KEMENTERIAN KESIHATAN MALAYSIA

NATIONAL STRATEGIC PLAN TO END TB (2021-2030)

DISEASE CONTROL DIVISION

MINISTRY OF HEALTH MALAYSIA

Published by

Disease Control Division (TB/ Leprosy Sector)
Ministry of Health Malaysia
Level 4, Block E10, Precint 1
Federal Government Administrative Centre
62590 Putrajaya, Malaysia.

National Strategic Plan to End TB (2021-2030)

e ISBN 978-967-25827-4-8

Available on the http://www.moh.gov.my websites

STATEMENT OF INTENT

This National Strategic Plan are meant to be guides for clinical and public health practice, based on the best available evidence at the time of development. Adherence to this plan may not necessarily guarantee the best outcome in every strategies. Every healthcare provider may use his/her own judgment of unique epidemiology and healthcare setting based on the clinical picture presented by the patient and the management options available locally.

REVIEW AND UPDATE

These NSP were issued in 2021 and will be reviewed in 2025 or sooner if new evidence becomes available. Every care is taken to ensure that this publication is correct in every detail at the time of publication. However, in the event of errors or omissions, corrections will be published in the web version of this document, which is the definitive version at all times. This version can be found on the websites mentioned above.

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NATIONAL STRATEGIC PLAN (NSP) DEVELOPMENT

The members of the Development Group (DG) for this NSP were from the various Division of Ministry of Health (MOH), State TB Officers, National Public Health Laboratory Officers and representative from Prison Department.
Members of DG were divided into six (6) groups and each group were assigned specific topic in this NSP. The NSP was adapted from World Health Organization (WHO) Guidelines, namely:

- Regional framework to End TB Western Pacific, 2021-2030
- Implementing the End TB Strategy: The Essentials
- Global Tuberculosis Report 2021
- Toolkit to a develop a national strategic plan for TB prevention, care and control

All strategies and recommendations were adapted, modified and formulated with local practices taken into considerations. The NSP was presented and agreed by the technical committee of Mesyuarat Exco dan Dasar Kesihatan Awam Bilangan 2/2023 on 6th July, 2023 and Mesyuarat Khas Ketua Pengarah Kesihatan Bilangan 5/2023 on 24th October 2023.

OBJECTIVES

To provide national referral guideline for action on implementation of effective strategies for prevention and control of TB and Drug Resistant TB in the countries.

TARGET GROUP/USER

This document is intended to guide healthcare providers and relevant stakeholders, local agencies and non-government organizations (NGOs) in the management, control and prevention of TB and Drug Resistant TB including:

- State TB Officers
- Doctors
- Pharmacists
- Allied health professionals
- Patients and their advocates

ACKNOWLEDGEMENT

The auditorial team would like to express our gratitude to various departments, civil societies and all individuals who have contributed directly or indirectly to the development of this plan. Support and guidance from all are very helpful in the development of this NSP.

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FOREWARD

TB remains the world's leading infectious killer and public health problem in Malaysia. The COVID-19 pandemic has affected TB services in Malaysia, in which TB notification rates reduced 10% and TB death increased by 5% in 2020. Globally WHO estimated 9.9 million fell ill with TB and only 5.8 million reported to have access to TB care and 1.5 million people died from TB in 2020. Late treatment seeking behaviour, delayed TB diagnosis and treatment has resulted in an increase in TB deaths.

Global targets for reductions in the burden of tuberculosis disease have been set as part of the Sustainable Development Goals (SDGs) 2030 and the End TB Strategy 2035 with target 90% reduction of TB incidence rate and 95% reduction in TB mortality rate as the indicators for measurement of progress by 2035. To realize this vision, we need to further scale up rapid and early diagnosis, expand people-centred care, introduce shorter and more effective treatment regimens, improve treatment outcomes, expand preventive therapy and research for new tools to prevent TB more efficiently. We need all stakeholders to live up to the challenge, show good will and engage in strong partnerships.

My sincere appreciation to all the Technical and Development Committee for the endless effort in drafting the NSP. I hope that all the strategic intervention activities in this NSP will be integrated in the management TB in Malaysia. TB should and must be given high priority as public health agenda, at par with the attention that we are giving to COVID-19 and other infectious diseases.

DIRECTOR GENERAL OF HEALTH
MINISTRY OF HEALTH, MALAYSIA

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ABBREVIATIONS

ADRs	Adverse Drug Reactions	MAPTB	Association for The Prevention of Tuberculosis
AEHO	Assistant Environment Health Officer	MDG	Millennium Development Goal
AFB	Acid Fast Bacilli	MDRTB	Multi Drug Resistant TB
AIDS	Acquired Immune Deficiency Syndrome	MO	Medical Officer
		MoH	Ministry of Health
ART	Antiretroviral Therapy	MR	Mortality Rate
ASEAN	The Association of Southeast Asian Nations	MTB-RIF	Mycobacterium Tuberculosis - Resistant to Rifampicin
BCG	Bacillus Calmette-Guerin	NCD	Non-Communicable Disease
CCRC	Cure & Care Rehabilitation Centre	NGO	Non-Government Organization
		NPHL	National Public Health Laboratory
CDC	Communicable Disease	NR	Notification Rate
CPT	Co-trimoxazole Prophylaxis Therapy	NSP	National Strategic Plan
		PH	Public health
DNA	Deoxyribonucleic acid	PLHIV	People Living with HIV
DOT	Directly Observe Treatment	PMDT	Programmatic Management of Drug Resistant TB
DR-TB	Drug Resistant TB		
DST	Drugs Sensitivity Test	PPM	Public Private Mix
EGT	Elaun Gantian Tambang	SDG	Sustainable Development Goal
EQAP	External Quality Assessment Program	SOP	Standard Operating Procedure
		TAS	Treatment Allowance Scheme
EQA-PT	External Quality Assessment-Proficiency Testing	TB	Tuberculosis
		TBCP	Tuberculosis Control Program
FMS	Family Medicine Specialist	TNF	Tumour Necrosis Factor
HCW	Health Care worker	TOT	Training of Trainers
HiAP	Health in All Policies	TST	Tuberculin Skin Test
HIV	Human Immunodeficiency Virus	UHC	Universal Healthcare Coverage
		UHP	Universal Health Precaution
IHSR	Institute for Health System Research	UN	United Nation
		WHO	World Health Organization
IPT	Isoniazid Prophylaxis therapy	WRD	WHO- Recommended Rapid Diagnostic
LED	Light Emitted Diode		
LPA	Line Probe Assay	XDR-TB	Extensive Drug Resistant TB
LTBI	Latent TB Infection		

EXECUTIVE SUMMARY

Tuberculosis (TB) is an infectious disease that is endemic in the country and remains a major public health problem. In 2020, WHO estimated around 10 million new TB cases worldwide with 1.4 million of TB deaths. Malaysia is classified as a country with upper moderate burden of tuberculosis with notification rate of TB between 50 to 99 per 100,000 populations. The End TB Strategy (refer Appendix 1) has set three high-level indicators to be achieved by the year 2035 that are; reduction 90% of the TB incidence rate; reduction 95% of the absolute number of TB deaths and 0% of TB patients and households that experience catastrophic cost as a result of TB disease. In order to achieve Sustainable Development Goal (SDG) and End TB Strategy targets by year 2030, the National Strategic Plan to End TB (2021-2030) was developed as the national guiding principles in management, control and prevention of TB in Malaysia. The baseline data of year 2015 and target indicators to achieved by year 2030 are as follows;

Indicator	Baseline 2015	Achievement 2020	Target 2025	Target 2030
Number of TB deaths compared with 2015 (TB Mortality Rate per 100,000 population)	1696 (5.5)	2320 (*increment 36%)* (7.1)	<1272 (*reduction 25%)* (3.5)	<848 (*reduction 50%)* (2.2)
TB notification rate per 100,000 population (Total TB Cases)	79 (24,220 cases)	72 (23,644 cases)	<50 (18,000)	<30 (11,500)
Treatment Success Rate (%)	80.9	79.1	90	90

Six (6) strategies focused in this plan include;

- Enhance Case Detection of TB & Co-Morbidity Management
- Strengthen Programmatic Management of Drug Resistant TB
- Strengthen Programmatic Management of TB Preventive Treatment
- Enhance Control of TB among Children
- Enhance Supportive Environment and Systems for Effective TB Control
- Research & Innovation.

Specific activities for each of the strategies were identified. These strategies need to be adapted according to the unique situation of states in Malaysia. States Health Departments are recommended to develop or update their respective state operational plan for betterment and sustainable implementation of TB control program.

1. INTRODUCTION

Tuberculosis is a curable disease and exist since thousands of years ago, yet it remains the top infectious disease killer in Malaysia. Malaysia has started National Tuberculosis Control Programme (NTBCP) since 1961 as a vertical programme and during that time *Pusat Tibi Negara* is the main referral centre for Tuberculosis. In 1995, the service was integrated into the Public Health System which the main control activities are being expanded into the peripheral health clinics and district hospitals. All TB cases diagnosed and treated in private or public healthcare facilities are mandatory to be notified to the nearby District Health Office (DHO).

Although Malaysia had not achieved the target of halting and reversing the incidence of TB in Millennium Development Goal (MDG 2015), significant effort to improve management and prevention of TB were achieved. The current target as stated in the End TB Strategy 2035 and SDG 2030 are to reduce 90% of the TB incidence rate and reduce 95% of the absolute number of TB deaths by year 2035 from data of 2015 as a baseline. This National Strategic Plan (NSP) to End TB (2021-2030) is aims to align the national TB response with the latest international evidence, strategic policies and programmatic guidance for TB control management. The NSP shall be the national guiding principles in control of TB towards the goal of ending the TB epidemic by 2035.

The Division of Diseases Control, Ministry of Health, Malaysia took the lead in the NSP development, with important technical inputs provided by the key national stakeholders and in close cooperation with other ministries and government agencies, as well as with the non-government organizations (NGOs) that providing support to TB control in the country. This NSP consist of an overview of TB epidemiological situation, strategies and main activities to achieve the target Indicators.

2. TUBERCULOSIS BURDEN IN MALAYSIA

2.1 BACKGROUND

Malaysia is classified as upper moderate TB burden country (Incidence rate of TB: 50-99 per 100,000 population). Malaysia has developed National Strategic Plan (NSP) for TB Control (2016-2020) that was in line with WHO milestones and target to end epidemic of TB by year 2035. The NSP for TB Control (2016-2020) was the national guiding principles in control of TB. Although the target to increase TB incidence and reduce TB mortality by year 2020 was not achieved, significant improvement in TB management and prevention control activities were observed. This section will focus in achievements of TB program for the past five years.

2.2 CASE DETECTION OF TB, DR-TB AND LTBI

TB cases increased from 24,220 cases in 2015 (NR 79.4 per 100,000 populations) to 26,352 cases in 2019. However due to pandemic covid-19, the number of TB cases reduced 10% to 23,644 cases in 2020 (refer figure 1).

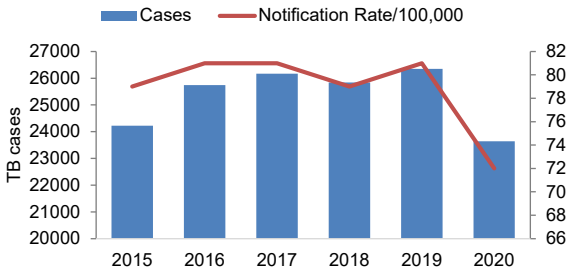
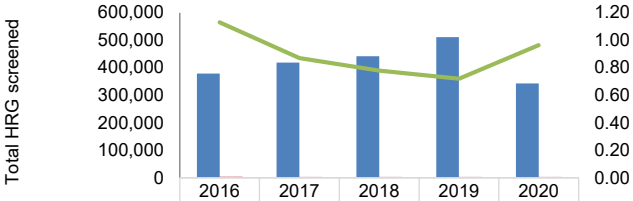


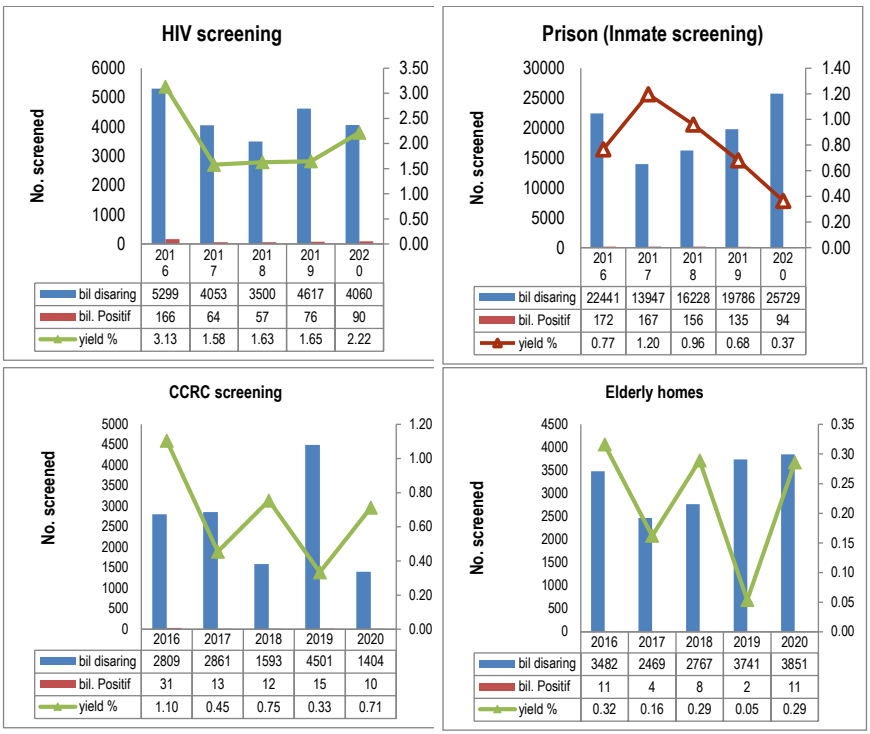
Figure 1. TB cases and TB Notification rate (NR) for Malaysia (2015-2020)

The strategy to increase case finding include enhance high risk group screening, symptomatic screening at out-patient clinic and out-reach screening at the high prevalence TB area. Guideline for high risk group screening and surveillance was implemented since January 2016. Total of 2,093,760 high risk group were screened (2016 to 2020) and total of 18,339 TB cases diagnosed and treated (refer figure 2). Achievement of selected group for GRH screening refer figure 3.



	2016	2017	2018	2019	2020
Total screened	378,853	418,897	441696	511509	342805
Positive TB	4,275	3,631	3424	3705	3304
Yield	1.13	0.87	0.78	0.72	0.96

Figure 2. HRG screening, Malaysia (2016-2020)



HIV screening	2016	2017	2018	2019	2020
bil disaring	5299	4053	3500	4617	4060
bil. Positif	166	64	57	76	90
yield %	3.13	1.58	1.63	1.65	2.22

Prison (Inmate screening)	2016	2017	2018	2019	2020
bil disaring	22441	13947	16228	19786	25729
bil. Positif	172	167	156	135	94
yield %	0.77	1.20	0.96	0.68	0.37

CCRC screening	2016	2017	2018	2019	2020
bil disaring	2809	2861	1593	4501	1404
bil. Positif	31	13	12	15	10
yield %	1.10	0.45	0.75	0.33	0.71

Elderly homes	2016	2017	2018	2019	2020
bil disaring	3482	2469	2767	3741	3851
bil. Positif	11	4	8	2	11
yield %	0.32	0.16	0.29	0.05	0.29

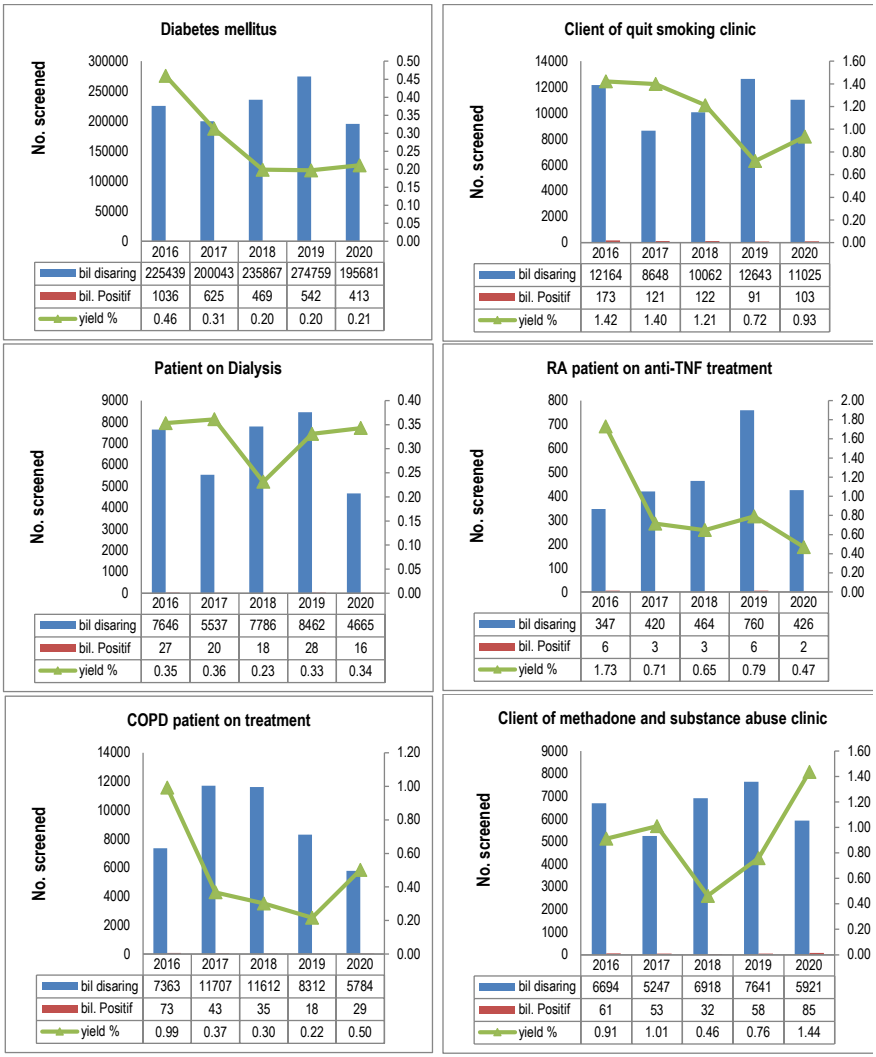


Figure 3. Achievement of selected group in the HRG screening (2016-2020)

Contact tracing is one of the core activities and have been implemented in Malaysia to control TB transmission. The identified contact will be followed up for 2 years with 4 visits to health clinic. Table 1 showed analysis of contact screening from year 2015 to 2020.

Table 1. Achievement of contact TB screening, Malaysia (2015-2020)

Year	TB cases	Contact examine at first visit	% contact screened (Target 80%)	TB detected at first visit	Contact examine at fourth visit	% of contact at fourth visit (Target 50%)	TB detected at fourth visit
2015	24,220	189,337	78.0	432	19579	10.3%	66
2016	25739	188,870	73.4	599	21508	11.4%	75
2017	26,168	188,642	72.1	551	25266	13.4%	77
2018	25,837	179,423	69.4	531	25519	14.2%	67
2019	26,352	177,121	67.2	532	22237	12.6%	68
2020	23,644	136,952	57.9	577	32505	23.7%	64

Case detection rate (CDR)

Case detection rate is determined based on number of new and relapse TB cases detected on the specific year divided by WHO estimation of TB incidence during that specific year. CDR for Malaysia was between 84% to 91% in year 2015 to 2019. However, CDR reduced to 76.2% in year 2020 (refer figure 4).

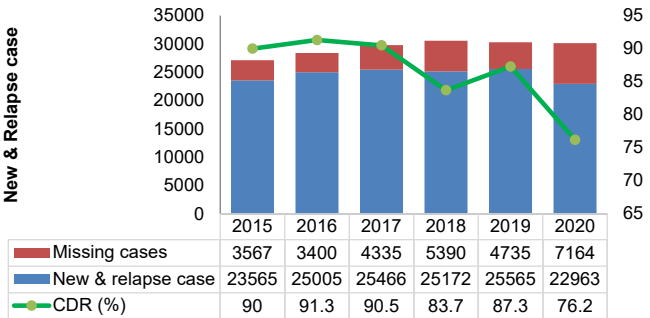


Figure 4. Case Detection Rate for TB, Malaysia (2015-2020)

Detection of Drug Resistant TB

Case finding for DR-TB include identifying individuals who may have high risk of developing DR-TB. Drug susceptibility test (DST) is an important to identify patients with high risk of DR-TB. Coverage of DST among new case was ranging from 63% to 80%, retreatment case 61% to 94% (refer figure 5).

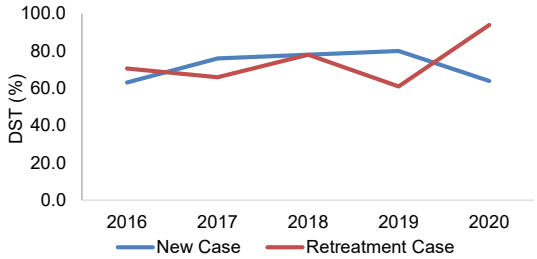


Figure 5. DST coverage (2016-2020)

The detection rate of RR/MDRTB increased from 1.3% (2016 to 2.28% (2017) and become stable at 1.5% to 1.9% from year 2018 to 2020.

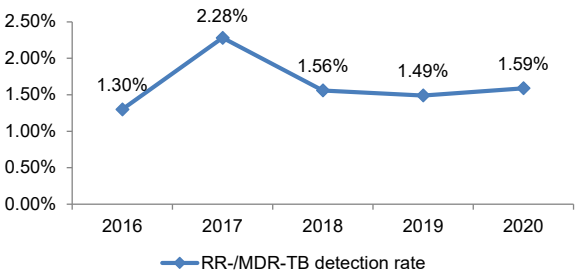


Figure 6. RR/MDRTB detection rate (2016-2020)

Detection of LTBI

Malaysia has implemented Isoniazid Preventive Therapy (IPT) to children less than 5-year-old and contact of PTB smear positive TB and people living with HIV (PLHIV). Table 2 showed coverage of IPT among children <5 years old range from 12.5% to 19%.

Table 2. Coverage of IPT among children <5-year-old (2018-2020)

	2018	2019	2020
No of children < 5-year-old WHO was contact of PTB smear Positive index case	10613	9709	8901
Number given IPT	1268	1851	1670
Percentage (%) (Target 50% by year 2020)	12.5	19.1	18.8

Coverage of IPT among PLHIV was 70% (2015), increased to 79% (2017), then reduced to 16% (2019) and 47% (2020) (refer figure 7).

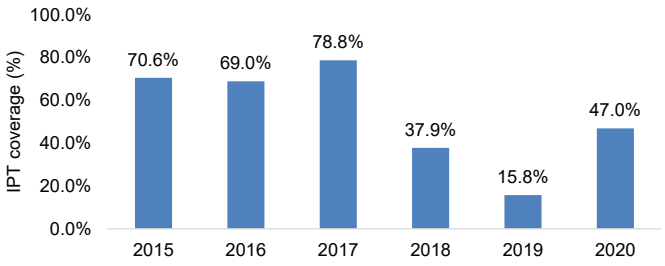


Figure 7. Coverage of IPT among PLHIV

In 2019, a pilot project 'Screening and treatment of LTBI among contact of bacteriologically confirmed positive TB' were done in 6 states in Malaysia namely Sabah, Kelantan, WPKL, Selangor, Johor and Terengganu. Prevalence of LTBI was noted 25.5% and enrolment to TB preventive treatment was 56.1%. The screening and TPT program among bacteriologically confirmed TB were then expand to whole states in Malaysia in subsequent year.

Detection of TB among children

TB cases among pediatric was increased in trend from 741 cases (IR 9.5 per 100,000) in 2015 to 863 cases (NR 11.3 per 100,000 population) in 2019. However, TB pediatric reduce 10% to 771 cases for subsequent year (2020) refer figure 8. 80% of TB pediatric were detected through passive case detection.

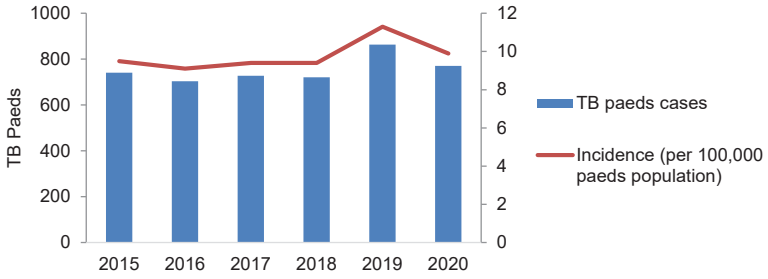


Figure 8. TB Pediatric and Incidence Rate, Malaysia (2015-2020)

TB co-morbid HIV

Since 2015, TB co-morbid HIV was between 6% to 7% (refer figure 9).

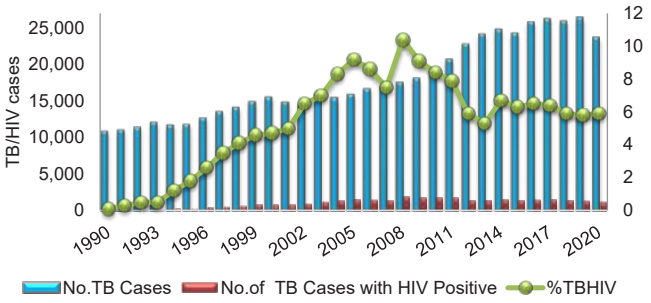


Figure 9. TB-HIV comorbidity, Malaysia (1990-2020)

TB among MOH Healthcare worker

TB among MOH HCW was increase from 284 cases (2015) to 310 cases (2017) and subsequently reduced to 281 cases in 2020.The Notification rate of TB among MOH HCW was noted higher than general population (112.4 vs 72) for year 2020 (refer figure 10.0)

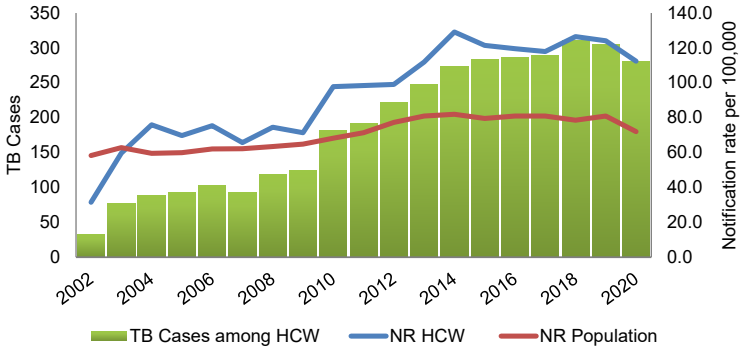


Figure 10. TB and NR among MOH HCW, Malaysia (2002-2020)

TB among Non-Malaysian

TB cases among non-Malaysian range from 12% to 15% from year 2015 until 2020 (refer figure 11). Majority of the cases were among Philippines and Indonesians.

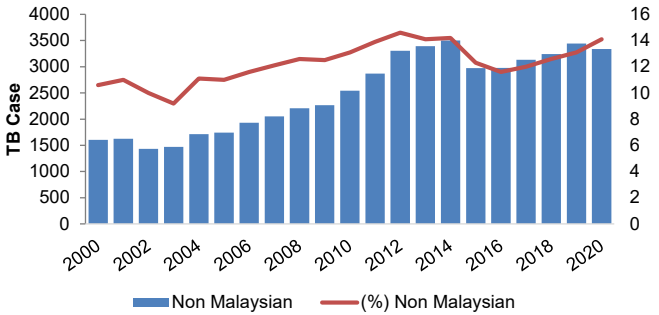


Figure 11. TB cases among Non-Malaysian (2000-2020)

2.3 TB CASE HOLDING AND TREATMENT OUTCOME

DOT achievement

Once the patient diagnosed with TB, counselling and DOT according to patient's preference will be initiated. DOT coverage for 2015 to 2019 was within 88-90%. However, during pandemic COVID-19, DOT coverage was noted reduced to 82.2% (refer figure 12). Majority of the DOT'S supervisors were healthcare workers (58%-67%), followed by family members (32%-40%), community volunteers (0.7%-1%) and NGOs (0.1%) refer figure 13.

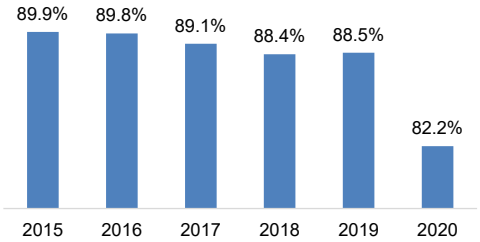
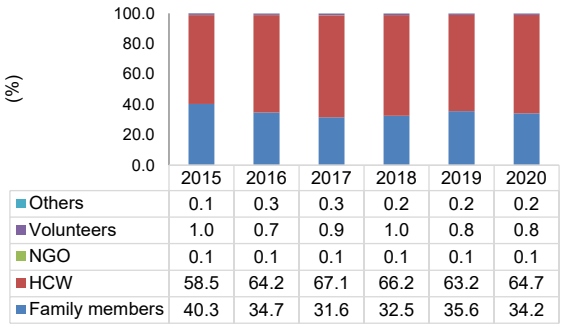


Figure 12. DOT coverage for Malaysia (2015-2020).

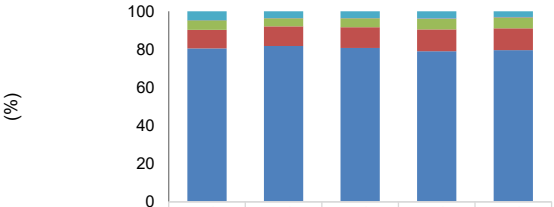


	2015	2016	2017	2018	2019	2020
Others	0.1	0.3	0.3	0.2	0.2	0.2
Volunteers	1.0	0.7	0.9	1.0	0.8	0.8
NGO	0.1	0.1	0.1	0.1	0.1	0.1
HCW	58.5	64.2	67.1	66.2	63.2	64.7
Family members	40.3	34.7	31.6	32.5	35.6	34.2

Figure 13. DOT supervisors, Malaysia (2015-2020)

Treatment outcome for new and relapse cases (cohort 2015-2019)

Treatment outcome for new and relapse TB cohort 2015 to 2019 remain as follows; treatment success rate cases range from 79% to 81%, died increased from 9.7% (2015) to 11.5% (2019), loss to follow up stagnant 4% to 5.7%, failed treatment increased from 0.1% (2015) to 0.3% (2019) and not evaluated reduced from 4.6% (2015) to 2.9% (2019) refer figure 14.

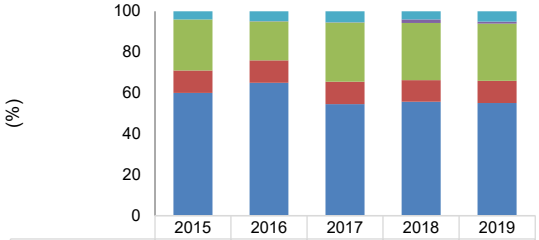


	2015	2016	2017	2018	2019
Not evaluated	4.6	3.5	3.5	3.6	2.9
Failed	0.1	0.1	0.1	0.2	0.3
Loss to follow up	5	4.3	4.7	5.7	5.7
Died	9.7	10.3	10.9	11.4	11.5
Success	80.6	81.8	80.8	79.1	79.6

Figure 14. Treatment outcome for new and relapse TB cases, (2015-2019)

Treatment outcome of previously treated cases, excluding relapse (cohort 2015-2019)

Treatment outcome for previously treated TB cases excluding relapse for cohort 2015 to 2019 showed that treatment success rate cases range from 54% to 65%, loss to follow up between 19% to 29%, died 10% to 11%, failed treatment 0.1% to 1.7% and not evaluated reduced from 4% to 5.4% (refer figure 15).

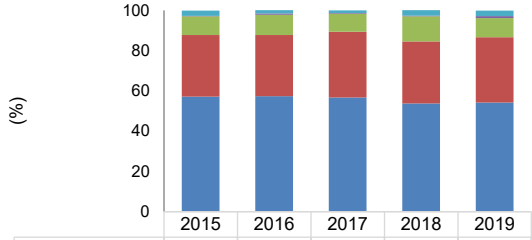


	2015	2016	2017	2018	2019
Not evaluated	4	4.9	5.4	4	5.1
Failed	0	0.1	0.1	1.7	1
Loss to follow up	25	19	29	28	28
Died	11	11	11	10.6	10.8
Success	60	65	54.5	55.7	55.1

Figure 15. Treatment outcome for previously treated cases, excluding relapse (2015-2019)

Treatment outcome of TB-HIV comorbid (cohort 2015-2019)

Treatment success rate for patient with TB-HIV co-morbid was noted around 53% to 57% with nearly a third patient died (30%-32.7%), loss to follow up (8.9% to 12.4%), failed treatment 03% to 0.9% and not evaluated 1.3% to 2.8% (refer figure 16).

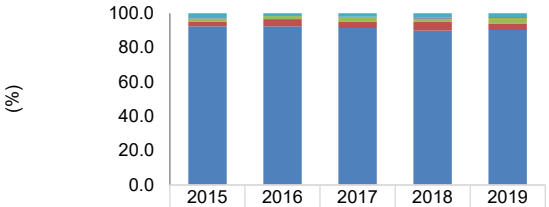


	2015	2016	2017	2018	2019
not evaluated	2.6	1.6	1.3	2.7	2.8
failed	0.3	0.7	0.4	0.4	0.9
loss to folow up	9.3	10	8.9	12.4	9.6
died	30.5	30.4	32.7	30.8	32.4
Success	57.2	57.4	56.7	53.8	54.2

Figure 16. Treatment outcome of TB-HIV co-morbid, Malaysia (2015-2019)

Treatment outcome of TB among children (cohort 2015-2019)

Treatment success rate for TB among children cohort 2015 to 2019 was between 89.9% to 92.4%, died (2.9% to 5.1%), failed treatment 03% to 0.9%, loss to follow up (1.6% to3.2%) and not evaluated 1.3% to 2.8% (refer figure 17).



	2015	2016	2017	2018	2019
not evaluated	2.9	1.6	1.9	2.7	2.2
failed	0.3	0.0	0.3	0.4	0.5
Loss to follow up	1.6	1.9	2.8	2.0	3.2
Died	2.9	4.2	3.6	5.1	3.8
Success	92.4	92.4	91.4	89.9	90.3

Figure 17. Treatment outcome of TB in children, Malaysia (2015-2019)

Treatment Outcome of RR/MDRTB (cohort 2015-2019)

Enrolment to second line TB treatment for RR/MDRTB patients was noted improved from 35% (2016) to 60% (2020) refer figure 18. Treatment success rate range for RR/MDR-TB cohort 2013 to 2018 was range from 32% to 69%, died (16% to 23%), failed treatment 0% to 3%, loss to follow up 8% to 21% and not evaluated 5% to 38% (refer figure 19).

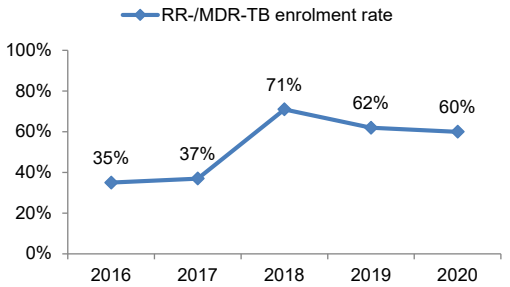
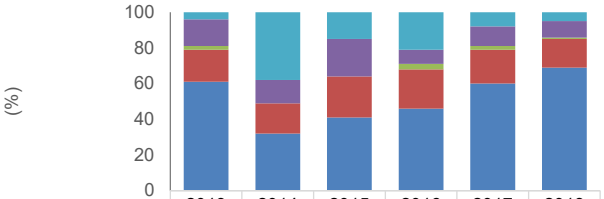


Figure 18. RR/MDRTB enrolment rate to second line drugs (2016-2020)



	2013	2014	2015	2016	2017	2018
Not evaluated	4	38	15	21	8	5
Loss to follow-up	15	13	21	8	11	9.2
Failed	2	0	0	3	2	0.8
Died	18	17	23	22	19	16
Success	61	32	41	46	60	69

Figure 19. Treatment outcome for RR/MDRTB, (cohort 2013-2018)

2.4 CHALLENGES TO END TB

Challenges can be classified to challenges related to TB diagnosis, treatment and prevention; challenges of the health systems that influence TB care; challenges related to social determinants of TB and overarching managerial and governance challenges that influence TB care. Challenges in TB care include challenges with prevention, missing TB case and quality of care.

Missing TB cases

WHO estimated incidence rate of TB for Malaysia was 92 (79-106) per 100,000 population in year 2019, whilst Malaysia reported incidence rate of TB was 81 per 100,000 population. It was estimated 4000 to 5000 missing cases not detected yearly. The missing cases may be caused by limited access to diagnostic tests due to lack of knowledge, stigma and perception barrier. In some cases, patient do have accessed to healthcare facilities, however patient was missing and not been traced although the result was positive TB. TB cases was missed and not diagnosed can be due to lack of trained healthcare provider in public and private facilities. Enforcement for notification of TB is inadequate. Although TB is a mandatory notification in Malaysia, there are still cases not been notified by the treating doctor.

Challenges with quality of care

Challenges faced for diagnosis of TB include delays in diagnosis due to insufficient quality of bacteriological and clinical diagnosis, under-diagnosis of TB in children and late detection

of drug-resistant TB due to health capacity barriers. Challenges in quality of treatment for TB include higher percentage of loss to follow up cases due to lack of psychosocial support, lack of people-centered approach, undocumented and unmanaged adverse events and financial and geographical barriers. Small percentage of failed treatment due to underlying chronic TB infection, delay diagnosis of DR-TB or inappropriate regimen. TB mortality while on treatment may be due to delay diagnosis and associated with comorbidities.

Challenges in TB prevention

Challenges in prevention mainly due to no fully effective vaccine available for prevention of TB at the moment. BCG vaccination remains important for preventing severe forms of TB in children. Due to pandemic COVID-19, people are practicing face mask and hand washing which indirectly reduce transmission of TB. However, this behavioral lifestyle should be maintained though pandemic COVID -19 was over. Practicing effective infection control at healthcare facilities is important to reduce incidence of TB among healthcare workers. There was lack of resources especially for enhanced control required for DR-TB. For implementation of TB preventive treatment, there was still insufficient quality tools for diagnosing LTBI and accessibility for shorter regimens. Wrong perception and lack of communication of individuals with LTBI and treating officer was also noted. Resistance among medical professional to initiate TPT to the selected high-risk group do exist and among those on TPT, adherence to treatment are still not satisfactory. There is also gaps in notification and surveillance of TPT.

Challenges in health system (beyond TB within health)

Malaysia has good quality of primary healthcare service but it is quite challenging in certain remote area in Sabah, Sarawak and peninsular Malaysia. Infrastructure are lacking in remote area and human resources are insufficient in high density area. Although TB is free in goverment health facilities, many patients and their families suffer financial hardships due to TB illnes especially when the sole breadwinner are hospitalization.

HIV, diabetes and smoking are associated with high risks for TB infection and TB active. The collaboration to address this risk factors need to be strengthened. The increasing burden of NCDs may act as barrier in reduction of TB disease.

There is still gap in research and innovations particularly in development of new effective vaccine and short non-toxic TB drugs regimen. A national TB research network and advocacy are not well established.

Challenges in empowering families, communities and civil society engagement include lack of human resources and funding to support community-led and community based activities to TB. Collaboration between the goverment and civil society is important for patient care and support, reducing stigma and discrimination.

Challenges related social determinants of TB (beyond health)

TB is a disease related to the poor and poverty. People with TB suffered catastrophic cost mainly by non-medical costs such as transportation cost and income lost due to TB. The financial lost is more prominent among people with DR-TB infection. Social protection mechanism was insufficient and inadequate coverage among the poor. People with low socio-economic status have more frequent contact with people with active TB disease; a higher likelihood of crowded and poorly ventilated living and working conditions; more food insecurity; lower levels of awareness and limited access to high quality health care. Such low socio-economic conditions can further lead to higher exposure to direct TB risk factors, such as HIV, malnutrition, smoking, alcohol abuse, silicosis, diabetes and mental illness.
TB burden is generally higher in urban than in rural areas due to high population density, crowded living and working conditions, as well as lifestyle changes associated with urban living. Cross-border migration poses significant challenges in monitoring health of migrants and in ensuring universal and equitable health access for them. There was limited multi-sectoral involvement to address this social determinant.

Overarching management challenges

Adequate financing is crucial in implementing advanced technology in diagnosis of TB, DR-TB and LTBI, initiation of shorter drug regime and integrated effective surveilance system in order to reach the ambitious target to end TB as a public health problem. More financial assistance are required to expand TB control program. Appropriate budget also required for operational reaserach and innovations.

Health sector alone unable to address the issues of social determinants of TB. Multi-sectoral collaboration from other agencies such as social services, education, labor, justice, housing and private sector have direct impact to diagnosis and treatment of TB and indirect impact for social determinants of TB. Generally there was weak coordination and accountability between these sectors. There was no clear governance mechanism of accountability for the stakeholders sectors beyond health.

COVID 19 and impact on TB

COVID 19 pandemic has impact on health sector and disrupted essential health services including TB services. Restricted movement or lock-down has indirectly reduce detection of both activeTB cases and latent TB infection. Assessments and modelling by WHO and other agencies estimated a significant increase in mortality and incidence globally. WHO estimated that if average global reduction in case notification was 25% over the period of three months in 2020 then by end of the year additional about 190 000 deaths (13% increase) will be observed, bringing the total TB deaths near the level of the year 2015. For 2020, Malaysia experienced 10% reduction in TB disease and 5% increment of TB mortality.

COVID-19 has also created opportunities to TB program such as development of innovative strategies to ensure continuity of TB services such as below;

1. Strengthen TB prevention like infection control measures and personal protection apply to both COVID-19 and TB which may bring some positive impact on TB. The states may use the opportunity to strengthen contact tracing, cough etiquette, personal protective equipment supplies and use. Services for providing TB preventive treatment and BCG vaccine should be maintained.

1. COVID-19 brings the opportunity of service integration and multi-sectoral response. Such as screening may be integrated with screening for TB symptoms, risk communication, and use of digital technologies. Multisectoral response in COVID is a unique example which may be referred and explored further for TB response.

2. People-centred and community-based care is promoted over hospitalized treatment except for serious conditions.

3. Use of digital health technologies should be intensified to support people with TB and programmes.

4. Proactive planning, procurement and regular monitoring of stocks of drugs and laboratory consumables should be in place to prevent interruptions in the supply of diagnostics and medicines, especially in the peripheral facilities.

5. The staff involved in TB should also be familiarized with COVID-19 guidance and vice versa. TB programme systems like contact tracing, infection prevention and control, household and community care could be further strengthened.

3. NATIONAL STRATEGIC PLAN TO END TB (2021-2030)

Tuberculosis in 2030

TB burden in Malaysia will be expected to reduce by year 2030. The indicator sets as target are reduction 50% of TB Mortality and Incidence Rate reduce to 50 per 100,000 population.

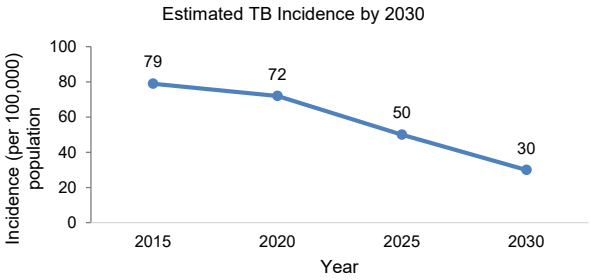


Figure 20. Estimated TB Incidence by year 2030

The environment in 2030 will be different. There will be improvement in living and working condition, food insecurity, poverty, stigma and discrimination as country is well developed. Health system delivery will be changed to more personalized care system. People will be empowered their own health and service delivery may be driven by innovations such as more utilizations of digital technology and artificial intelligence. New vaccine for TB may be developed and more usage of point of care test e.g. molecular diagnostic will be introduced. Therefore, essential TB function including screening, diagnosis, treatment and prevention using existing tools need to be strengthened, scaled up with quality ensured and reasonable budget is required.

Health system will be moved from disease specific program approach towards people-centered integrated care system in line with the vision of Universal Healthcare Coverage (UHC). Specific TB functions need to be continued and strengthened towards 2030 includes TB sensitive-policy, monitoring and evaluation and high standard quality assured TB services. There will be demographic transition in which the percentage of population aged 65 or over will increase rapidly. TB in elderly will increase and be more challenging as clinical signs and symptoms can be subtle and may also be indistinguishable from symptoms of malignancies. Prognosis of TB tends to be more unfavorable and mortality is higher in elderly. Therefore, preparing for population ageing requires program to strengthen active case finding in elderly population and routine screening for elderly who visits healthcare centers.

Malaysia is undergoing rapid economic growth which may lead to rapid urbanization which creates multiple types of population e.g. internally displaced, urban slums and mobile populations and multiple providers (public and private) that poses more challenge to TB control program. Increasing prevalence of non-communicable disease (NCD) and their risk factors such as diabetes mellitus (DM) and tobacco use will increase risk of TB infection or progression of latent TB infection (LTBI) to active TB.

The NSP Ending TB vision, goal, target, strategies and target indicators are as follows:

VISION	**Malaysia free of TB by year 2035**
GOAL	The Goal of TB control in Malaysia is to decrease the burden of tuberculosis by ensuring universal access to timely and quality diagnosis and treatment of all forms of TB and prevent development of drug resistance TB.
TARGET	The targets of TB control by year 2030: 1. TB mortality reduce by 50% 2. TB notification rate (all case) reduce to 30 per 100,000 population
STRATEGIES	
Strategy 1	Enhance Case Detection of TB & Co-Morbidity Management
Strategy 2	Enhance Programmatic Management of Drug Resistant TB
Strategy 3	Enhance Programmatic Management of Latent TB Infection
Strategy 4	Enhance Control of TB among Children
Strategy 5	Enhance Supportive Environment and Systems for Effective TB Control
Strategy 6	Research & Innovation

Indicator	**Baseline 2015**	**Achievement 2020**	**Target 2025**	**Target 2030**
Number of TB deaths compared with 2015 (TB Mortality Rate per 100,000 population)	1696 (5.5)	2320 (*increment 36%)* (7.1)	<1272 (*reduction 25%)* (3.5)	<848 (*reduction 50%)* (2.2)
TB notification rate per 100,000 population (Total TB Cases)	79 (24,220 cases)	72 (23,644 cases)	<50 (18,000 cases)	<30 (11,500 cases)
Treatment Success Rate (%)	80.9	79.1	90	90

3.1 STRATEGY 1. ENHANCE CASE DETECTION OF TB

WHO had made 17 new and revised recommendations for screening for TB diseases (WHO consolidated guidelines on TB Module 2: Systematic screening for TB diseases, 2021). According to this guideline, systematic screening may be conducted among the general population in areas with an estimated TB prevalence of 0.5% or higher. The main changes of the current update include computer aided detection (CAD) is being recommended for the first time as an alternative to human interpretation of digital chest x-ray for screening and triage of TB. Molecular WHO recommended rapid diagnostic tests (mWRDs) may be used to improve the accuracy of symptom screening in populations at high risk of TB.

Strategic interventions and activities for Strategy 1:

STRATEGIC INTERVENTION	ACTIVITIES	Responsible organization
1.1 Strengthen screening activities/ outreach activities	1.1.1 Enhance screening among high risk group including contacts, PLHIV dan outreach screening for immigrants and urban slums 1.1.2 Strengthen pre-entry screening for institutions such as prison, cure and care rehabilitation centre, detention centre and elderly homes	TBCP HIV Program Ministry of Home Affairs
1.2 Strengthen screening at hospital and private facilities	1.2.1 Strengthen guideline for PPM with private facilities. 1.2.2 Annual TB care meeting with private facilities	TBCP Private healthcare facilities
1.3 Increase radiologic diagnostic capacity (x-ray services)	1.3.1 Increase coverage of x-ray facilities in health clinics 1.3.2 Ultra-portable x-ray with of AI technologies for remote areas/ TB outbreak 1.3.3 Outsourcing of mobile x-ray to high TB prevalence area and institution	Family Health Development TBCP
1.4 Increase laboratory diagnostic capacity	1.4.1 Expansion use of rapid molecular test in PR1 health clinics 1.4.2 Strengthen lab quality 1.4.3 Increase laboratory equipped with LED microscope	TBCP Medical Program
1.5 Upgrade MyTB System	1.5.1 Enhance data reporting system, strengthen contact variable 1.5.2 Integration with laboratory data	TBCP NPHL

STRATEGIC INTERVENTION	ACTIVITIES	Responsible organization
	1.5.3 Integration with hospital information system/ pharmacy system	
1.6 Management of TB-HIV	1.6.1 Systematic screening of people living with HIV to detect TB and LTBI 1.6.2 Strengthen HIV prevention including IPT and CPT 1.6.3 To promptly initiate ART for TB/HIV patients 1.6.4 Strengthen recording and reporting, as well as monitoring and evaluation 1.6.5 Promote reduction of stigma and discrimination, community engagement and social protection	TBCP HIV Program
1.7 Management of TB-Diabetes	1.7.1 Develop collaborative framework for care and control of TB and diabetes	TBCP NCD Program
1.8 Management of TB- smoking	1.8.1 Counselling and referral to Quit Smoking Clinic	TBCP NCD Program
1.9 Strengthen DOT to ensure completed treatment	1.9.1 Adequate counselling for TB patient and family 1.9.2 Defaulter tracing 1.9.3 Video observed treatment (VOT) as alternative 1.9.4 Collaboration with NGO and private facilities	TBCP Pharmacy Program NGOs
1.10 Referral of TB cases to the country of origin	1.10.1 Enhance notification and referral for TB cases: a. Foreign workers b. Illegal social visit pass c. FOMEMA screening	TBCP FOMEMA

3.2 STRATEGY 2. ENHANCE PROGRAMMATIC MANAGEMENT OF DRUG RESISTANT TUBERCULOSIS (PMDT)

Drug resistance (DR-TB) are more difficult to treat than drug-susceptible TB, and threaten progress towards the targets set to End TB Strategy by the World Health Organization (WHO). WHO estimates that about half a million cases of multi-drug or rifampicin resistant (MDR/RR-TB) are estimated to occur each year. The main reason for increase in DR-TB cases include non-compliance to treatment, improper treatment and poor treatment regimes. Interventions to prevent DR-TB includes early detection and high-quality treatment of drug susceptible and drug resistant TB and effective implementation of infection control measures.

WHO Consolidated Guidelines on Tuberculosis, Module 4: Treatment - Drug-Resistant Tuberculosis Treatment (2020) is a comprehensive set of WHO recommendations for the treatment and care of DR-TB. The document includes two new recommendations, the composition of shorter regimens and the use of the BPaLM regimen (i.e. bedaquiline, pretomanid,linezolid and moxifloxacin). In addition, the consolidated guidelines include existing recommendations on treatment regimens for isoniazid-resistant TB and MDR/RR-TB, including longer regimens, culture monitoring of patients on treatment and the timing of antiretroviral therapy (ART) in MDR/RR-TB patients infected with the human immunodeficiency virus (HIV).

Strategic interventions and activities for activities for PMDT

STRATEGIC INTERVENTION	ACTIVITIES	Responsible organization
2.1 Increase detection of DR-TB cases ➢ Enforce mandatory notification of DR-TB ➢ To strengthen Public Private Mix (PPM)	2.1.1 All high-risk group will be tested with rapid molecular test as initial diagnostic test for diagnosis of TB 2.1.2 To organize training session for management of DR-TB cases to MOH staff 2.1.3 Dialogue Session with APHM to ensure notification and data sharing	TBCP Medical Program NPHL
2.2 Ensure all bacteriologically confirmed TB have access to DST test ➢ Ensure DST second-line for all DR-TB patients	2.2.1 All bacteriologically confirmed TB will send specimen for culture and ID DST 2.2.2 Use rapid molecular diagnostic tools for early detection of DR-TB at primary care 2.2.3 Develop SOPs for DST involving second-line drugs including Bedaquiline	

STRATEGIC INTERVENTION	ACTIVITIES	Responsible organization
	2.2.4 DST second-line using Next Sequencing for re-treatment & complicated DR-TB cases	
2.3 Strengthen treatment for DR-TB cases ➢ To increase availability of negative pressure isolation room for DR-TB	2.3.1 To review and update CPG Management of DR-TB according to latest WHO guideline. 2.3.2 To ensure availability of second-line drugs 2.3.3 Propose exemption of medical fee for non-Malaysian patients who require treatment with second-line TB drugs. 2.3.4 Ensure proper maintenance of existing negative pressure isolation room	TBCP Medical Program Pharmacy Program
2.4 Strengthen commitment for DR-TB ➢ Ensure treatment adherence	2.4.1 Development of National MDR-TB expert committee, Steering committee & regular stake holder discussion 2.4.2 To provide social and financial support for DR-TB eg Majlis Agama Islam, Jabatan Kebajikan Masyarakat, Kerajaan Negeri, MAPTB etc. 2.4.3 Engagement with NGO and others society organization 2.4.4 Ensure zero loss to follow up for DR-TB cases	TBCP Social Society NGOs Pharmacy Program
2.5 To develop online database for DR-TB registration, surveillance and monitoring of treatment outcome	2.5.1 Develop online database for DR-TB registration Integration data from 2.5.2 Integrated laboratory data and rapid molecular reporting into SIMKA System 2.5.3 Monitoring safety and adverse effects to second line TB treatment	TBCP BPM

3.3 STRATEGY 3. ENHANCE PROGRAMMATIC MANAGEMENT OF LATENT TB INFECTION

Latent tuberculosis infection (LTBI), defined as a state of persistent immune response to prior-acquired Mycobacterium tuberculosis antigens without evidence of clinically manifested active TB. Approximately 10% of people with LTBI will develop active TB disease in their lifetime, with the majority developing it within the first five years after initial infection. TB preventive treatment (TPT) is one of the key interventions recommended by WHO to achieve the End TB Strategy targets. Currently available treatments have an efficacy ranging from 60% to 90%.

The 2020 WHO consolidated guidelines on tuberculosis, Module 1: Prevention TB preventive treatment have 18 recommendations that cover critical steps in the programmatic management of LTBI and follow the cascade of preventive care: identification of populations at risk (PLHIV as part of the HIV care package, household contacts and others), ruling out active TB disease, testing for LTBI, providing treatment, and monitoring adverse events, adherence and completion of treatment.

Strategic interventions and activities for activities for Programmatic Management of Latent TB Infection

STRATEGIC INTERVENTION	ACTIVITIES	Responsible organization
3.1 Increase detection of individuals with LTBI ➢ Strengthen screening for LTBI among selected high-risk group	3.1.1 Development and endorsement of the LTBI guideline ➢ Establish Contact of TB Cases Committee and meeting at least once a year at state level (chair by PKN) and three times a year at district level (chair by PKD) 3.1.2 Screening of LTBI among the selected high-risk group: a. contacts of bacteriologically confirmed TB b. HCW at MOH facilities as well as HCW and non HCW at Institutions within the schedule below: ➢ pre-placement :(within 1-month of placement) ➢ transfer in: recent placement, at least 2 years from the last screening at previous workplace,	TBCP Primary Care Program KPAS NPHL

STRATEGIC INTERVENTION	ACTIVITIES	Responsible organization
	(never received IPT and active TB treatment) ➢ pre-retirement :1 year before retirement date c. Long term (>6weeks) immunosuppressant dependent (e.g. prednisolone, anti-TNF) d. ESRF/ on renal replacement therapy e. Type 2 DM (uncontrolled, Hba1c >9% within 1 year) f. Pre-transplant patient (recipient) g. Inmates in institution i. (Old Folks Home) ii. Prisoner	
3.2 Strengthen the method for LTBI Screening	3.2.1 Increase coverage for facilities with IGRA test	TBCP NPHL
3.3 Enhance enrolment to TPT ➢ Increase coverage for TPT	3.3.1 TPT initiated within 1 month of diagnosis 3.3.2 Monitoring and follow up for two years for all diagnosed LTBI, as treatment outcome; a. Percentage of individual with LTBI completed TPT b. Rate of active TB among LTBI treated with TPT c. Rate of active TB among non-treated LTBI 3.3.3 Availability of rifapentine 3.3.4 Development of DG circular and KPI for TPT	TBCP Medical Program Pharmacy Program
3.4 Strengthen implementation of LTBI Information System	3.4.1 Development of LTBI web-based system 3.4.2 Regular monitoring of data quality by TB team at various level 3.4.3 Budget for LTBI system 3.4.4 Training for staff	TBCP BPM
3.5 Increase awareness and knowledge on TPT	3.5.1 Promoting and Educating the public through social media and mass media ➢ Social media -youtube / Facebook / Blog	TBCP Medical Program HECC

STRATEGIC INTERVENTION	ACTIVITIES	Responsible organization
➢ Dissemination of information to public through health promotion education activities ➢ Improve consistency of HCWs knowledge, awareness and practices towards PMTPT	➢ Mass media -Airtime (TV & Radio)/ Newspaper / Magazine ➢ Monitoring the rating of viewer on the social media & mass media and their engagement 3.5.2 Assessment of the public knowledge, attitude, awareness and practices through general survey and opinion poll. 3.5.3 Training of trainer workshop on PMTPT ➢ Workshop for X-ray interpretation for medical officer ➢ Facilitator for LTBI Module every category 3.5.4 Integration of Tuberculosis and LTBI screening module in the; ➢ Orientation module for health care worker preplacement ➢ Infection control program ➢ HCW pre-retirement module 3.5.5 Academic syllabus at school, ILLKKM, Undergraduates	

3.4 STRATEGY 4. ENHANCE CONTROL OF TB AMONG CHILDREN

Ending TB in children and adolescents is an integral part of the End TB Strategy, which is aligned with SDGs targets to end the global TB epidemic. Achieving these targets requires provision of TB care and prevention within the broader context of universal health coverage.

WHO (2020) estimates that over one million children under 15 years of age fall ill with active TB disease each year, and 253 000 children (including 52 000 children living with human immunodeficiency virus (HIV) die of this curable and preventable disease. Only 46% of the estimated number of cases are reported by national TB programmes (NTPs) around the world, leaving a gap of over 580 000 children who are not diagnosed, treated and/or reported each year.

TB control priorities include the need to: find the missing children with active TB and link them to TB care; prevent TB in children who are in contact with infectious TB cases (through implementation of active contact investigation and provision of preventive treatment); and advance integration within general child health services, including maternal and child health/ reproductive, maternal, newborn, child and adolescent health, HIV, nutrition and other programs.

STRATEGIC INTERVENTION	ACTIVITIES	Responsible organization
4.1 Early detection of TB disease among children	4.1.1 Develop manual teaching module of Paediatric TB Management ➢ Training for Health Care Worker at national, state and district level 4.1.2 Strengthen screening of TB among children who are contact of Index case TB 4.1.3 Incidence reporting for missed screening of children among TB contacts	TBCP

STRATEGIC INTERVENTION	ACTIVITIES	Responsible organization
4.2 Ensure continuity of TB treatment	4.2.1 Child-friendly fixed-dose formulation should be used to treat tuberculosis in children 4.2.2 Strengthen collaboration among TB team at health clinics, district health office and hospitals 4.2.3 Regular TB paediatric audit meeting: chaired by Paediatrician with FMS and Public Health in the committee ➢ Meeting to review contact tracing and case management, LTBI treatment, clinical management and DOTS	TBCP Pharmacy Division Medical Programme
4.3 To strengthen TPT treatment and management among children	4.3.1 To ensure availability of standard TPT management guidelines at all health care facilities 4.3.2 Regular monitoring of coverage of TPT among children	TBCP Family Development Program
4.4 To sustain high coverage of BCG immunisation	4.4.1 Enhance collaboration with maternal and child health program 4.4.2 Availability of information, education and communication materials, vaccination kits and vaccine preventable diseases.	TBCP Family Development Program
4.5 To increase awareness regarding Paediatric TB ➢	4.5.1 Develop Task force TB among children 4.5.2 Strengthen networking with other agencies (MOE/MAPTB/Professional society/NGOs 4.5.3 TOT pediatric TB to other agencies ➢ To increase engagement with community and school 4.5.4 Engagement with NGOs to produce short video / infographic related to pediatric TB ➢ Focal group discussion \ ➢ To develop education material (social media friendly)	TBCP Family Development Program NGOs

3.5 STRATEGY 5:TO ENABLE SUPPORTIVE ENVIRONMENT AND SYSTEMS FOR EFFECTIVE TB CONTROL

Engagement and Partnerships

Partnership between health and social sector including patients, families, communities and civil society organizations are important to end the epidemic of TB. Community engagement can assist in identify people with suspected TB and refer them for diagnosis and treatment. They can also assist in alleviating stigma and discrimination. Local agencies can help in reaching out to vulnerable and underserved groups and addressing determinants of TB.

In Malaysia, TB diagnosis and treatment is delivered by public and private care providers. TB cases notification are mandatory by all health-care providers. Collaboration, regular meeting and discussion between this provider are encouraged to provide quality diagnosis and TB case management.

STRATEGIC INTERVENTION	ACTIVITIES	Responsible organization
5.1 To strengthen collaboration between MOH with NGOs and other agencies	5.1.1 Joint committee meeting with other agencies & NGOs stakeholders ➢ Establish inter-agency taskforce ➢ Identify all relevant agencies/ partners/ NGO/ affected person 5.1.2 Continuous consultation on organizational roles & responsibilities	TBCP NGOs
5.2 Improve TB awareness among public ➢ Rebranding of TB Awareness Program to reach the community by incorporating technology and clear communication strategies ➢ To include TB in literacy & community activities	5.2.1 Using social media for health promotion & awareness ➢ telegram ➢ FB / Instagram / Tweeter ➢ YouTube channel 5.2.2 Creating symbolism for National TB program through ➢ TB Celebrity icon ➢ TB Ribbon 5.2.3 Documentary & Coverage of TB awareness/ activities within mainstream/ social media 5.2.4 TB talk during program / activities by other agencies e.g. religious	TBCP HECC

STRATEGIC INTERVENTION	ACTIVITIES	Responsible organization
	gathering e.g. Khutbah Jumaat, Sunday Prayer	
5.3 To improve TB awareness within Health Sector/ Vulnerable population.	5.3.1 Integrating TB awareness in existing health program. Include TB awareness component in: ➢ Program Dr Muda modules ➢ PROSIS ➢ KOSPEN ➢ Panel Penasihat 5.3.2 Include vulnerable population below through existing program by other agencies/NGO: ➢ Prisoners ➢ People who use drugs ➢ Migrants/refugees 5.3.3 Develop and integrating basic TB education within existing program ➢ Prison ➢ AADK ➢ JKM	TBCP HECC
5.4 To improve TB awareness among educational sector ➢ Introducing appropriate TB awareness at different level of education	5.4.1 Early Childhood/ Pre-school ➢ Develop simple TB curriculum using a Play based Activities 5.4.2 Primary & Secondary School ➢ TB in science / Pendidikan Kesihatan subjects ➢ TB in Science / Biology subjects 5.4.3 Tertiary Education ➢ Educating & molding of TB/health educators among college/university students	TBCP HECC Ministry of Education
5.5 To improve TB at workplace ➢ Refiguring TB awareness program at workplace ➢ Encourage TB control program adaptation at	5.5.1 Identify workplace with high risk population & high burden of TB cases. 5.5.2. Adopting WHO/ILO guideline on workplace TB Control activities: ➢ Empower a group of workers with management	TBCP/HECC DOSH

STRATEGIC INTERVENTION	ACTIVITIES	Responsible organization
medium/high risk workplace • KPAS • DOSH, KSM [OSHA]	representative (appoint as TB warrior) ➢ Awareness among workers ➢ Encourage scheduled screening activities ➢ Promoting adherence to treatment ➢ Continuous outcome evaluation	
5.6 To enhance the public engagement/ ownership through community-based activities by NGOs / other agencies ➢ Establish community volunteers program in the community with higher burden of TB.	5.6.1 Training communities on volunteer roles in screening & treatment adherence (DOT Supervisor) 5.6.2 Engage the Community leader/Health unit leader of the 'Persatuan Penduduk', Ketua Kampung, Local Icon & selected ex-TB patient in the team 5.6.3 Social Support: Home visit to motivate & review compliance, get feedback on problems encountered during treatment & facilitate patients for financial aid / other welfare need.	TBCP/HECC NGOs
➢ Integrate TB awareness & screening within community-based activities by NGOs / other agencies	5.6.4 Integration of TB awareness & screening into programs e.g. ➢ Ziarah Kasih by YB ADUN ➢ State government program ➢ Community engagement program by various agencies	
5.7 Public-Private Mix (PPM) Engagement	5.7.1 Increase awareness among GP on TB screening. Training on TB screening using MMA platform & Online CPD: ➢ Annual CME - collaboration with MMA ➢ Online CPD 5.7.2 Improving Private- Public sector referral system for TB. Direct referral through Liaison Officer in Klinik Kesihatan 5.7.3 Reward to GP who performs well in screening and detecting TB	TBCP Private healthcare facilities

STRATEGIC INTERVENTION	ACTIVITIES	Responsible organization
	5.7.4 Enforcing TB notification system in private sector	
5.8 NGO empowerment e.g. MAPTB	5.8.1 Enhance case detection & high-risk group screening ➢ Sharing information / data for operation e.g. Target group / Local endemic data 5.8.2 Find TB Program: help in finding missing cases, contacts tracing & defaulters ➢ Volunteer training ➢ Schedule awareness program in TB POE (pocket of endemicity) by NGO ➢ Incentive to volunteers who referred suspected / contacts / defaulters of TB cases to clinic/ supervise DOT 5.8.3 Provide *extra* support for TB patients and high-risk group (malnourishes, poor socioeconomic) ➢ Existing Food Bank Programme 5.8.4 Provide EGT & TAS to TB patients.	TBCP NGOs
5.9 Addressing stigma & discrimination ➢ Gathering support/ advocacy to address stigma	5.9.1 Increase awareness and fight the prejudice towards TB in Malaysia: ➢ "Purple-Green Ribbon" Campaign ➢ Celebrities: Artist / Dai'e / Political idol / Instafamous ➢ Act as Media Spokesperson on behalf of MAPTB 5.9.2 Increase commitment/pledge/ CSR among corporate entities/foundation	TBCP NGOs

3.6 STRATEGY 6: TO INTENSIFY RESEARCH AND INNOVATION

TB elimination requires the highest political commitment with financial support as well as public empowerment to overcome challenges with regard to TB research and innovation. The end TB strategy recommends that major technology breakthroughs are imperative to further accelerate the rate of TB reduction in achieving the end TB strategy goal. The political declaration of the General Assembly of the United Nations encourages countries to formulate a framework to facilitate implementation of the commitments on research and innovation. The objectives and recommendations to accelerate TB research and innovation as set out below;

i. Create an enabling environment for high-quality TB research and innovation to increase capacity to conduct research and use its outcomes equitably, in a sustained and effective manner
ii. Increase financial investments in TB research and innovation by developing innovative and collaborative financing mechanisms to facilitate the timely development and diffusion of appropriate and affordable biomedical tools and technologies
iii. Promote and improve approaches to data sharing to advance scientific discovery, reduce duplication of effort, and facilitate the translation of evidence into national and global policies on TB prevention, diagnosis, treatment and care.

Political commitment to elevate TB to the highest priority is crucial to ensure good financial support in overcoming challenges with regard to TB research. The effort of TB elimination can be further enhanced by the intensification of research and innovation via new tools and strategies. The success rate of the strategy can be enhanced by the formulation of inter-and intra-agency research collaboration as well as cooperation. The establishment of a tuberculosis research network, as well as the mobilisation of stakeholders to participate in tuberculosis research, is critical to ensuring a continuous and sustainable effort in the advancement of tuberculosis control.

National research and innovation policies should enable effective and swift absorptive capacity at all levels of the national health care system, and in other sectors as applicable, so that patients can benefit fully and equitably from the latest evidence and innovation. In order to achieve this, the establishment of a framework mechanism is important to translate research into policy that aligns the national policies and regulatory mechanisms with the needs of patients and health care systems. The establishment of a TB research and innovation network will bring together the stakeholders to develop a country-specific research plan and future direction. The national TB research and innovation network should involve collaborative public-private partnerships that bridge the public and private sectors to broaden access to new skills, sources of finance, specialised research and development infrastructure, as well as product creation and innovation pipelines. The following are examples of potential stakeholders:

I. Internal Stakeholders

- Sector TB/Leprosy, Disease Control Division, Ministry of Health (Chair)Health services representatives from different levels of TB programmes, Ministry of Health
- National Institutes of Health Malaysia.

II. External Stakeholders

- Community and civil representatives
- Non-Governmental Organisations (NGOs) representatives
- Professional society representatives e.g. Malaysian Thoracic Society (MTS) and Lung Foundation of Malaysia (LFM)
- National Universities (UiTM, UM, UKM, USM, UMS, IMU)
- Other government agencies e.g. Ministry of Science & Technology and Ministry of Higher Education
- Industry representatives e.g. pharmaceutical industry
- International partners e.g. WHO, UN, ASEAN, International NGOs, International Union of TB and Lung Disease (IUATLD) and Universities.

An enabling environment in terms of legal, fiscal, political, and sociocultural factors is critical for promoting the capacity to conduct and use research outcomes equitably in a sustainable and effective manner. Capacity-building for national surveillance TB data management, especially big data analysis, should be enhanced, expanded and adapted for the development of evidence-based policy. Collaborative financing is an important way to do more with existing resources by joining forces to conduct high-impact multisite and multidisciplinary studies.

The introduction of new tools and strategies as well as promoting universal access to and better use of existing technologies are important to effectively reducing TB incidence and mortality. New tools and strategies include: risk scoring tool and mobile apps for treatment adherence monitoring are currently ongoing, mobile apps for treatment adherence monitoring, rapid point-of-care tests for diagnosing TB infection and TB disease and for detecting drug resistance; shorter, safer regimens for treating TB infection and drug-sensitive TB (DS-TB); shorter, safer and more effective treatment for DR-TB; a TB vaccine that is effective before and after exposure and across a range of age groups and geographical settings; and innovative strategies to address the social and environmental drivers of TB.

STRATEGIC INTERVENTION	ACTIVITIES	Responsible organization
6.1 To elevate TB research and innovation to the highest priority	6.1.1 Coordinate and work with Research & Technical Support, MOH Program	TBCP Internal & External Stakeholders

STRATEGIC INTERVENTION	ACTIVITIES	Responsible organization
6.2 To develop a mechanism to translate research and innovation into programme improvement	6.2.1 To advocate translation of research and innovation into policy 6.2.2 To prepare a mechanism/ algorithm for policy recommendation paper based on research and innovation findings	Internal & External Stakeholders
6.3 To produce a comprehensive research and innovation plan	6.3.1 To formulate the national TB research and innovation agenda and priorities 6.3.2 Construct a set of unique and country specific TB research and innovation priorities based on the current TB epidemic	Internal & External Stakeholders
6.4 To secure funding for research, innovation and training	6.4.1 Develop financing mechanism to address TB with the highest priority 6.4.2 Mechanism of funding for research and innovation operations, training and infrastructure	Internal & External Stakeholders
6.5 To establish a National TB Research and Innovation Network (NTRIN)	6.5.1 Establishing a working committee that includes all relevant stakeholders 6.5.2 Establish a coordinating body 6.5.3 Formulate inter and intra agency research collaboration and cooperation 6.5.4 Mechanism for the collaboration between NTRIN and public health conjoint board under MPH and DrPH program 6.5.5 Coordinate with NGOs for public participation	Internal & External Stakeholders

STRATEGIC INTERVENTION	ACTIVITIES	Responsible organization
6.6 To strengthen TB research leadership	6.6.1 Determine TB training activities 6.6.2 Collaborate with NIH for training activities 6.6.3 Involvement in the National TB Conference	Internal & External Stakeholders
6.7 To enhance multisector collaboration for TB research and innovation agenda	6.7.1 To galvanize stakeholders to participate in TB research via advocacy groups 6.7.2 Conduct working group meetings 6.7.3 Initiate and encourage NGO public support through community-based intervention research 6.7.4 Participate in National World TB Day activities	Internal & External Stakeholders
6.8 To undertake periodic tb research and innovation review	6.8.1 Aligned indicators with TB sector and continual monitoring 6.8.2 Developing a centralised database on TB research and innovation 6.8.3 Establishing a follow-up mechanism on TB research and innovation 6.8.4 Periodic reporting of TB research and innovation findings to stakeholders	Internal &External Stakeholders

4. OPERATIONAL AND MONITORING PLAN

The purpose of the operational and monitoring plan is to provide the details of time-frame for the objectives, activities and monitoring plan to serve as a roadmap for NTBCP to prepare for annual work plans to be implemented.

4.1 END TB STRATEGY INDICATOR

No	Indicator	Definition	Recommended target level	2015 (baseline)	2020 (achievement)	Target by 2025	Target by 2030
1.	TB treatment coverage	*Number of new and relapse cases that were notified and treated, divided by the estimated number of incident TB cases in the same year, expressed as a percentage.*	≥90%	87%	87%	90%	90%
2.	TB Treatment success rate	*Percentage of notified TB patients who were successfully treated. The target is for drug–susceptible and drug-resistant TB combined, although outcomes should also be reported separately.*	≥90%	78%	80%	90%	90%
3.	Percentage of TB affected households that face	*Number of people treated for TB (and their households) who incur catastrophic costs (direct and indirect combined),*	0%	No data	33% (pilot study)	0%	0%

No	Indicator	Definition	Recommended target level	2015 (baseline)	2020 (achievement)	Target by 2025	Target by 2030
	catastrophic costs due to TB	*divided by the total number of people treated for TB.*					
4.	Percentage of new TB patients diagnosed using WHO-recommended rapid tests	*Number of new and relapse TB patients tested using a WRD at the time of diagnosis, divided by the total number of new and relapse TB patients, expressed as a percentage*	≥90%	No data	No data	10%	25%
5.	LTBI treatment coverage	*Number of people enrolled on LTBI treatment divided by the number eligible for treatment, for 3 priority groups:* *5.1 people newly enrolled in HIV care;* *5.2 children aged less 5 years who are household contacts of people with bacteriologically confirmed pulmonary TB;* *5.3 people aged ≥5 years who are household contacts of people with*	≥90%	5.1 70.6% 5.2 no data 5.3 no data	5.1 47% 5.2 22% 5.3 55%%	5.1 90% 5.2 90% 5.3 90%	5.1 90% 5.2 90% 5.3 90%

No	Indicator	Definition	Recommended target level	2015 (baseline)	2020 (achievement)	Target by 2025	Target by 2030
		bacteriologically confirmed pulmonary TB					
6.	Contact investigation coverage	*Number of contacts of people with bacteriologically confirmed TB who were evaluated for TB, divided by the number eligible, expressed as a percentage.*	≥90%	79.8%	81.1%	≥90%	≥90%
7.	TB patients (bacteriologically confirmed) with DST results	*Number of bacteriologically confirmed TB cases with DST results for at least rifampicin, divided by the total number of bacteriologically confirmed TB cases in the same year, expressed as a percentage.*	100%	No data	86%	100%	100%
8.	Treatment coverage with new TB drugs	*Number of TB patients treated with regimens that include new (endorsed after 2010) TB drugs, divided by the number of notified patients eligible for treatment with new TB drugs, expressed as a percentage.*	≥90%	No data	No data	≥90%	≥90%
9.	Percentage of TB	*Number of new and relapse TB patients with*	100%	88%	82%	90%	100%

No	Indicator	Definition	Recommended target level	2015 (baseline)	2020 (achievement)	Target by 2025	Target by 2030
	patients who know their HIV status	*documented HIV status, divided by the number of new and relapse TB patients notified in the same year, expressed as a percentage.*					
10.	TB case fatality ratio (CFR)	*Number of TB deaths divided by estimated number of incident cases in the same years, expressed as a percentage.*	≤5%	6.4%	7.7%	≤5%	≤5%

4.2 Monitoring Output and Process Indicator

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
Strategy 1. Enhance Case Detection of TB					
1.1.1 Enhance screening among high risk group including contacts, PLHIV, immigrants and urban slums	Output	TBIS 204S TBIS 101C	350,000 screened per year	400,000	500,000
1.1.2 Strengthen screening at institutions such as prison, CCRC and elderly homes	Process				
1.2.1 Strengthen guideline for PPM with private facilities.	Process	Availability of guideline	No	Guideline available by 2025	
1.2.2 Annual TB care meeting with private facilities	Process	No of meeting per year	Yearly meeting		
1.3.1 Increase coverage of x-ray facilities in health clinics	Output	No. of health clinic equip with static x-ray	25%	Increase 5%	Increase 5%
1.3.2 Ultra-portable x-ray with of AI technologies for remote areas/ TB outbreak	Output	Availabilities of ultra-portable x-ray	0	Phase 1: 5 units	Phase 2: 10 units
1.3.3 Outsourcing of mobile x-ray to high TB prevalence area and institution	Output	outsourcing mobile x-ray service	10,000 film	10,000 per year	10,000 per year
1.4.1 Expansion use of rapid molecular test in PR1 health clinics	Output	Percentage of new and relapse TB cases diagnosed using WRD	No data	10%	25%

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
1.4.2 Strengthen laboratory quality	Process				
1.4.3 Increase laboratory equipped with LED microscope	Output	LED coverage	70%	80%	90%
1.5.1 Enhance data reporting system, strengthen contact variable	Process	TBIS 101C updated online	No	Yes	Yes
1.5.2 Integration with laboratory data	Process				
1.5.3 Integration with hospital information system/ pharmacy system	Process				
1.6.1 Systematic screening of people living with HIV to detect TB and LTBI	Output	No. of PLHIV (New Case) screen for TB per no. of new diagnosed HIV		100%	100%
1.6.2 Strengthen HIV prevention including TPT and CPT	Output	No. of PLHIV started on TPT per no. of PLHIV eligible for TPT	47%	90%	90%
1.6.3 To promptly initiate ART for TB/HIV patients	Output	Percentage of HIV positive incident TB cases that received treatment for TB and HIV	30%	90%	90%
1.6.4 Strengthen recording and reporting, as well as monitoring and evaluation	Process				

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
1.6.5 Promote reduction of stigma and discrimination, community engagement and social protection	Process	Activity to reduce stigma	Once per year	Once per year	Once per year
1.7.1 Develop collaborative framework for care and control of TB and diabetes	Process	To optimize treatment of patient TB co-morbid diabetes			
1.8.1 Counselling and referral to Quit Smoking Clinic	Process	Percentage of TB and smoking counselled and referred to quit smoking clinic	No data	90%	90%
1.9.1 Adequate counselling for TB patient and family	Process	Percentage of TB patient being counselled for TB treatment	No data	100%	100%
1.9.2 Defaulter tracing	Output	Percentage of loss to follow-up cases for new &relapse TB cases (cohort)	5.78%	<2%	<2%
1.9.3 VOT as alternative for DOT	Process	Adherence on VOT	Data not available	90%	90%
1.9.4 Collaboration with NGO and private facilities	Process	Engagement with NGO	Once per year	Once per year	Once per year
1.9.5 Enhance notification and referral for TB cases: a. Foreign workers b. Illegal social visit pass	Process	TB cases diagnosed via FOMEMA screening will be notified to returning			

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
c. FOMEMA screening		countries with IHR form			
Strategy 2. Enhance Programmatic Management of Drug Resistant Tuberculosis (PMDT)					
2.1.1 All high-risk group will be tested with rapid molecular test as initial diagnostic test for diagnosis of TB	Process	Ensure high-risk group for DR-TB screen with rapid molecular test	Data not available	50% screening	90% screening
2.1.2 To organize training session for management of DR-TB cases to MOH staff	Process	Training session	Once per year	Once per year	Once per year
2.1.3 Dialogue Session with APHM to ensure notification and data sharing	Process	Dialogue session	No data	Once per year	Once per year
2.2.1 All bacteriologically confirmed TB will send specimen for culture and ID DST	Output	DST coverage for bacteriologically confirmed TB	New case :95% Retreatment case :64%	New case :100% Retreatment case :100%	New case :100% Retreatment case:100%
2.2.2 Use rapid molecular diagnostic tools for early detection of DR-TB at primary care	Output	Coverage of GeneXpert in PR 1 primary care	0	5%	10%
2.2.3 Develop SOPs for DST involving second-line drugs including Bedaquiline	Process	Document guideline available			

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
2.2.4 DST second-line using Next Sequencing for re-treatment & complicated DR-TB cases	Process	Availability of DST second line	Yes	Yes	Yes
2.3.1 To review and update CPG Management of DR-TB according to latest WHO guideline.	Process	New revised guideline available	No	Yes	Yes
2.3.2 To ensure availability of second-line drugs: secure continuous budget for procurement of second-line TB drugs and management of supply chain	Process	Availability of second line drugs	No	Latest shorter regime of second line drugs available by 2025	
2.3.3 Propose exemption of medical fee for non-Malaysian patients who require treatment with second-line TB drugs.	Process	Availability of exemption document	No	Yes	Yes
2.3.4 Ensure proper maintenance of existing negative pressure isolation room	Process				
2.4.1 Development of National MDR-TB expert committee, Steering committee & regular stake holder discussion	Process	Meeting twice per year	No	Meeting twice per year	Meeting twice per year
2.4.2 To provide social and financial support for DR-TB	Process				

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
eg MAIK, Majlis Agama Islam, Jabatan Kebajikan Masyarakat, Kerajaan Negeri, MAPTB etc.					
2.4.3 Engagement with NGO and others society organization	Process	Once per year	Yes	Once per year	Once per year
2.4.4 Ensure zero loss to follow up for DR-TB cases	Output	Percentage of loss to follow up	9% (cohort 2018)	0%	0%
2.5.1 Develop online database for DR- TB registration	Process	Database online available	No	Yes	Yes
2.5.2 Integrated laboratory data and rapid molecular reporting into SIMKA System	Process	Data integration with SIMKA	No	Yes	Yes
2.5.3 Monitoring safety and adverse effects of second line TB treatment	Process	Active safety monitoring and management of TB drugs (aDSM)	No	Yes	Yes
Strategy 3. Enhance Programmatic Management of LTBI					
3.1.1 Development and endorsement of the LTBI guideline	Process	Guideline available			
3.1.2 Screening of LTBI among the selected high-risk group: a. contacts of pulmonary TB smear positive cases	Output	Percentage of contact of PTB smear positive screened for LTBI	10%	50%	80%

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
b. Long term (>6weeks) immunosuppressant dependent (e.g. prednisolone, anti-TNF) c. ESRF d. Type 2 DM (uncontrolled, (Hba1c >9% within 1 year) e. Pre-transplant patient (recipient) f. On renal replacement therapy g. Inmates in institution (Old Folks Home, prisoner)	Process	Percentage of LTBI screening	Data not available	10%	25%
3.2.1 Increase coverage for facilities with IGRA test	Output	Availability of IGRA test at health clinic	50%	75%	100%
3.3.1 TPT initiated within 1 month of diagnosis	Output	Percentage of enrolment to TPT	62%	75%	100%
3.3.2 Monitoring and follow up for two years	Output	Percentage of individual with LTBI completed TPT	53%	90%	90%
3.3.3 Availability of rifapentine	Process	Percentage of treatment with Rifapentine	0%	25%	50%
3.3.4 Development of DG circular and KPI for TPT	Process	Availability of document	No	Yes	Yes
3.4.1 Development of LTBI web-based system	Process	Availability of LTBI web-based system	No	Yes	Yes

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
3.4.2 Regular monitoring of data quality by TB team at various level	Process	Quarterly monitoring	Yes	Quarterly monitoring per year	Quarterly monitoring per year
3.4.3 Budget for development of LTBI system	Process	Availability of budget	No	Yes	Yes
3.4.4 Training for staff	Process	Number of training	Once per year	Once per year	Once per year
3.5.1 Promoting and educating the public through social media and electronic media	Process	No of activity	Yes	Once per year	Once per year
3.5.2 Assessment of the public knowledge, attitude, awareness and practices through general survey and opinion poll	Process	Survey done	No	Once in 5 year	Once in 5 year
3.5.3 Training on LTBI	Process	No. of training activities	Once a year	Once a year	Once a year
3.5.4 Integration of TB Active and LTBI screening module	Process	Availability of document	No	Yes	Yes
3.5.5 Academic syllabus at school, ILLKKM, Undergraduates	Process	Availability of document	No	Yes	Yes
Strategy 4. Enhance Control of TB Among Children					
4.1.1 Develop manual teaching module of Pediatric TB Management	Process	Availability of TB pediatric module	No	Module available by 2023	

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
4.2.1 Child friendly fixed dose formulation should be used to treat tuberculosis in children	Process	Availability of child friendly formulation	Not available	Child friendly formulation available by 2025	
4.2.2 Strengthen screening of TB infection among children who are contact of Index case TB	Output	Percentage of children (contact) screened for LTBI/ Active TB	22%	90%	90%
4.2.3 Regular TB paediatric audit meeting Involving TB Program Manager, Pediatrician, FMS and Public Health team in the committee	Output	No of meeting per year	2 times per year	2 times per year	2 times per year
4.2.4 Incidence reporting for missed screening of children among TB contacts	Process	No of incidence reporting per year	No data	Zero incidence reporting per year	Zero incidence reporting per year
4.3.1 To ensure availability of standard TPT management guidelines at all health care facilities	Process	Availability of guideline	Yes	Yes	Yes
4.3.2 Regular monitoring of coverage of TPT among children	Output	Monitoring per year	2 times per year	4 times per year (quarterly)	4 times per year (quarterly)
4.4.1 Enhance collaboration with maternal and child health program	Process	Meeting once per year	Meeting once per year	Meeting once per year	Meeting once per year
4.4.2 Availability of information, education and	Process	Availability of education materials	Yes	Yes	Yes

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
communication materials, vaccination kits and vaccine preventable diseases.					
4.5.1 Develop Task force of TB among children	Process	Availability of task force	No	Yes	Yes
4.5.2 Strengthen networking with other agencies (MOE/MAPTB/Professional society/NGOs	Process	No. of meeting	Once per year	Once per year	Once per year
4.5.3 TOT pediatric TB to other agencies	Process	No. of training	No Data	Once per year	Once per year
4.5.4 Engagement with NGOs: produce short video / infographic related to pediatric TB	Process	No of engagement	No data	Once per year	Once per year
Strategy 5:To Enable Supportive Environment and Systems For Effective TB Control					
5.1.1 Joint committee meeting with other agencies & NGOs (stakeholders)	Process	No. of meeting	Once per year	Once per year	Once per year
5.1.2 Continuous consultation on organizational roles & responsibilities	Process	No. of meeting	Once per year	Once per year	Once per year
5.2.1 Using social media for health promotion & awareness	Process	No. of activity	Once per year	Once per year	Once per year
5.2.2 Creating symbolism for National TB program through TB celebrity icon & TB ribbon	Process	No. of activity	No data	Once per year	Once per year

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
5.2.3 Documentary & Coverage of TB awareness/activities within mainstream/ social media	Process	No. of TB awareness programme	Once per year	Once per year	Once per year
5.2.4 TB talk during program / activities by other agencies e.g. religious gathering e.g. Khutbah Jumaat, Sunday Prayer	Process	No. of TB awareness programme	No data	Once per year	Once per year
5.3.1 Integrating TB awareness in existing health program.	Process	No. of TB awareness programme	Once per year	Once per year	Once per year
5.3.2 Include vulnerable population below through existing program by other agencies/NGO: ➢ Prisoners ➢ People who use drugs ➢ Migrants/refugees	Process	No. of TB awareness programme	Once per year	Once per year	Once per year
5.3.3 Develop and integrating basic TB education within existing program ➢ Prison ➢ AADK ➢ JKM and Other agencies/ NGOs	Process	No. of TB awareness programme	Once per year	Once per year	Once per year

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
5.4.1 Early Childhood/ Pre-school ➢ Develop simple TB curriculum using a Play based Activities	Process	No. of activity	No data	Once per year	Once per year
5.4.2 Primary & Secondary School ➢ TB in science / Pendidikan Kesihatan subjects ➢ TB in Science / Biology subjects	Process				
5.4.3 Tertiary Education Educating & molding of TB/health educators among college/university students	Process	No. of activity	No data	Once per year	Once per year
5.5.1 Identify workplace with high risk population & high burden of TB cases.	Process	No. of activity	No data	Once per year	Once per year
5.5.2. Adopting WHO/ILO guideline on workplace TB Control activities: ➢ Empower a group of workers with management representative (appoint as TB warrior)	Process	No. of activity	No data	Once per year	Once per year

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
➢ Develop a partnership with nearby healthcare facilities.					
5.6.1 Training communities on volunteer roles in screening & treatment adherence (DOT Supervisor)	Process	No. of training	No data	Once per year	Once per year
5.6.2 Engage the Community leader/ health unit leader of the 'Persatuan Penduduk', Ketua Kampung, Local Icon & selected ex-TB patient in the team	Process	No. of engagement	No data	Once per year	Once per year
5.6.3 Social Support: Home visit to motivate & review compliance, get feedback on problems encountered during treatment & facilitate patients for financial aid / other welfare need.	Process	No. of activity	No data	Once per year	Once per year
5.6.4 Integration of TB awareness & screening into programs e.g. ➢ Ziarah Kasih by YB ADUN ➢ State government program ➢ Community engagement program by various agencies	Process	No. of activity	No data	Once per year	Once per year

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
5.7.1 Increase awareness among GP on TB screening. Training on TB screening using MMA platform & Online CPD	Process	No. of activity	No data	Once per year	Once per year
5.7.2 Improving Private- Public sector referral system for TB. Direct referral through Liaison Officer in Klinik Kesihatan	Process				
5.7.3 Reward to GP who performs well in screening and detecting TB	Process	No. of activity	No data	Once per year	Once per year
5.7.4 Enforcing TB notification system in private sector	Process	Enforcement activity	No data	Once per year	Once per year
5.8.1 Enhance case detection & high-risk group screening	Output	No. of referral to healthcare clinic	No data	1%	1%
5.8.2 Find TB Program: help in finding missing cases, contacts tracing & defaulters	Process	No. of activity	No data	Once per year	Once per year
5.8.3 Provide *extra* support for TB patients and high-risk group (malnourishes, poor socioeconomic)	Process	No. of activity	No data	Once per year	Once per year
5.8.4 Provide EGT & TAS to TB patients.	Output	Budget for EGT &TAS	RM 400,000	Increment 100%	
5.9.1 Increase awareness and fight the prejudice towards TB in Malaysia:	Process	No. of activity	No data	Once per year	Once per year

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
➢ "Purple-Green Ribbon" Campaign ➢ Celebrities: Artist / Dai'e / Political idol / Instafamous ➢ Act as Media Spokesperson on behalf of MAPTB					
5.9.2 Increase commitment /pledge/ CSR among corporate entities/foundation	Process	No. of activity	No data	Once per year	Once per year
Strategy 6: To Intensify Research and Innovation					
6.1.1 Coordinate and work with Research & Technical Support, MOH Program	Process	A mandated coordinating body		Once per year	
6.2.1 To advocate translation of research and innovation into policy	Process	At least 1 awareness programme for all research institutions and NGOs			
6.2.2 To prepare a mechanism/ algorithm for policy recommendation paper based on research and innovation findings	Process	Number of research findings that has written and submitted a policy recommendation paper/section		Once per year	

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
6.3.1 To formulate the national TB research and innovation agenda and priorities	Process	A document on National TB Research Agenda		1 per NSPTB review period	
6.3.2 Construct a set of unique and country specific TB research and innovation priorities based on the current TB epidemic	Process	An inventory of relevant TB research and innovation: ▪ TB Inventory Study ▪ Lab based research- diagnostic tools ▪ Comprehensive TB catastrophic costing study ▪ Digital health information architecture ▪ Interactive health education tools – e.g. TB Apps, animations ▪ Big Data, AI and advanced analytics ▪ Cost benefit analysis – ROI Health setting research			

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
6.4.1 Develop financing mechanism to address TB with the highest priority	Process	Establish a working committee that includes all relevant stakeholders		Once a year	
6.4.2 Mechanism of funding for research and innovation operations, training and infrastructure	Process	Establish a coordinating body		1 per NSPTB review period	
6.5.1 Establishing a working committee that includes all relevant stakeholders	Process	A mandated working committee		Every 2 years	
6.5.2 Establish a coordinating body	Process	A mandated coordinating body			
6.5.3 Formulate inter and intra agency research collaboration and cooperation	Process	A document on mechanism of collaboration and cooperation		1 per NSPTB review period	
6.5.4 Mechanism for the collaboration between NTRIN and public health conjoint board under MPH and DrPH program	Process	An memorandum of agreement of at least 1 research project			

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
6.5.5 Coordinate with NGOs for public participation	Process	At least 1 community-based intervention programme		Every 2 years	
6.6.1 Determine TB training activities	Process	Inventory of TB skills/expertise required and the training programme			
6.6.2 Collaborate with NIH for training activities	Process	Identified organisation of training programmes based on demand/desired skills identified			
6.6.3 Involvement in the National TB Conference	Process	At least 1 awareness programme during the conference			
6.7.1 Identify partners	Process	Network construct incorporating all identified stakeholders			
6.7.2 To galvanize stakeholders to participate in TB research via advocacy groups	Process	Number of researches with advocacy groups participation			

Activities	Indicator	Monitoring	Baseline (2020)	Target 2025	Target 2030
6.7.3 Conduct working group meetings	Process	Number of network group meetings		Every 2 years	
6.7.4 Initiate and encourage NGO public support through community-based	Process	At least 1 MOA on programme			
6.7.5 Participate in National World TB Day activities	Process	At least 1 community-based intervention programme during World TB Day			
6.8.1 Aligned indicators with TB sector and continual monitoring	Process	Process – coordinating body			
6.8.2 Developing a centralised database on TB research and innovation	Process	A centralised database on TB research			
6.8.3 Establishing a follow-up mechanism on TB research and innovation	Process	Process – coordinating body			
6.8.4 Periodic reporting of TB research and innovation findings to stakeholders	Process	At least 1 research review			

5. Financing

This section will estimate the total TB program needs for implementation of TB intervention activities in this document. Financial needs estimates were performed for each of the strategies. The estimated budget need is as below:

Activities	Unit	Estimated Unit Cost (RM)	Cost for One Year		Target 2021- 2025		Target 2026-2030	
			No of Unit	Cost (RM)	No of Unit	Cost (RM)	No of Unit	Cost (RM)
Strategy 1: Enhance Case Detection of TB & Co-Morbidity Management								
1.3.2 Ultra-portable xray with AI technologies for detection of TB	x-ray machine	400,000	15	6,000,000	15	6,000,000		
1.3.3 Outsourcing of mobile x-ray	X-ray unit	75	10,000	750,000	50,000	3,750,000	50,000	3,750,000
1.5.1 Enhance data reporting system	Upgrading MyTB system	500,000				500,000		
Strategy 1:Cost				**6,750,000**		**10,250,000**		**3,750,000**
Strategy 2: Enhance Programmatic Management of Drug Resistant Tuberculosis (PMDT)								
2.2.2 Use of rapid molecular diagnostic tools for early detection of TB/DR-TB	GeneXpert MTB RIF	100,000	15	1,500,000	30	3,000,000	0	0
	MTB/Rif cartridge	85	5000	425,000	25,000	2,125,000	50,000	4,250,000
2.3.2 Availability of new shorter	100 patients	2,000,000	300	6,000,000	1500	30,000,000	1500	30,000,000

Activities	Unit	Estimated Unit Cost (RM)	Cost for One Year		Target 2021- 2025		Target 2026-2030	
			No of Unit	Cost (RM)	No of Unit	Cost (RM)	No of Unit	Cost (RM)
second-line drugs								
Strategy 2:Cost				**7,925,000**		**35,125,000**		**34,250,000**
Strategy 3: Enhance Programmatic Management of Latent TB Infection (PMLTBI)								
3.1.2 Screening with IGRA for HRG	IGRA test	80	50,000	4,000,000	250,000	20,000,000	500,000	40,000,000
3.3.3 Availability of Rifapentine	Rifapentine 900 mg weekly for 3 months	200	5,000	1,000,000	25,000	5,000,000	50,000	10,000,000
Strategy 3: Cost				**5,000,000**		**25,000,000**		**50,000,000**
Strategy 4: Enhance Control of TB Among Children								
4.2.1 Child-friendly fixed-dose formulation to treat TB in children	RHZ 75/50/150 per patient RH75/50 per patient	300	1000	300,000	3500	1,050,000	5000	1,500,000
Strategy 5: Enable Supportive Environment and Systems for Effective TB Control								
5.8.2 Find TB Program: help in finding missing cases, contacts tracing & defaulters	Selected high burden district	20,000	2	40,000	10	100,000	20	400,000
Total Strategy 1, 2,3, 4 and 5: Cost				**20,015,000**		**71,625,000**		**89,900,000**

APPENDIX 1

THE END TB STRATEGY: AT A GLANCE

VISION: A WORLD FREE OF TB

Zero death, diseases and suffering due to Tuberculosis

GOAL: END THE GLOBAL TB EPIDEMIC

INDICATORS	MILESTONE		TARGETS	
	2020	2025	2030*	2035
Reduction in the number of TB deaths compared with 2015	35%	75%	90%	95%
Reduction in TB Incidence rate **ocompared with 2015**	20% <85 per 100,000 population	50% <55 per 100,000 population	80% <20 per 100,000 population	90% <10 per 100,000 population
TB-affected families facing catastrophic costs due to TB	0	0	0	0

PRINCIPLES

1. Government stewardship and accountability, with monitoring and evaluation
2. Strong coalition with civil society organizations and communities
3. Protection and promotion of human rights, ethics and equity
4. Adaptation of the strategy and targets at states level, with global collaboration

PILLARS AND COMPONENTS

1. INTEGRATED, PATIENT-CENTRED CARE AND PREVENTION

- A. Early diagnosis of TB including universal drug-susceptibility testing, and systematic screening of contacts and high-risk groups
- B. Treatment of all people with TB including drug-resistant TB, and patient support
- C. Collaborative TB/HIV activities, and management of co-morbidities
- D. Preventive treatment of persons at high risk, and vaccination against TB

2. BOLD POLICIES AND SUPPORTIVE SYSTEMS

- A. Political commitment with adequate resources for TB care and prevention
- B. Engagement of communities, civil society organizations, and public and private care providers
- C. Universal health coverage policy, and regulatory frameworks for case notification, vital registration, quality and rational use of medicines, and infection control
- D. Social protection, poverty alleviation and actions on other determinants of TB

3. INTENSIFIED RESEARCH AND INNOVATION

- A. Discovery, development and rapid uptake of new tools, interventions and strategies
- B. Research to optimize implementation and impact, and promote innovations

APPENDIX 2

People –centred care

- In the past, TB control programmes emphasized supportive supervision or directly observed therapy (DOT) by health-care workers or treatment partners by engaging volunteers, families and communities.
- While supportive supervision will remain a foundation of effective TB control, it only partially addresses patient needs. We must go further – towards comprehensive people-centred TB care that is sensitive and responsive to the medical, psychosocial and financial needs of all patients and families affected by TB.
- Many of the challenges faced by NTPs require actions that increase people-centredness and the continuum of TB services.
- The journey towards people-centred health care requires change within four domains:
  (1) individuals, families and communities;
  (2) health-care workers;
  (3) health-care organizations (facilities); and
  (4) health systems.

(1) Informed and empowered individuals, families and communities

- Enable patients, families, community representatives and civil society organizations to be actively engaged in TB programme planning, implementation, service delivery and monitoring, as well as research and advocacy.
- Facilitate the exchange of information among patients, families and peer support groups.
- Promote and empower patient organizations and peer support groups at national, subnational and community levels.
- Disseminate experiences of TB patients, families and communities through media and public events.
- Build a strong coalition of stakeholders that advocate equitable access to people-centred quality TB services, as well as to eliminate stigma and discrimination associated with TB at all levels of society.
- Empower people and communities to demand quality services to meet their needs and expectations.

(2) **Competent and responsive health-care workers**

(3) Review methods and materials for the training of health-care and TB care workers taking into account the core competencies that are relevant to people-centred care.

(4) Adequately prepare all TB care workers to provide holistic care including basic communication and counselling skills, and skills to address non-TB morbidities and psychosocial issues through service coordination.

- Establish patient–provider relationships built on respect, compassion and principles of nondiscrimination and equity.
- Ensure regular, supportive and integrated supervision, including feedback mechanisms, to guide and empower health workers and to instil greater confidence in TB care.
- Ensure workforce sufficiency in terms of quantity and quality, taking into account staff turnover.
- Build a supportive environment for health workers to provide services to TB patients by offering appropriate training and provider incentives, setting up infection control measures and taking steps to eliminate stigma and discrimination against TB care workers.

(3) Efficient and humane health-care organizations (facilities)

- Build capacity to offer psychological, welfare and legal support for TB patients through strong service coordination.
- Support easy referral and continuity of care (one-stop approach).
- Improve access to TB diagnosis and treatment with particular attention to the poorest and most vulnerable population groups e.g. expanding treatment outlets in the poorest rural and urban settings, involving providers who practise close to where patients live.
- Identify and address discrimination, gender and equity issues.
- Ensure facility design with emphasis on access, people and family friendliness, while ensuring patient safety and proper infection control.

(4) Supportive health-care systems

- Ensure TB services are free of charge or heavily subsidized and patient financial burden is minimized.
- Ensure quality and safety of TB care through appropriate, effective mechanisms such as facility standards (e.g. infection control, diagnostic capacity and quality) and professional standards (i.e. ISTC) through certification, accreditation, registration and renewal of licenses.
- Establish and strengthen mechanisms for feedback, such as routine collection of service evaluation, patient satisfaction surveys and community dialogue.

APPENDIX 3

CASE DEFINITION

Bacteriologically Confirmed Tuberculosis

A bacteriologically confirmed TB case is one from whom a 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.

Clinically Diagnosed Tuberculosis

A clinically diagnosed TB case is one who does not fulfil the criteria for bacteriological confirmation but has been diagnosed with active TB by a clinician or other medical practitioner who has decided to give the patient a full course of TB treatment. This definition includes cases diagnosed on the basis of X-ray abnormalities or suggestive histology and extra pulmonary cases without laboratory confirmation. Clinically diagnosed cases subsequently found to be bacteriologically positive (before or after starting treatment) should be reclassified as bacteriologically confirmed.

Bacteriologically confirmed or clinically diagnosed cases of TB are also classified according to:

- anatomical site of disease;
- history of previous treatment;
- drug resistance;
- HIV status.

Case classification
Classification based on anatomical site of disease

Pulmonary tuberculosis (PTB) refers to any bacteriologically confirmed or clinically diagnosed case of TB involving the lung parenchyma or the tracheobronchial tree. Miliary TB is classified as PTB because there are lesions in the lungs. Tuberculous intra-thoracic lymphadenopathy (mediastinal and/or hilar) or tuberculous pleural effusion, without radiographic abnormalities in the lungs, constitutes a case of extra

pulmonary TB. A patient with both pulmonary and extra pulmonary TB should be classified as a case of PTB.

Extra pulmonary tuberculosis (EPTB) refers to any bacteriologically confirmed or clinically diagnosed case of TB involving organs other than the lungs, e.g. pleura, lymph nodes, abdomen, genitourinary tract, skin, joints and bones, meninges.

Classification based on history of previous TB treatment (patient registration group)

Classifications based on history of previous TB treatment are slightly different from those previously published. They focus only on history of previous treatment and are independent of bacteriological confirmation or site of disease. Also note that the registration groups for DR-TB are slightly different and are described in the *Companion handbook to the 2011 WHO guidelines for the programmatic management of drug-resistant tuberculosis*, due for publication by WHO in 2013.

New patients have never been treated for TB or have taken anti-TB drugs for less than 1 month.

Previously treated patients 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:

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).

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.

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. (These were previously known as *treatment after default* patients.)

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.

Patients with unknown previous TB treatment history do not fit into any of the categories listed above.

New and relapse cases of TB are **incident** TB cases.

Classification based on drug resistance

Cases are classified in categories based on drug susceptibility testing (DST) of clinical isolates confirmed to be *M. tuberculosis*:

- **Monoresistance:** 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:** resistance to any fluoroquinolone and to at least one of three second-line injectable drugs (capreomycin, kanamycin and amikacin), in addition to multidrug resistance.
- **Rifampicin resistance:** resistance to rifampicin detected using phenotypic or genotypic methods, with or without resistance to other anti-TB drugs. It includes any resistance to rifampicin, whether monoresistance, multidrug resistance, polydrug resistance or extensive drug resistance.

APPENDIX 4

Treatment outcome definitions

The new treatment outcome definitions for Drug Susceptible and Drug Resistant TB (WHO,2021) are as below:

Outcome	Definition
Treatment failed	A patient whose treatment regimen needed to be terminated or permanently changed[a] to a new regimen or treatment strategy.
Cured	A pulmonary TB patient with bacteriologically confirmed TB at the beginning of treatment who completed treatment as recommended by the national policy, with evidence of bacteriological response[b] and no evidence of failure.
Treatment completed	A patient who completed treatment as recommended by the national policy, whose outcome does not meet the definition for cure or treatment failure.
Died	A patient who died[c] before starting treatment or during the course of treatment.
Lost to follow-up	A patient who did not start treatment or whose treatment was interrupted for 2 consecutive months or more
Not evaluated	A patient for whom no treatment outcome was assigned.[d]
Treatment success	The sum of cured and treatment completed.

[a] Reasons for the change include:
- no clinical response and/or no bacteriological response (see note 'b');
- adverse drug reactions; or
- evidence of additional drug resistance to medicines in the regimen.

[b] "Bacteriological response" refers to bacteriological conversion with no reversion.
- "bacteriological conversion" describes a situation in a patient with bacteriologically confirmed TB where at least two consecutive cultures (for DR-TB and DS-TB) or smears (for DS-TB only), taken on different occasions at least 7 days apart, are negative.
- "bacteriological reversion" describes a situation where at least two consecutive cultures (for DR-TB and DS-TB) or smears (for DS-TB only), taken on different occasions at least 7 days apart, are positive either after the bacteriological conversion or in patients without bacteriological confirmation of TB.

[c] Patient died for any reason.

[d] This includes cases "transferred out" to another treatment unit and those whose treatment outcome is unknown; however, it excludes those lost to follow-up.

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