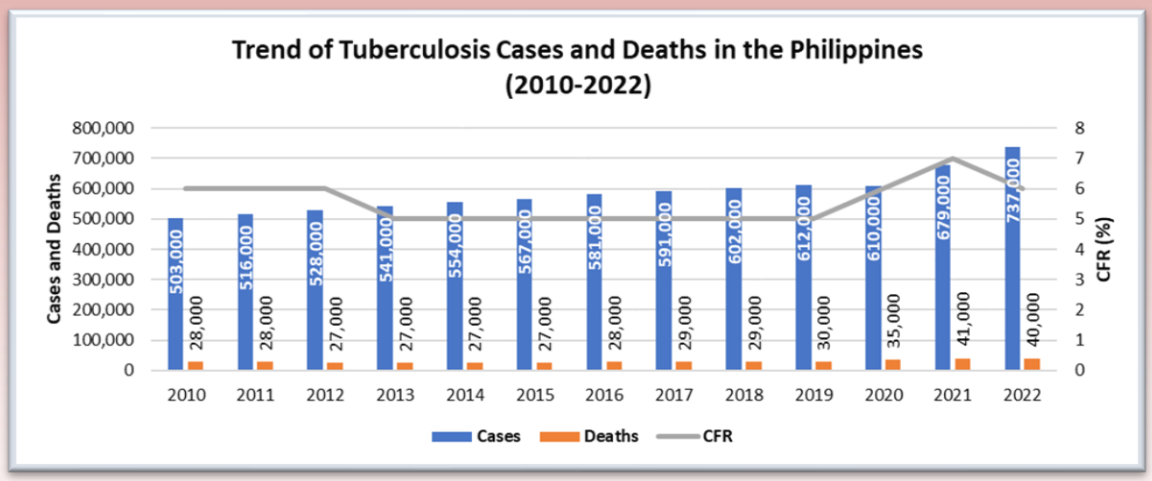


Figure 13. Trend of tuberculosis cases and deaths in the Philippines, 2010-2022
(Source:Our World in Data (https://ourworldindata.org/tuberculosis))

Singapore

The data show an initial increase from 1,402 cases in 2015 to a peak of 1,500 cases in 2016, followed by a relatively stable period with cases remaining above 1,440 cases, before a sharp decrease to 1,134 cases in 2019 (Ministry of Health Singapore, 2019). After an increase in 2020, with 1,216 cases reported, the country shows a continuous downward trend (Ministry of Health Singapore, 2024).

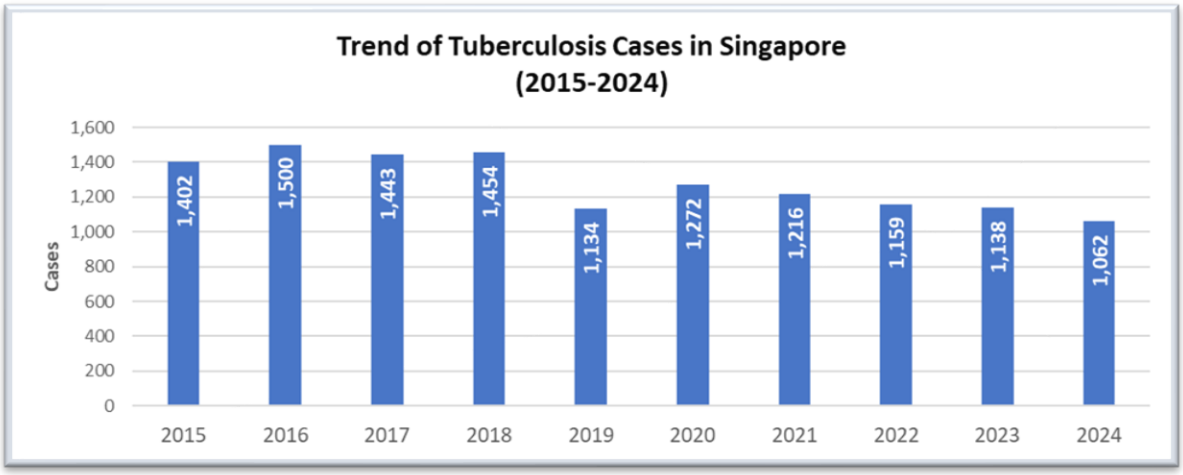


Figure 14. Trend of tuberculosis cases in Singapore, 2015-2024
(Source: Ministry of Health Singapore (https://www.moh.gov.sg/))

Thailand

Figure 15 shows the trend in tuberculosis (TB) cases and deaths in Thailand from 2010 to 2023 (Ministry of Public Health Thailand, 2024). The figure shows a decreasing trend in cases and deaths from 2010 to 2016. However, there is a steady increase in cases from 2017 to 2019, followed by a gradual decrease in the following years. Overall, the country reported relatively few deaths, ranging from 2 to 126 over the period. The case fatality rate remains low at less than 1%.

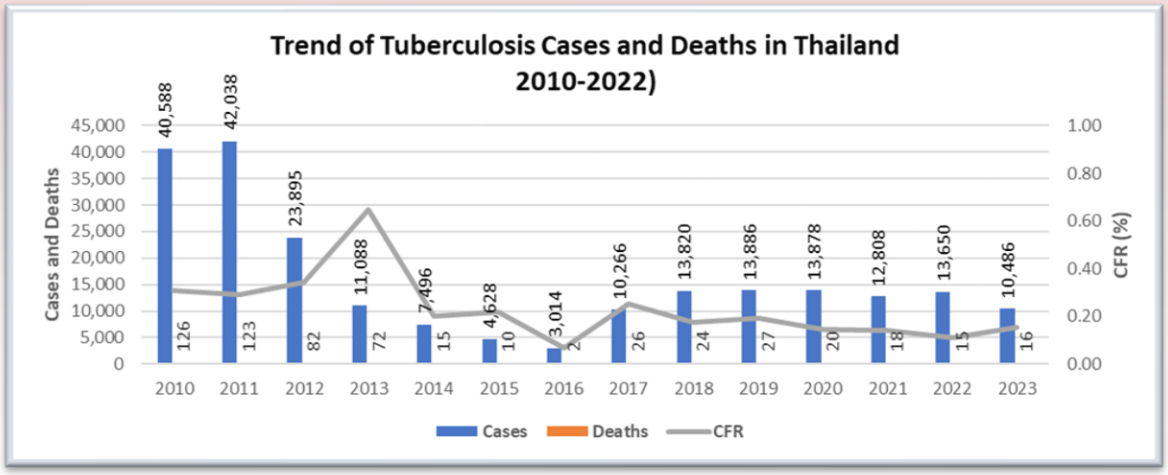


Figure 15. Trend of tuberculosis cases and deaths in Thailand, 2010-2023
(Source: Ministry of Public Health Thailand (http://doe.moph.go.th/surdata/index.php))

Viet Nam

As demonstrated in Figure 16, the trend of tuberculosis cases in Vietnam from 2012 to 2020 exhibited fluctuations, with a decline from 103,882 cases in 2012 to 102,067 cases in 2024 (Ministry of Health Viet Nam, 2020). Following this, a slight increase in cases was observed in 2015, followed by a sharp rise to 106,527 cases in 2016. This was subsequently followed by a decrease up to 2018. However, in 2019, there was a resurgence in cases to 104,505, before a decline in 2020 with 101,438 cases reported.

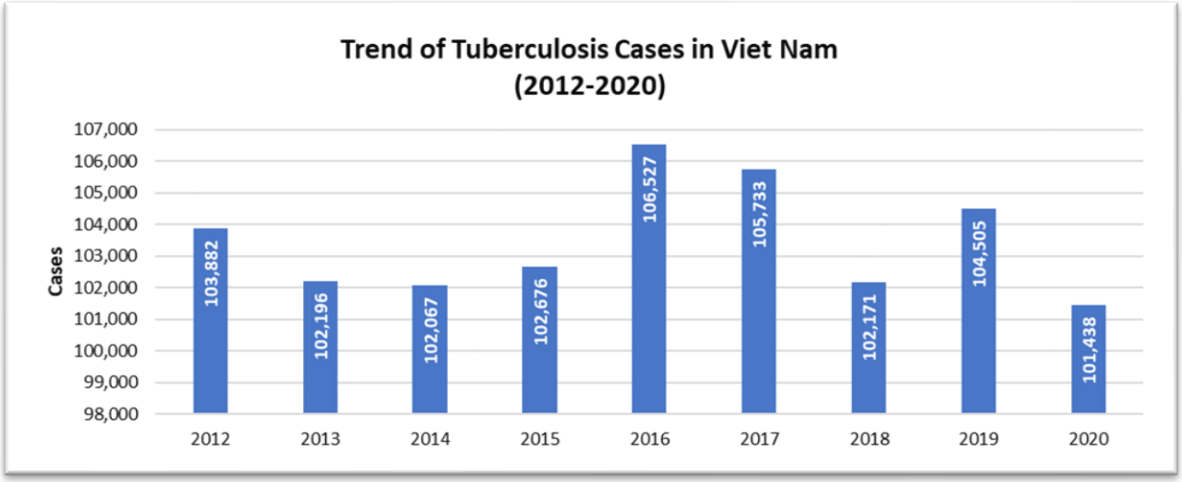


Figure 16. Trend of tuberculosis cases and deaths in Viet Nam, 2012-2020
(Source: Ministry of Public Health Health Viet Nam (https://moh.gov.vn))

5 Case Management and Prevention

Case Management

Current guidelines for treating drug-resistant tuberculosis (DR-TB) emphasize the importance of reliable, quality-assured drug susceptibility testing (DST) provided by national TB programs (NTPs) and associated laboratories (WHO, 2022a). This testing is crucial for guiding the use of WHO-recommended treatment regimens. Rapid molecular testing is enhancing the ability of NTPs to quickly identify multidrug-resistant (MDR) and rifampicin-resistant TB (RR-TB), allowing for informed treatment decisions. Therefore, access to rapid molecular testing is essential, particularly for rifampicin, isoniazid, and fluoroquinolones, as it helps select the most appropriate initial DR-TB regimen.

Mandatory DST for rifampicin applies to all cases, while DST for fluoroquinolones is required when rifampicin resistance is present (WHO, 2022). As new regimens are recommended, DST for these drugs becomes increasingly critical. Local DRS data can provide baseline resistance prevalence estimates and track trends that inform DST algorithms and local policy decisions.Drug-resistance surveillance (DRS) can be conducted through routine diagnostic DST or special surveys representing the entire TB patient population.

There are two main types of preventive treatment (TPT) for TB caused by drug-susceptible strains of *M. tuberculosis (WHO, 2024e).* The first, and most common, is isoniazid taken alone for at least 6 months (IPT). The second involves the use of rifampicin or rifapentine. While IPT has been used more in the past, rifamycin-based treatments are becoming more popular because they don't need to be taken for as long. For multidrug-resistant (MDR) or rifampicin-resistant (RR) TB, a different approach is needed, often using levofloxacin.

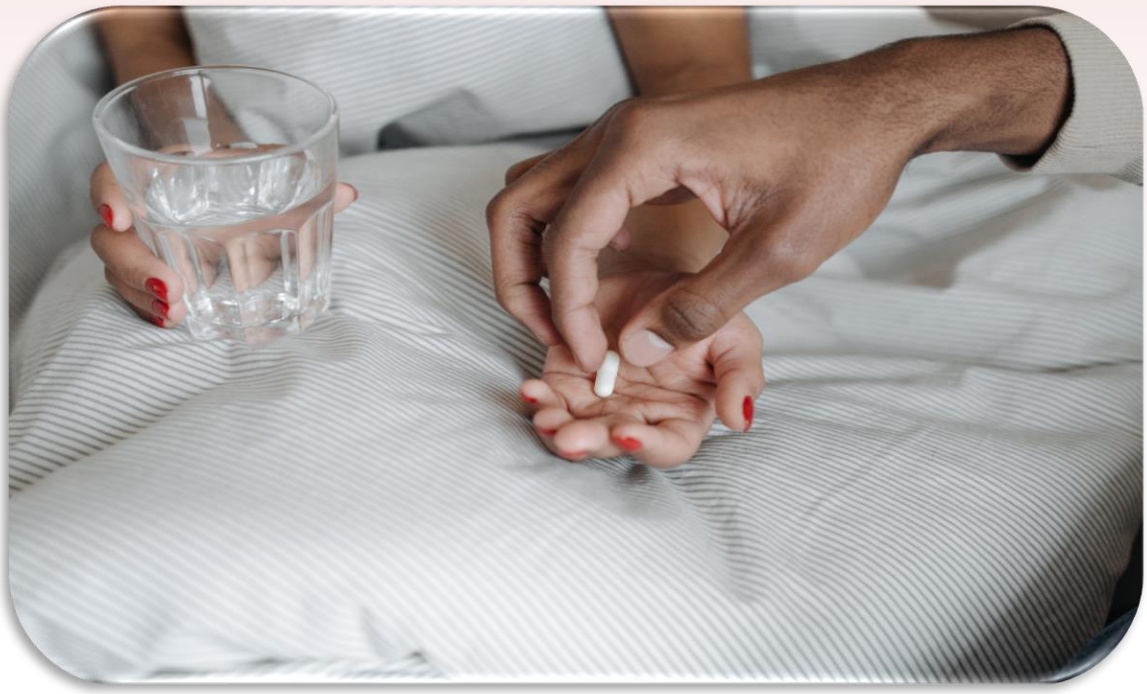
The WHO consolidated guidelines on tuberculosis preventive treatment (TPT) provide 21 recommendations for programmatic management of TPT (PMTPT) and the cascade of preventive care (WHO, 2024e). These cover identifying at-risk groups (e.g., people with HIV, household contacts), screening for active TB, testing for TB infection, providing treatment and support, managing adverse drug reactions, monitoring adverse events, and ensuring adherence, as detailed below:

Table 6. Recommendations for Programmatic Management of TPT (PMTPT) and Cascade of Tuberculosis Preventive Care

Recommendations for Programmatic Management of TPT (PMTPT) and the Cascade of Tuberculosis Preventive Care	
Identifying populations for Tuberculosis Preventive Treatment (TPT)	
People with HIV	
1.	*Adults and adolescents with HIV*: Those who are unlikely to have active TB should receive TPT as part of their HIV care.

2.	*Infants (under 12 months) with HIV*: If they have been in contact with someone with TB, and a clinical evaluation suggests they don't have TB, they should receive TPT.
3.	*Children (12 months and older) with HIV*: If they are unlikely to have TB based on clinical evaluation, they should be offered TPT, especially if they live in areas with high TB transmission, regardless of whether they've been in contact with someone with TB. This should be part of their overall HIV care.
4.	*Children with HIV who have completed TB treatment*: All children living with HIV who have been successfully treated for TB may receive TPT.
Household contacts of people with TB (regardless of HIV status)	
5.	*Children under 5 years* exposed to bacteriologically confirmed pulmonary TB should receive TPT if TB disease is ruled out, even without TB infection testing.
6.	*Individuals aged 5 years and older,* including adolescents and adults, who are household contacts of confirmed pulmonary TB cases may receive TPT if they do not have TB disease
Other people at risk	
7.	*Individuals undergoing anti-tumor necrosis factor therapy, on dialysis, preparing for an organ or hematological transplant, or diagnosed with silicosis* should receive systematic TB infection testing and treatment.
8.	*Prisoners, healthcare workers, migrants from high TB-burden countries, homeless individuals, and people who use drugs* may also be considered for systematic TB infection testing and treatment.
TB screening and ruling out TB disease	
9.	*Infants and children living with HIV should be assessed for TB* if they have poor weight gain, fever, cough, or recent contact with a TB patient.
10.	*Adults and adolescents with HIV should be screened using a clinical algorithm*; those without cough, fever, weight loss, or night sweats are unlikely to have TB.
11.	*Chest X-rays can assist in TB screening* for adults and adolescents with HIV.
12.	*C-reactive protein (CRP) > 5 mg/L may serve as an additional screening tool* for TB in adults and adolescents living with HIV.
13.	*Adults and adolescents living with HIV:* WHO-recommended molecular rapid diagnostic tests may be used for TB screening.
14.	*HIV-negative household contacts (≥ 5 years) and other risk groups:* TB can be ruled out if no symptoms or abnormal chest X-ray findings are present.
15.	*Individuals (≥ 15 years) in high-risk populations:* Systematic screening may include symptom checks, chest X-ray, or molecular tests.
16.	*Children (< 15 years) in contact with TB cases:* Screening should involve symptoms (cough, fever, poor weight gain), chest radiography, or both.
Testing for TB infection	
17.	*A tuberculin skin test (TST) or interferon-γ release assay (IGRA) can be used* to test for TB infection.
18.	*Mycobacterium tuberculosis antigen-based skin tests (TBST)* may be used to test for TB infection
TB preventive treatment options ***Isoniazid or rifamycins***	
19.	*Recommended regimens (regardless of HIV status):* a. 6 or 9 months of daily isoniazid, or b. 3-month weekly rifapentine + isoniazid, or c. 3-month daily isoniazid + rifampicin.
20.	*Alternative regimens (regardless of HIV status):* a. 1-month daily rifapentine + isoniazid, or

	b. 4-month daily rifampicin.
Levofloxacin	
21.	*For individuals exposed to multidrug- or rifampicin-resistant tuberculosis* a. 6 months of daily levofloxacin



Treatment outcomes

All bacteriologically confirmed and clinically diagnosed TB cases should be assigned an outcome from this list except those with RR-TB or MDR-TB, who are placed on a second-line drug regimen (WHO, 2022):

Table 7. Treatment outcomes for TB patients (excluding patiens treated for RR-TB or MDR-TB)

Case Definition	Description
Cured	A pulmonary TB patient with bacteriologically confirmed TB at the beginning of treatment who was smear- or culture-negative in the last month of treatment and on at least one previous occasion.
Treatment completed	A TB patient who completed treatment without evidence of failure BUT with no record to show that sputum smear or culture results in the last month of treatment and on at least one previous occasion were negative, either because tests were not done or because results are unavailable.

Treatment failed	A TB patient whose sputum smear or culture is positive at month 5 or later during treatment.
Died	A TB patient who dies for any reason before starting or during the course of treatment.
Lost to follow-up	A TB patient who did not start treatment or whose treatment was interrupted for 2 consecutive months or more
Not evaluated	A TB patient for whom no treatment outcome is assigned. This includes cases "transferred out" to another treatment unit as well as cases for whom the treatment outcome is unknown to the reporting unit
Treatment success	The sum of cured and treatment completed.

Table 8. Outcomes for RR-TB/MDR-TB/XDR-TB patients treated using second-line-treatment

Case Definition	Description
Cured	Treatment completed as recommended by the national policy without evidence of failure AND three or more consecutive cultures taken at least 30 days apart are negative after the intensive phase.
Treatment completed	Treatment completed as recommended by the national policy without evidence of failure BUT no record that three or more consecutive cultures taken at least 30 days apart are negative after the intensive phase.
Treatment failed	Treatment terminated or need for permanent regimen change of at least two anti-TB drugs because of: a. lack of conversion by the end of the intensive phase, or b. bacteriological reversion in the continuation phase after conversion to negative, or c. evidence of additional acquired resistance to fluoroquinolones or second-line injectable drugs, or adverse drug reactions (ADRs).
Died	A patient who dies for any reason during the course of treatment.
Lost to follow-up	A patient whose treatment was interrupted for 2 consecutive months or more.
Not evaluated	A patient for whom no treatment outcome is assigned. (This includes cases "transferred out" to another treatment unit and whose treatment outcome is unknown)
Treatment success	The sum of cured and treatment completed

Prevention

To lower the risk of tuberculosis infection and transmission, the WHO (WHO, 2024f) recommends several measures:

1. **Seek Medical Attention:** If experiencing symptoms such as a persistent cough, fever, or unexpected weight loss, it is crucial to consult a healthcare provider. Early intervention for TB can help prevent the disease from spreading and enhance recovery prospects.
2. **Get Tested:** Individuals with an elevated risk of TB, such as those with HIV or those living or working with TB patients, should undergo testing for the disease.
3. **Take TB Preventive Treatment (TPT):** TPT can help prevent the progression from infection to active disease. If prescribed TPT, ensure to complete the full course.
4. **Practice Good Hygiene:** If diagnosed with TB, maintain proper hygiene while coughing. This includes minimizing contact with others, wearing a mask, covering mouth and nose when sneezing or coughing, and disposing of sputum and tissues appropriately.
5. **Implement Special Measures:** In healthcare settings and other institutions, measures such as using respirators and ensuring proper ventilation are essential to minimize the risk of infection.

6 Control Measures Strategy

Preventing TB infection and halting the progression from infection to disease are essential for achieving the targets set by the End TB Strategy. The primary healthcare measure for preventing this progression is tuberculosis preventive treatment (TPT), which the World Health Organization (WHO) recommends for people living with HIV, those in close contact with TB patients, and other at-risk groups. Implementing TPT is often associated with screening initiatives aimed at identifying and treating individuals with TB earlier in their illness, which can aid in reducing transmission and improving health outcomes. Additional preventive strategies include TB infection prevention and control measures and vaccinating children with the Bacille Calmette-Guérin (BCG) vaccine.

SDG Target 3.3 "By 2030, end the epidemics of AIDS, TB, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases"

The Sixty-seventh World Health Assembly in 2014 endorsed a strategy related to TB situations named "The End TB Strategy" that was developed by WHO with a vision of a world free of TB, with zero deaths, disease and suffering due to the disease. The strategy contains ten components arranged in three pillars and executed by four principles (WHO, 2022b).

Table 9. The end TB Strategy pillars and principles

Pillar 1	Pillar 2	Pillar 3
INTEGRATED, PATIENT-CENTRED CARE AND PREVENTION	**BOLD POLICIES AND SUPPORTIVE SYSTEMS**	**INTENSIFIED RESEARCH AND INNOVATION**
Early diagnosis of TB including universal drug- susceptibility testing, and systematic screening of contacts and high-risk groups	Political commitment with adequate resources for TB care and prevention	Discovery, development and rapid uptake of new tools, interventions and strategies
Treatment of all people with TB including drug- resistant TB, and patient support	Engagement of communities, civil society organizations, and public and private care providers	Research to optimize implementation and impact, and promote innovations
Collaborative TB/ HIV activities, and management of co-morbidities and TB- associated impairment and disability	Universal health coverage policy and regulatory frameworks for case notification, vital registration, quality and rational use of medicines, and infection control	

Preventive treatment of persons at high risk, and vaccination against TB	Social protection, poverty alleviation add 'other social determinants of TB'	
Principles		
Government stewardship and accountability, with monitoring and evaluation		
Strong coalition with civil society organizations and communities		
Protection and promotion of human rights, ethics and equity		
Adaptation of the strategy and targets at country level, with global collaboration		

ASEAN Strategy to End Tuberculosis by 2035

ASEAN member states (AMS) have committed to ending tuberculosis (TB), aligning with the UN High-Level Meeting (UNHLM) goals (ASEAN, 2024). On World TB Day 2024, themed "Yes! We can End TB," ASEAN emphasizes the collective commitment required to eradicate tuberculosis.

The key commitments include:

1. **Diagnosis and Treatment:** Ensuring 90% of those who develop TB receive quality-assured diagnosis and treatment by 2027.
2. **Preventive Treatment:** Ensuring 90% of those at risk receive preventive treatment by 2027.
3. **Funding:** Increasing global funding for TB to US$22 billion by 2027.
4. **People-centered approach:** Improving access to health services using a people-centered approach.

AMS will implement priority actions to achieve these targets by establishing multisectoral platforms, improving access to TB services, and addressing social determinants of TB. They will also focus on the three pillars of the End TB Strategy: integrated, patient-centered care and prevention; bold policies and supportive systems; and intensified research and innovation. This includes leveraging digital technologies, such as digital X-rays and computer-aided diagnosis, and preparing for the introduction and scale-up of new TB vaccines. The overall goal is to end TB in ASEAN by 2035.

Control Measures in ASEAN Member States

Brunei Darussalam

Brunei aims to eradicate tuberculosis by 2050 and has implemented the National TB Control Program since 2000. The National Tuberculosis Coordinating Centre (NTCC) oversees prevention, diagnosis, and treatment efforts. All suspected TB cases must be reported to the Ministry of Health under the Infectious Diseases Act. Patients, including those from private healthcare, are referred to the NTCC or directly supervised short-term treatment (DOTS) centres for treatment and follow-up. All identified and suspected active PTB cases are also subject to active contact tracing, done using the "stone in the pond" method, which begins with high-risk contacts and grows based on risk assessment (Chaw, 2022).

Cambodia

The National Centre for Tuberculosis and Leprosy Control (CENAT) and its partners in Cambodia implement the National Strategic Plan (NSP) to End TB 2021-2030, aiming for a TB-free nation by 2035 (CENAT, 2021). They build on progress from the 2014-2020 NSP while intensifying efforts to combat TB. The NSP provides a framework for stakeholders to execute bold elimination strategies.

Guided by the "FIND–TREAT–PREVENT–BUILD, STRENGTHEN, AND SUSTAIN" (FTPB) approach, the NSP emphasizes early diagnosis and effective treatment, supported by prevention strategies such as managing Latent TB Infection (LTBI) in high-risk groups. It also stresses the need for adequate financing, robust programmatic surveillance, monitoring, evaluation, and research to create an enabling environment for these efforts. The major actions planned are:

1. TB case notification to be made mandatory
2. To secure and sustain enhanced funding to End TB in Cambodia
3. Interventions aligned with the broader Universal Health Coverage (UHC) movement,
4. A high-level mechanism for coordinated national multisectoral approaches to End TB to be setup
5. Provide universal access to quality chest X-ray and rapid tests for LTBI and TB case detection
6. Engage private care providers and strengthen involvement of hospitals
7. Ensure social protection for people with TB and their families
8. Address special need of migrants, both cross country and internal migrants and cross-border issues which is projected to increase

Indonesia

The Ministry of Health of the Republic of Indonesia has created a roadmap for eliminating tuberculosis in Indonesia from 2020 to 2030 (Ministry of Health Republic of Indonesia, 2023). This document outlines a goal to reduce the incidence of tuberculosis to 65 cases per 10,000 individuals by the year 2030. To support this objective, Indonesia has established six strategies for tuberculosis prevention from 2020 to 2024 aimed at achieving TB elimination by 2030, which include:

1. Strengthening commitment and leadership of central, provincial, and district government to support the acceleration towards tuberculosis elimination in 2030;
2. Increasing access to high-quality and patient-centered tuberculosis diagnosis and treatment services;
3. Optimization of promotion and prevention efforts, provision of tuberculosis preventive therapy, and infection control;
4. Utilization of research findings and technologies for screening, diagnosis, and management of Tuberculosis'
5. Increasing communities, partners, and multisectoral participation in TB elimination efforts; and
6. Strengthening program management through health system strengthening In 2022.

Lao People's Democratic Republic

Lao PDR aims to eliminate tuberculosis (TB) within the country, aspiring for a generation free from infection and illness—resulting in zero deaths, diseases, and suffering caused by TB (Ministry of Health Lao PDR, 2020). The objectives of the National TB strategic plan (NSP) 20121-2025 are organised under the 3 pillars of the global End TB strategy, including: identifying overlooked TB cases to achieve the ENDTB targets by 2025, which consist of a 75% reduction in mortality and a 50% decrease in incidence compared to 2015 figures, as well as ensuring that TB patients and their families incur no catastrophic costs. The outcome indicators set for 2025 are:

1. ≥ 90% TB treatment coverage of estimated TB incidence (from 57% in 2018);
2. 100% Upfront testing of rifampicin resistance (by Xpert test) for presumptive TB patients at the
3. time of diagnosis;
4. 100% Enrolment of drug sensitive and drug resistant TB patients on optimal TB treatment

Malaysia

Malaysia aims to eliminate tuberculosis by 2035 (Ministry of Health Malaysia, 2021). The objective of TB control in the country is to reduce the incidence of tuberculosis by providing universal access to timely and quality diagnosis and treatment for all TB forms, while also preventing the emergence of drug-resistant strains. By 2030, Malaysia seeks to achieve a 50% reduction in TB mortality and reduce the notification rate to 30 cases per 100,000 people. To meet these goals, Malaysia is implementing six key strategies:

1. Strategy 1. Enhance Case Detection of TB & Co-Morbidity Management
2. Strategy 2. Enhance Programmatic Management of Drug Resistant TB
3. Strategy 3. Enhance Programmatic Management of Latent TB Infection
4. Strategy 4. Enhance Control of TB among Children
5. Strategy 5. Enhance Supportive Environment and Systems for Effective TB Control
6. Strategy 6. Research & Innovation

Myanmar

In line with the End TB Strategy framework, Myanmar National Strategic Plan (NSP) tackles outstanding issues while outlining new objectives (Ministry of Health and Sports Myanmar, 2020). The overarching vision of this NSP is to eradicate TB in Myanmar by 2050. The aim is to lower the incidence of TB to fewer than 10 cases per 100,000 individuals by 2035. For the current NSP, the target is to achieve a 50% reduction in TB incidence by 2025, relative to the baseline established in 2015. The objectives of the NSP are:

1. to expand TB services as part of UHC and strengthen partnerships
2. to minimize TB transmission by intensifying preventive efforts and reaching high-risk populations
3. to achieve a faster decline in TB burden through an accelerated multisectoral TB response

Philippines

Under the Philippine Acceleration Action Plan for TB (PAAP TB) 2023-2035, the Department of Health of the Philippines aims to achieve TB elimination by integrating the commitments into mandates, policies, and work programs. The Action Plan has engaged broader stakeholders to expand the multi-sectoral approach and builds on the Philippine Strategic Elimination Plan (PhilSTEP), developed in 2018. By integrating multisectoral commitments,

PAAP TB consist several strategies objectives based on sectors (The Philippines Department of Health, 2024):

1. The Labor Protection Sector will guarantee employees continuous access to essential primary care services protecting workers' right to good health and healthy workplace.
2. The Education, Public Information and Community Engagement sector will provide a gateway for comprehensive access to primary care in the learning institutions and lead the promotion of healthy habits among children, adolescents, young adults and the education workforce.
3. The Social Protection sector will ensure vulnerable populations access to comprehensive, coordinated and essential healthcare services and social protection packages, including those to combat TB.
4. The Support for Service Delivery sector will enable province- and city-wide health systems with contracted primary care networks to deliver comprehensive primary care across settings and accelerate TB elimination campaigns.

Singapore

The National Tuberculosis Programme (NTBP), which was formerly referred to as the Singapore TB Elimination Programme (STEP), was initiated by the Ministry of Health (MOH) in 1997 (NCID, 2025). This initiative aimed to enhance the country's efforts in preventing and managing TB, addressing a long-standing stagnation in the incidence of the disease over the previous decade. The missions of the programme are to protect the people from TB through prompt diagnosis and management, effective contact tracing and screening, strong partnerships, and sustainable strategies.

The NTBP Registry supervises the national tuberculosis notification registry and tracks the treatment progress and outcomes of all TB cases across the country. The National Tuberculosis Care Centre (NTBCC), the clinical division of the NTBP, acts as the national referral center for evaluating and treating TB, is responsible for managing 80% of the nation's TB cases, the majority of which are treated through Directly Observed Therapy (DOT).

Thailand

Through the Operational Plan to End Tuberculosis, Phase 2 (2023 – 2027), Thailand aims to reduce the problem of TB epidemic in Thailand, targeting to reduce the incidence from 143/100,000 population in 2021 to 89/1000,000 population in 2027 (Ministry of Public Health Thailand, 2023). To ensure that the Operational Plan is fully consistent with the Global End

TB Plan, as recommended by WHO, the Plan consists of five strategies and their associated strategic objectives and interventions as follows.

1. Strategy 1. Intensify TB case finding and the diagnosis of TB and drug-resistant TB
2. Strategy 2. Enhance the care and treatment of TB patients and drug-resistant TB patients according to international standards.
3. Strategy 3. Enhance the effectiveness and accessibility of diagnosis and treatment of latent TB infection and TB infection control
4. Strategy 4. Strengthen the support system for implementing the TB program
5. Strategy 5. Promote research and innovation in TB prevention and control

Viet Nam

Vietnam faces a significant TB burden, classified by the WHO as a high-burden country for both TB and MDR/RR-TB (Ministry of Health Viet Nam, 2022). In 2022, the estimated TB incidence was 172,000 cases, with a notification rate of only 60%, highlighting a substantial gap in diagnosis and reporting. MDR/RR-TB also poses a challenge, with a large disparity between estimated and notified cases. Despite these challenges, Vietnam demonstrates a strong commitment to combating TB through its National Strategic Plan (NSP) 2021-2025, aiming to end TB by 2030. Aligned with the National Action Plan to End TB by 2030, the NSP builds upon previous successes and focuses on finding and treating all TB cases to reduce transmission and finding and treating individuals infected with TB to prevent disease progression. The key pillars are in accordance with the 3 pillars of the global End TB strategy:

1. **Person-Centered Care:** Improving access for those not in the health system through awareness campaigns, barrier removal, and outreach.
2. **Bold Policies, Expanded Partnerships, and Strengthening Systems:** Utilizing health insurance and social protection to reduce catastrophic costs for patients.
3. **Innovations and Research:** Emphasizing the importance of ongoing research and innovative approaches for improved TB control.

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