



Taiwan's End Tuberculosis (TB) by 2035 Project Phase II

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Ministry of Health and Welfare

Republic of China (Taiwan)

Table of Contents

I. Project Origin.....	1
(I) Basis	2
(II) Strengths and Weaknesses of TB Control and Prevention System in Taiwan	2
(III) Challenges in TB Control and Prevention in Taiwan	7
II. Project Objectives	12
(I) Objective Explanation	12
(II) Performance Indicators, Measurement Standards, and Target Values	12
III. Review of Current Relevant Policies and Programs	17
(I) Epidemiological Analysis of the Overall Effectiveness of TB Control and Prevention	17
(II) Enhancing the Disease Control Infrastructure and Prevention Strategies	20
(III) Patient-Centered Integrated Care Strategy.....	30
(IV) Strengthening Operational Research and Innovating Technologies	40
(V) Expanding International Collaboration on Control and Prevention	42
IV. Execution of Strategies and Methods	45
(I) Main Tasks.....	45
(II) Breakdown of (Annual) Implementation Strategy.....	45
(III) Course and Methods of Execution, and Division of Labor.....	48
A. Strengthening disease control infrastructure and prevention network	48
B. Proactive detection and early intervention in target populations.....	63
C. Patient-centered care and case management	73
D. Preventing onset and interrupting transmission.....	88
V. Timeline and Resource Requirements	101
(I) Project Timeline	101
(II) Funding Sources and Calculation Criteria	101
(III) Funding Requirements (including annual breakdown) and Coordination with Mid-term Expenditure Estimates.....	103
VI. Expected Outcomes and Impact.....	105



I. Project Origin

The World Health Assembly (WHA) endorsed the "Global Strategy and Targets for Tuberculosis Prevention, Care, and Control after 2015" proposed by the World Health Organization (WHO) in May 2014. The future effort aims to "End the Global Epidemic of Tuberculosis" with the vision of "ZERO deaths, disease and suffering due to TB." It envisions a 50% reduction in TB incidence rate by 2025 compared to 2015, and a 90% reduction by 2035. In comparison with 2015, a 75% decrease in TB-related deaths is to be achieved by 2035, ultimately progressing towards the elimination of TB with a 95% reduction. A concomitant of this goal is the elimination of TB-induced catastrophic costs experienced by families. This initiative aligns with the United Nations' "2030 Agenda for Sustainable Development," making the eradication of TB a political priority. It is expected to contribute to achieving universal health coverage within national legislative and policy frameworks.

To achieve the objectives of the plan, WHO advocates proactive implementation of three key pillars, i.e., "Integrated, Patient-Centered Care and Prevention," "Bold Policies and Supportive Systems" for TB control and prevention, and "Intensified Research and Innovation," for the fulfillment of control and prevention policies WHO further warns that without more effective new tools along with innovative approaches to prevention, diagnosis, treatment and care, the global goal of eliminating TB may remain unattainable. The ongoing shortage of funds is also identified as a significant obstacle that could severely impede progress in efforts to eradicate TB.

TB is relevant to everyone, with the most significant impact on impoverished and vulnerable populations, such as children and the elderly. Factors like smoking, alcohol and substance abuse, air pollution, silica dust exposure, HIV infection, diabetes, and malnutrition all contribute to an increased risk of TB infection. The perceived or extrinsic stigma and discrimination faced by TB patients remain the most critical obstacles in current TB control and prevention efforts. Currently, global average TB incidence only saw a 2% decline. International experts and scholars emphasize the need for continuous efforts in treating latent tuberculosis infection (LTBI) and active TB, along with the development of new drugs, vaccines or diagnostic technologies to accelerate the reduction in incidence. These measures are essential to achieving the goal of eradicating TB.

As of now, TB remains one of the serious infectious diseases affecting public health in Taiwan. Its severity surpasses the combined impact of all other infectious diseases, posing threats not only to people's health and lives but also eroding societal productivity. Moreover, it significantly impairs national competitiveness and national image. Given the absence of new prescriptions and vaccines at the international level, TB control and prevention efforts in Taiwan aim to not only continually improve existing strategies such as TB diagnosis, case management and the Directly Observed Treatment Short-Course (DOTS) program, but also seek to sufficiently resource the enhancements of active TB detection (Find TB) and of strategies for treating LTBI in target populations (Prevent TB) through this current initiative. By implementing more robust and effective prevention and intervention measures, the project aims to halt the transmission of TB bacteria. The ultimate objective is to move towards the goal of eliminating TB by 2035.

(I) Basis

- A. The Communicable Disease Control Act.**
- B. Section 4 of the 2025 Health and Welfare Policy White Paper, "Achieving a Further Halving of Tuberculosis and Aiming for Zero Growth in AIDS Cases."**
- C. The "Promoting health of all citizens" policy from the "Happy Homeland" section of the 2018 National Development Plan.**

(II) Strengths and Weaknesses of TB Control and Prevention System in Taiwan

- A. The TB control and prevention system in Taiwan is a robust synergy of public health, health care and diagnostic components.**

(A) The three major pillars of healthcare, diagnostics, and public health provide the foundation for TB prevention.

Since 2001, TB control and prevention system has been operating under the triple-network model consisting of "medical system," "diagnostic system" and "public health system," successfully establishing the cornerstone for TB control and prevention. Through collaboration

between public health and medical sectors, the system provides patients with diagnosis, comprehensive treatment and case management services. The overall control and prevention network comprises the Taiwan Centers for Disease Control (TCDC) and regional control centers, local county and city government health bureaus, township health offices, as well as frontline healthcare institutions and laboratories. All these units work together to contribute to TB control and prevention efforts in Taiwan. They not only provide comprehensive services in terms of individual case diagnosis and community care, but also collaborate to implement proactive screening/preventive mechanisms for high-risk individuals with TB, thus realizing the three-stage and five-level public health control and prevention strategy.

Since 2008, the TB laboratory accreditation system has been applied to improve the accuracy and efficiency of TB testing via encouraging laboratories to participate in certification, proficiency testing, and regular personnel training. As of 2019, there are 34 accredited TB laboratories nationwide, conducting an average of 500,000 to 600,000 TB specimen tests each year. Under the monitoring and guidance of an External Quality Assurance (EQA) system, each laboratory can provide stable testing quality which ensures that clinical physicians have reliable and comprehensive test results for diagnosing TB patients. Moreover, by tracking the quantity of bacteria in sputum during a patient's treatment process, an objective assessment of treatment effectiveness can be conducted. This serves as an effective basis for monitoring to interrupt the transmission of TB. It is evident that the current TB testing system in our country is well-established, and the testing quality can be maintained at a certain level.

- (B) The National Health Insurance (NHI) ensures the right to medical care for the public while also taking into consideration the quality of TB diagnosis and care.

In Taiwan, the diagnostic and treatment expenses for TB have not only been covered by NHI but have also been subsidized through public budget allocations by the TCDC since 2006. This financial support aims to alleviate

the economic burden on individuals seeking treatment, thereby reducing instances of "sickness due to poverty." Furthermore, our country has a widespread network of healthcare institutions in various regions, providing the public with convenient and freely selectable medical environments. In addition to community care provided by public health nurses from local health centers, our country, in comparison to other nations, implements the "Tuberculosis Case Management System" within hospitals. This system involves hospital case managers who provide education and care for TB cases, promoting collaboration between clinical and public health aspects. Hospitals are encouraged to establish "Tuberculosis Control and Prevention Committees" that facilitate professional discussions on the medical management of TB patients, ensuring more timely and appropriate treatments. This approach enhances the willingness and stability of the public in seeking medical attention, offering high-quality care services.

In November 2001, the Bureau of NHI (now the NHI Administration, NHIA) initiated a pay-for-performance (P4P) pilot program in TB care, which was formally incorporated into the NHI payment standards in 2004. The goal was to enhance the quality of care for TB patients, ensuring their complete recovery, reducing the wastage of medical resources, and improving the efficiency of healthcare utilization. Follow-up data indicated that the completion rate of treatment after 18 months for cases participating in the TB P4P program was 75% in 2001, compared to 63% for non-participating cases. In 2004, the completion rate increased to 84% for participating cases and remained at 61% for non-participating cases, demonstrating better treatment outcomes for those involved in the TB P4P scheme. Additionally, the collaborative relationship between the healthcare and public health systems has become more robust in practice. However, considering the project's focus on eliminating TB, the treatment of LTBI is a crucial aspect of control and prevention efforts. As of 2020, cases undergoing treatment for LTBI are not included in the payment standards, which prevents the integration of medical and public health systems to provide more comprehensive care services.

B. The Communicable Disease Control Act serves as the legislative backbone for TB control and prevention.

In accordance with the regulations of the Communicable Disease Control Act, there is a clear division of responsibilities between the central and local authorities. The central government is responsible for integrating and coordinating overall mandatory notifiable infectious diseases prevention efforts, and for overseeing, directing, supervising, and assessing local county and city health bureaus on the implementation of infectious disease-related matters. Local authorities have the flexibility to adjust policies based on regional considerations and execute various control and prevention tasks. To safeguard public welfare and address non-cooperation or individuals posing a risk of infecting others, county and city health bureaus have the authority, in accordance with the procedures stipulated in the Communicable Disease Control Act, to enforce legally mandated isolation measures for infectious diseases. This prevents the spread of communicable TB within the community and effectively halts the escalation of the epidemic.

C. The advancement and development of new drugs, vaccines, and diagnostic technologies contribute to the diversity of preventive strategies.

TB patients may face challenges in treatment adherence due to the lengthy treatment duration or side effects of medication, leading to potential abandonment of treatment and an inadvertent increase in the risk of drug-resistant strains. Currently, there are numerous international studies addressing issues related to TB prevention, diagnosis, and treatment. These studies provide new opportunities for the development of vaccines, diagnostic tools, and drugs. Some novel diagnostic tools and drugs have shown promising initial results, offering advantages such as lower side effects, increased safety, and greater efficacy in combating TB, providing patients with more choices of medication. Furthermore, the development of molecular biological assays significantly shortens the turn-around-time for TB bacteria testing, allowing for faster diagnoses by

healthcare professionals. Additionally, the Global Tuberculosis Vaccine Foundation (Aeras) is actively researching vaccines against adult TB, such as M72/AS01, which has completed the second phase of trials. If successfully developed, it would represent a significant milestone in the fight against TB.

D. Frequent turnover of public health personnel hinders the effective transfer of control and prevention experience.

The treatment and management of TB cases require a considerable level of healthcare expertise to provide quality care services. Due to the complexity and diversity of responsibilities at health centers, coupled with varying levels of cooperation from TB cases, difficulty in reaching homeless individuals, residents in mountainous aboriginal regions (MARs), and impoverished individuals living alone, frontline workers often need to invest more effort and time in executing management tasks, placing a substantial burden on street-level healthcare personnel. Furthermore, in recent years, Taiwan's TB control and prevention strategies have focused on early preventive measures, such as contact investigations, examinations and the treatment of LTBI. This underscores the need for increased workloads for street-level control and prevention personnel to ensure the quality and subsequent benefits of implementing these strategies.

E. Lack of support from non-governmental organizations impedes the expansion of the control and prevention network.

The internationally renowned non-governmental organization Partners In Health (PIH), in collaboration with academic institutes, is dedicated to the development of communities in developing countries to overcome poverty and diseases. By providing treatment, care and other support, PIH has contributed to achieving the WHO's goal of halving the TB incidence rate in Peru over a decade. This illustrates the significant benefits of collaboration between non-governmental organizations and national healthcare systems in promoting control and prevention strategies. In the context of HIV control and prevention in Taiwan, over 20

non-governmental organizations actively participate and engage in advocacy for the rights of HIV-infected individuals, seeking welfare benefits, providing short-term care, screening, education, and other services. Some organizations also serve as platforms for teaching and research on HIV prevention, rallying diverse communities to contribute collectively to HIV prevention efforts, demonstrating considerable effectiveness. Furthermore, for over 2,000 registered patients with rare diseases in Taiwan, more than ten non-governmental organizations are involved in establishing patient support groups, providing patient and family care services, public advocacy, and advocating for relevant legislation. In comparison, the support and care for thousands of TB cases in Taiwan each year heavily rely on the healthcare and public health systems, facing difficulty in the expansion of the control and prevention network without strong support from non-governmental organizations.

(III) Challenges in TB Control and Prevention in Taiwan

A. The effectiveness of reducing TB incidence is limited due to population aging.

According to the data estimated by the National Development Council in 2018 regarding the population structure in Taiwan from 2018 to 2065, Taiwan has officially entered an "aging society" in 2018, with the population aged 65 and above accounting for 14% of the total population. It is projected to transition to a "super-aged society" by 2026, where the population aged 65 and above will constitute 20% of the total population. Due to the historically high prevalence of TB in the elderly population in Taiwan, the positivity rate for LTBI in individuals aged 65 and above is approximately 30%. Currently, individuals aged 65 and above account for over 60% of all TB cases. The elderly population is more susceptible to the reactivation of latent tuberculosis due to factors such as gradual immunity decline and the presence of other chronic diseases. If individuals also suffer from comorbidities like diabetes, HIV infection or end-stage renal disease (ESRD), the time for sputum conversion after treatment is

generally longer, and the survival rate post-treatment is also lower. Managing cases in this demographic is not only more complex in terms of treatment, but also poses challenges for individual case management. Moreover, with the ongoing aging of the population in Taiwan and the increasing demand for long-term care, the role of long-term care facilities with a focus on centralized care management becomes crucial. Integrating these facilities into the long-term care system is becoming increasingly important for implementing effective TB control and prevention strategies.

B. LTBI carriers within certain groups face a higher risk of developing active TB compared to the general population.

According to WHO estimates, approximately one-fourth of the global population has LTBI, and 10-15% of them may progress to active TB. The risk of developing the disease can be reduced through preventive treatment. It is recommended to provide LTBI treatment for specific high-risk groups, including contacts (especially children under 5 years old), individuals with HIV infection, immunocompromised individuals such as organ transplant recipients, users of tumor necrosis factor inhibitors, dialysis patients, silicosis patients, and other high-risk populations in congregate settings, such as correctional facilities, healthcare workers, and long-term care facilities. This is to effectively prevent the progression to TB in these individuals.

C. The issue of health inequality in MARs has led to a higher TB incidence rate compared to the national average.

MARs are high-incidence regions for TB in Taiwan. Over the past decade, health authorities have been dedicated to active case finding in these areas, resulting in a gradual reduction in the incidence rate compared to the national average. However, the incidence rate remains approximately three times higher than the general population. Further analysis of two transmission indicators at the time of TB diagnosis reveals that in MARs (with smear- and culture-positive rates of 43% and cavitation on chest X-rays of 18%), both indicators are higher than the national

average (with smear- and culture-positive rates of 36% and cavitation on chest X-rays of 14%). This indicates a more severe delay in diagnosis in these areas, possibly due to a lack of medical resources and transportation challenges. Patients often seek medical attention only when their condition worsens and becomes disturbing, potentially leading to TB transmission during the period between symptom onset and seeking medical care and posing a significant threat to public health and community prevention. Moreover, the current active case finding for TB in MARs primarily relies on mobile X-ray screening services. Despite its advantage to proactively identifying cases and avoiding delayed diagnosis, additional strategies are necessary to overcome challenges in some remote areas. These challenges include narrow and steep roads, transportation obstacles restricting access of the X-ray mobile vehicle to specific locations, mobility issues which prevent individuals from standing for chest X-ray screening, and limitations for people unable to participate in screening activities due to work or education commitments. Furthermore, people not living in their registered residence restricts the discovery rate to the young and elderly populations, making it challenging to expand to the working age group. Additionally, there is a need to promote TB awareness and improve healthcare accessibility among the aboriginal population in MARs.

D. Frequent international exchanges and the increasing migrant population pose a growing challenge in the face of drug-resistant tuberculosis outbreaks.

According to the WHO Global TB Report for the year 2018, worldwide in 2017, there were 560,000 people resistant to the most effective first-line drug, rifampicin, with 82% classified as having multidrug-resistant tuberculosis (MDR-TB), indicating resistance to at least rifampicin and isoniazid. Three countries with the most severe MDR-TB epidemics were India at 24%, China at 13%, and Russia at 10%, collectively accounting for nearly half of the global cases. These countries are all located in or near Asia. Additionally, neighboring countries with close and frequent

exchanges with Taiwan, such as the Philippines, Indonesia, Vietnam, and Thailand, are also considered high-burden MDR-TB countries and serve as major source countries for foreign workers in Taiwan.

According to the WHO statistics for the year 2018, 3.5% of new TB cases and 18% of retreatment cases are diagnosed as MDR-TB or rifampicin-resistant tuberculosis (RR-TB). In Taiwan, approximately 1.5% of new TB cases are RR-TB, and 1% are MDR-TB. In recent years, the majority of MDR-TB cases with a history of overseas travel or residence have originated from China or Vietnam, accounting for approximately 13% of reported MDR-TB cases. Statistical data indicates that the number of reported confirmed TB cases among foreign nationals in Taiwan has increased from approximately 450 cases in 2008 to around 850 cases in the past five years. Additionally, there have been cases of Taiwanese businesspeople infected with MDR-TB in China returning to Taiwan for treatment, as well as cases of students or new immigrants from China diagnosed with MDR-TB in Taiwan. These cases highlight the growing threat to public health in Taiwan posed by the TB situation in neighboring countries.

E. The general public still lacks sufficient awareness of TB or LTBI, and the issue of stigmatization of the disease persists.

WHO points out that the perceived shame and external discrimination experienced by TB patients remain the most critical barriers in current TB control and prevention efforts. According to a 2017 survey on public attitudes toward preventive treatment for LTBI conducted by the TCDC, 65% of the population has a relatively positive attitude towards preventive medication for LTBI. However, there remains 10% of the population with a negative attitude towards treatment. Among them, those with lower awareness of epidemic prevention or fewer daily hygiene routines exhibit a significantly higher rate of negative attitudes towards treatment. In addition, the public's perception of the risk of TB infection is relatively low, with some mistakenly believing that TB has been eradicated from society. Internationally, TB is referred to as the "Silent killer,"

indicating insufficient public awareness of TB which leads to the neglect of its severity or even the misconception that TB no longer exists, resulting in failure to seek medical attention promptly when patients experience symptoms of TB. Patients may not realize the importance of seeking medical care promptly for sputum testing and chest X-rays, leading to delayed medical treatment and the continued spread of the disease in the community. On the other hand, with the continuous decline in the number of newly reported domestic cases, clinical physicians have fewer opportunities to diagnose and care for TB patients, causing declined vigilance which may result in physicians failing to suspect TB in patients with respiratory symptoms, leading to delayed diagnosis in the medical aspect.

II. Project Objectives

(I) Objective Explanation

In response to the WHO initiative for TB, our objectives are to reduce the incidence of new TB cases in Taiwan, provide a safe living environment for the people, and improve the international ranking of TB incidence, enhancing the competitiveness of national development.

(II) Performance Indicators, Measurement Standards, and Target Values

To make the indicators of this plan more meaningful and align with the epidemiological trends of TB in Taiwan, the expected performance indicators are planned as follows based on expert assessments:

A. Primary objective

This plan aligns with the WHO's global goal to achieve a TB incidence rate of 10 cases per 100,000 population by 2035. In 2018, the TB incidence rate in Taiwan was 39 cases per 100,000 population. Due to factors such as population aging, about 60% of diagnosed TB cases in Taiwan are among individuals aged 65 and older. With a focus on active case finding strategies in this plan to identify potential cases, it is estimated that the TB incidence rate will decrease to 35 cases per 100,000 population in 2020, with a projected reduction of 6%. The goal is to further reduce the incidence rate to 25 cases per 100,000 population by 2025. The plan aims to leverage worldwide emerging technologies to gradually move towards the ultimate goal of TB elimination by 2035.

B. Performance indicator

(A) TB case management performance

- a. Age-specific treatment success rate by 2025: 92% for the population under 45 years old, 82% for the age group between 45 and 64, and 60% for the population aged 65 and above.

In recent years, Taiwan has been committed to the DOTS program promotion. With the assistance of DOTS caregivers, most TB patients

have been able to successfully complete their treatment. However, due to factors such as an aging population and comorbidities, elderly patients often die from other comorbid conditions during the follow-up process, which limits the growth space for the treatment success rate. According to the 2017 Taiwan Tuberculosis Control and Prevention Annual Report, the treatment success rates in 2016 for reported cases of TB in different age groups were 89% for those under 45 years old, 81% for the 45-64 age group, and 60% for those aged 65 and above. On the foundation of the first-phase plan, this current plan aims to continue utilizing age group-based strategies to address challenges such as insufficient public health personnel, and increase clinical physicians' willingness to provide care. The goal is to improve treatment success rates for patients and achieve the predetermined objectives.

b. HIV testing rate among TB cases

By 2025, the HIV testing rate for TB cases should reach 80%.

WHO has pointed out that TB is one of the most common diseases that affect HIV-infected individuals, including those receiving antiretroviral therapy, and is a major cause of AIDS-related deaths. In 2018, the HIV screening rate for all TB cases was 24.7%. In view of this, there will be a comprehensive expansion of HIV testing for TB cases, along with the establishment of an ongoing collaborative model for the co-management of TB and HIV, to alleviate the burden of TB for HIV-infected individuals and vice versa.

(B) Performance of TB prevention among high-risk individuals

By 2025, the number of LTBI individuals receiving treatment should reach 9,500, with a completion rate of 86.5%.

Since the implementation of the LTBI treatment policy in Taiwan, the target population has been gradually expanded based on indicators such as infectiousness of index cases and the age group of contacts. It initially focused on high-infectiousness index cases and younger age group contacts, expanding to the entire age spectrum of contacts, index

patients with moderate infectiousness and contacts with comorbidities. As the incidence of new TB cases in Taiwan has shown a declining trend, the number of contacts has correspondingly decreased. To achieve the goal of TB elimination by 2035, there is a need to proactively promote LTBI treatment in high-risk populations beyond contacts. In 2018, the number of individuals with LTBI joining treatment reached 9,000, with a treatment completion rate of 80%. This project aims to promote lateral collaboration between organizations and integrate resources to implement LTBI screening and treatment services for high-risk populations recommended by WHO guidelines. This approach will effectively reduce the risk of future TB development in these populations, thereby preventing community spread after onset and reducing future medical expenses for treating TB patients.

(C) Quality control performance for laboratory testing

By 2025, the indicator for laboratory testing quality, i.e., identification of TB bacteria in initial sputum within 28 days, should achieve a completion rate of 92%.

To maintain the quality of laboratory testing, the target for the completion rate of TB bacteria identification in initial sputum within 28 days was 90% in 2018. This novel indicator will be applied to continue monitoring the timeliness of 34 accredited laboratories. By promoting improved testing efficiency and implementing internal and external quality control systems, the goal is to reduce the time it takes for laboratories to provide reports, facilitating timely intervention for epidemic prevention.

Table 1: Main Objectives and Performance Indicators

Objective Items	Measurement Standards	Execution Year				
		2021	2022	2023	2024	2025
Primary Objective						
The annual incidence rate of new TB cases should consistently decrease with an average reduction of 6% each year	The annual incidence rate of TB is calculated by dividing the number of new cases in a year by the mid-year population and multiplying the result by 100,000.	33	31	29	27	25
Performance Indicator 1: TB Case Management Performance						
Treatment success rate* by age group	≤44 year-old: for newly reported TB cases aged ≤44, the indicator shall be the rate of successful treatment tracked over 12 months.	90.0	90.5	91.0	91.5	92.0
	45-64 year-old: for newly reported TB cases aged 45-64, the indicator shall be the rate of successful treatment tracked over 12 months.	81.0	81.5	82.0	82.5	83.0
	≥65 year-old: for newly reported TB cases aged 65 and above, the indicator shall be the rate of successful treatment tracked over 12 months.	58.0	58.5	59.0	59.5	60.0
TB case HIV testing rate	Number of TB cases having completed HIV screening ÷ All TB cases × 100%	60.0	65.0	70.0	75.0	80.0
Performance Indicator 2: High-Risk Population Management Performance						

Effectiveness of treatment in individuals with LTBI	The number of individuals with LTBI starting treatment	9,500	9,500	9,500	9,500	9,500
	The number of individuals with LTBI who completed treatment ÷ The number of individuals with LTBI who have started treatment × 100%	84.5	85.0	85.5	86.0	86.5
Performance Indicator 3: Quality Control of Laboratory Testing						
Laboratory testing quality indicator - achievement rate of identification of <i>M. tuberculosis</i> in initial sputum within 28 days for new cases	(The number of cases with identification of <i>M. tuberculosis</i> in initial sputum dated within 28 days from the date of specimen collection) ÷ (The number of cases with initial sputum culture yielded for <i>M. tuberculosis</i>) × 100%	90.0	90.5	91.0	91.5	92.0

*Note: Definition of "Treatment Success": The patient is cured or has completed the treatment. This target follows the WHO annual reporting, using the tracking cohort from two years preceding the project year (e.g., by December 31, 2025, the indicator reflects the results of the 2023 cohort tracking).

III. Review of Current Relevant Policies and Programs

(I) Epidemiological Analysis of the Overall Effectiveness of TB Control and Prevention

A. The incidence rate of new TB cases

The number of new TB cases in Taiwan has shown an overall decreasing trend. Using the number of 16,472 cases from one year before the implementation of the Ten-Year National Mobilization Plan to Halve Tuberculosis (2005) as a baseline, the confirmed new cases in 2018 were 9,179, translating into a cumulative decrease of 44%. The incidence rate was 39 cases per 100,000 population, marking a 46% decline from 73 cases per 100,000 population in 2005. The average annual reduction during the earlier stages of the plan's implementation was 5%.

B. Age distribution

In Taiwan, the majority of TB cases are found in the population aged 65 and above. The proportion of cases in this age group ranged from 51% to 58% between 2005 and 2018, which is significantly higher than other age groups. The incidence rate increases with age, showing an upward trend. The incidence rate for the population aged 65 and above is approximately 4 times higher than the national average. However, the reduction in incidence rate among cases aged 65 and above is also more significant compared to other age groups.

C. Gender distribution

In 2018, the incidence rate among males was 55 cases per 100,000 population, while for females, it was 23 cases per 100,000 population. The incidence rate for males was 2.4 times higher than that for females, with both the number and rate of occurrence being higher in males than females.

D. Geographic distribution

The overall trend of incidence rates indicates higher rates in the eastern region compared to the western region, and higher rates in the southern region compared to the northern region. From 2005 to 2018, the incidence rates in all counties and cities have shown a decreasing trend. Further analysis based on MARs reveals that in 2018, the incidence rate of new TB cases in these areas was 112 cases per 100,000 population, approximately 3 times higher than the national incidence rate of 39 cases per 100,000 population. The incidence rate in these MARs has experienced a cumulative reduction of 59% from 2005 to 2018, demonstrating significant overall improvement.

E. Mortality surveillance

TB case mortality in Taiwan has been decreasing annually, with the number of deaths falling from 970 cases in 2005 to 506 cases in 2018. The mortality rate has also decreased from 4.3 cases per 100,000 population to 2.1 cases per 100,000 population, representing a 51% reduction. Over the period from 2005 to 2018, individuals aged 65 and above accounted for the majority of deaths, approximately 85% of the total. In terms of gender distribution in 2018, the mortality rate in males was 3.3 cases per 100,000 population, while in females it was 1.0 case per 100,000 population, with males facing a mortality rate 3.3 times higher than females. Geographically, the southern and eastern regions exhibited higher mortality rates, with Yunlin County, Hualien County, and Pingtung County showing the highest mortality rate in 2018.

F. Drug-resistant tuberculosis (DR-TB)

In 2018, the drug resistance rate for any anti-tuberculosis drug was 14% among new tuberculosis cases, and 19% among retreatment cases. Over the past three years, the rate of MDR-TB in retreatment cases decreased from 8% in 2010 to 6% in 2018. The proportion of MDR-TB cases among new cases remained around 1%. In 2018, the ratio of MDR/RR-TB in retreatment cases was 7%, while the ratio in new cases was 2%. According to the WHO annual report, the 2017 global rate of MDR/RR-TB was 18% in retreatment cases and

4% in new cases. Taiwan's efforts in the control and prevention of DR-TB significantly surpass international standards.

G. Co-infection of TB and the human immunodeficiency virus (HIV)

In 2017, the rate of HIV infection among new TB cases was 0.7% in Taiwan (males: 0.9%; females: 0.2%). Among individuals aged 15 to 49 with new TB cases, the HIV infection rate was 2.6% (males: 4.0%; females: 0.4%). Compared to the global situation, the prevalence of HIV among new TB cases in Taiwan in 2017 falls into the lowest category of 0-4% according to the WHO classification. However, TB incidence among people living with HIV (PLHIV) in Taiwan is more than 10 times higher than the national incidence rate, highlighting the urgent need to strengthen relevant control and prevention efforts.

H. Cohort tracking of treatment outcomes

The treatment outcomes from generational tracking of reported cases over a 12-month duration between 2005 and 2016 indicated a treatment success rate of 88% for the population under 45 in 2016, meeting the WHO target of 85% or above. However, the elderly population, influenced by comorbidities such as other cancers and diabetes, showed higher mortality rates which resulted in a lower treatment success rate compared to other age groups.

I. Surveillance of TB incidence in foreign nationals

The reported cases of TB among foreign nationals in Taiwan have shown an increasing trend from 384 cases in 2006 to 847 cases in 2018. The gender composition of patients is approximately 40% male and 60% female. In terms of status, there is a significant increase in TB cases among migrant workers, from 138 cases in 2006 to 643 cases in 2018. Although the number of cases among new immigrants has decreased from 129 in 2006 to 44 in 2018, the incidence rate of TB among new immigrants after entering Taiwan remains 1.7 to 7.3 times higher than that of the local population. This is associated with the fact that many new immigrants come from China or Southeast Asian

countries with a high burden of TB or MDR-TB. In terms of nationality, Indonesia is the primary source of imported cases, accounting for 43% of cases in 2018, followed by 22% from Vietnam(187 cases) and 19% from the Philippines with (161 cases). All three countries are considered high-burden TB nations as mentioned earlier.

(II) Enhancing the Disease Control Infrastructure and Prevention Strategies

A. Implementation of roles and responsibilities in control and prevention units

To effectively combat TB, collaboration across all levels is crucial, specifically the active involvement of county and city health bureaus in promoting and implementing various epidemic prevention measures. Therefore, by convening TB control and prevention coordination meetings and inviting county and city health officials responsible for supervising TB control and prevention, discussions can be held regarding the goals and implementation status of crucial control and prevention strategies in each region. Successful strategies can be shared among participants, laying the groundwork for TB prevention work, fostering consensus, and enhancing the effectiveness of implementation. Additionally, through the development of evaluation indicators and incentive measures, local governments are encouraged to adhere to the TB control and prevention policies set by the central government. Engaging local resources is emphasized to improve the performance of case tracking and management, aiming to effectively achieve the goals of TB control.

B. Promoting talent cultivation in TB control and prevention

Collaborations between medical, laboratory, nursing, epidemiological, school health associations and other non-governmental organizations should be undertaken to conduct various training programs such as TB prevention and treatment education for physicians, TB laboratory and biosafety training, education for TB case managers, campus TB prevention training, as well as

training in tuberculin skin testing (TST) and BCG vaccination techniques. These courses aim to enhance the clinical skills of physicians in TB diagnosis and treatment, improve laboratory testing quality, maintain case management quality for public health and hospital personnel involved in TB prevention, and elevate professional competence of campus health professionals in TB control and prevention.

In terms of physician training and education, the TB diagnosis and treatment guidelines are continuously updated, and a one-year general medical training program has been incorporated for physicians' continuous medical education. This allows trained physicians to learn under the guidance of clinical supervisors about the diagnosis, treatment, and care of TB. This training program aligns with government health policies, aiming to provide comprehensive and continuous holistic care for the public.

C. Actively promoting strategies to interrupt the transmission

(A) Promoting proactive identification strategies for high-risk populations

a. Proactive identification strategies for high-risk individuals

Internationally, it is recommended to focus on TB control and prevention efforts on target populations with a higher risk of developing the disease, such as individuals with HIV infection, those using anti-TNF- α inhibitors, dialysis patients, organ transplant recipients, injection drug users, poorly controlled diabetes patients and the elderly, as this approach is deemed more cost-effective. Given the significant impact of the HIV epidemic on the recent reversal of the declining trend in TB incidence and mortality worldwide, the "HIV/TB Collaborative Management Model" has been implemented since 2013, ensuring appropriate management of HIV/TB cases. Efforts are consistently directed towards the control and prevention of various comorbidities and high-risk groups. Continuous emphasis is placed on education for and raising awareness among healthcare professionals. Collaborative initiatives with county and city health bureaus have been implemented to carry out pioneering prevention programs, offering proactive detection and LTBI screening services. Individuals with positive

screening results are encouraged to join treatment programs to reduce the risk of active TB disease. Additionally, ongoing collaboration with the Health Promotion Administration is undertaken to conduct symptom inquiries on TB during adult and elderly health checkups. Those with a persistent cough lasting for more than two weeks are referred for chest X-ray examinations, facilitating early detection and timely medical intervention.

Due to factors such as the presence of concurrent chronic diseases and weakened immune systems, the latent tuberculosis bacilli in the bodies of the elderly are more prone to re-activation. In Taiwan, approximately 60% of TB cases are found in the population aged 65 and above. Due to the aging population, the proportion of elderly cases is increasing each year. In 2018, the "Tuberculosis Control and Prevention Pilot Program for Residents and Staff in Nursing Homes, Care and Rehabilitation Facilities" was initiated to address this issue. Collaborating with 28 long-term care institutions, the program focused on proactive case detection, screening and treatment for LTBI, symptom monitoring, and other strategies. The aim was to establish a TB control and prevention model for long-term care institutions to internalize these strategies as routine institutional practices in the future, safeguarding the health of residents and staff. During the program, 4,289 residents and staff received screening services for LTBI, and 555 individuals who tested positive joined a treatment program. As Taiwan continues to experience population aging and face an increasing demand for long-term care, the integration of TB control and prevention strategies with the long-term care system becomes increasingly important, especially for long-term care institutions with characteristics of congregate settings.

b. Mobile population monitoring

Monitoring data for the year 2017 showed one TB cluster related to a tunnel construction project, and another cluster during a road widening project where two temporary workers were diagnosed as

cases of infectious pulmonary TB. The latter resulted in 10% of workplace contacts exhibiting LTBI. In order to safeguard the health of workers, a collaborative effort across government departments has been initiated. The Ministry of Labor shall notify industries and unions to reinforce the implementation of relevant occupational safety and health laws along with regulations pertaining to labor health examinations. It is crucial to promptly identify and diagnose abnormal cases to safeguard the health of surrounding workers. Additionally, efforts will be sustained to include temporary workers and other mobile populations as targets for active TB detection.

c. Active case finding strategy in MARs

From 2005 to 2018, the cumulative reduction in TB incidence in MARs was 59%, surpassing the national cumulative reduction of 44%. However, the overall TB incidence rate in MARs remains higher than the national average. Specifically, MARs consistently exhibit higher rates than flatland aboriginal regions and the national average, making them a continued focus for TB control and prevention efforts.

According to age-specific analysis, the incidence of TB in MARs is higher than the national average across all age groups, particularly showing a significant increase after the age of 35. Besides the high incidence rates, another crucial issue is delayed diagnosis of the disease. Further analysis of two transmission indicators at the time of TB diagnosis reveals that in MARs (with 43% being smear- and culture-positive, and 18% showing cavitation on chest X-ray), the values are higher than the national averages (36% and 14%, respectively). This suggests a more severe situation of delayed diagnosis in MARs, possibly due to factors such as limited healthcare resources and inconvenient transportation. Patients tend to seek medical attention only when the condition worsens and becomes intolerable, potentially leading to the spread of TB during the period between symptom onset and seeking medical care. This poses a significant threat to public health and community prevention. To address this issue, the TCDC continues to

implement mobile chest X-ray screening services in MARs to actively identify TB cases and refer them for comprehensive treatment and care. According to the analyzed data, the instances of delayed diagnosis in actively identified cases in MARs (with 40% being smear- and culture-positive, and 10% showing cavitation on chest X-ray) are significantly lower than cases where individuals sought medical care due to symptoms (43% and 18%, respectively). This demonstrates that the strategy of implementing mobile chest X-ray screening in MARs can effectively lead to the active finding of cases and reduce delayed diagnosis.

Further analysis of the implementation of chest X-ray screening in MARs reveals the following coverage rates for registered population: single-year screening coverage rate of 22% in 2016, cumulative 2-year screening rate of 37% from 2015 to 2016, and cumulative 3-year screening rate of 49% from 2014 to 2016. According to past reports from health bureaus, approximately 50% of the registered population in each MARs is not residing in their registered households, of which a higher proportion falls in the younger demographic due to outward work or education commitments, leading to lower participation rates in screenings compared to older individuals. In 2017, the "Combined Service Project: Active Tuberculosis Finding for Mountainous Aboriginals and NHI Healthcare Service in Mountainous Areas" was initiated, entrusting local governments to integrate regional resources and plan for mountainous aboriginals an active TB finding model that aligns with local benefits. This effort resulted in the active finding of 40 cases. Additionally, as part of the "Aboriginal Health Inequality Improvement Strategy Action Plan" implemented by the Ministry of Health and Welfare from 2018 to 2020, a pilot program called the "Active Tuberculosis Finding Program for Mountainous Aboriginal Villages" was launched in 2018 for 8 MARs. Collaborating with major healthcare institutions frequently visited by mountainous aboriginal people, reminders for chest X-ray examinations are integrated into the clinic systems, which led to active case finding of 33 confirmed cases.

Moreover, by distributing TB symptom assessment questionnaires, efforts were made to encourage school children to advocate for the importance of chest X-ray screenings to their families, raising awareness about TB control and prevention. However, there remains a pressing need to sustain efforts in promoting TB control and prevention strategies in MARs to increase the coverage rate of active finding among the population not residing in their registered households.

d. Contacts of TB cases

Since the implementation of contact investigation in Taiwan, the average number of completed contact investigations per case has seen significant progress, increasing from 2.2 people in 2006 to 13 people in 2018. In order to enhance the efficiency of contact investigations and tracing, a "contact-centered" monitoring and management model has been implemented since 2014. This allows each contact to be managed conveniently by the health unit located near their "main activity site." In recent years, the completion rate of contact investigations within one month of diagnosing a TB case has consistently exceeded 95%, which demonstrates the proactive efforts of public health personnel.

According to the analysis of the effectiveness of contact tracing for TB cases, a total of 395,656 contacts of confirmed TB cases between 2008 and 2012 have completed their first chest X-ray screening. Among them, 1,062 contacts were diagnosed with TB within 3 months of the examination. The detection rate increased with the infectiousness of the index cases (ranging from 80 to 410 cases per 100,000 population), all of which were higher than the general population's TB incidence rate (41 cases per 100,000 population). This indicates that conducting chest X-ray examinations for contacts is an important and beneficial active case finding strategy for TB. However, approximately 4% of confirmed TB cases currently do not have any contact traced. To promptly identify community sources of infection and LTBI, early intervention in relevant control and prevention measures is crucial to interrupting community transmission. Accurate and comprehensive tracing of high-risk contacts

is also essential. Therefore, implementing contact tracing and examinations remains an area that requires continuous efforts in the future.

e. Screening for migrant population upon entry

In the control and prevention of TB among migrant populations, there is ongoing effort to strengthen the screening of foreign workers/individuals upon entry. Migrant workers are required to undergo regular health check-ups during their stay in Taiwan. Foreign nationals diagnosed with TB, contacts of TB cases, or individuals with LTBI are provided with the same services like relevant tests, diagnosis and care as offered to Taiwanese nationals. Furthermore, for foreign cases from countries with a high burden of TB or MDR-TB, rapid molecular drug susceptibility testing is provided to expedite the confirmation of the diagnosis. This allows for timely and appropriate treatment, preventing potential transmission within the community and safeguarding the health of the Taiwanese population. Continuous monitoring of the occurrence of TB in this population after entry is planned to prevent subsequent disease transmission within households or communities.

(B) To prevent high-risk individuals from developing active TB, a policy promoting the treatment of LTBI is being implemented

a. Treatment and Management of LTBI

The treatment of LTBI, as confirmed in various literature, is effective in preventing the pathological progression in individuals infected with *Mycobacterium tuberculosis*. It is a highly cost-effective preventive measure and has become an important strategy in the WHO's efforts to end TB. In recent years, Taiwan has progressively expanded its coverage on LTBI testing and treatment. Since 2016, the "LTBI for All Program" has been implemented, covering contacts of highly contagious cases (sputum smear- and culture-positive *Mycobacterium tuberculosis*) across all age groups. The program has introduced the use

of "Interferon-Gamma Release Assay (IGRA)" as the LTBI testing tool for individuals aged 5 and above. Short-course LTBI treatment with isoniazid and rifapentine (3HP) has also been added. Starting 2017, IGRA-services have been extended to contacts of highly contagious cases confirmed before the implementation of the LTBI for All program. Through small-scale pilot programs, LTBI screening and treatment services have been provided to other high-risk groups beyond contacts, such as residents of MARs, individuals with chronic comorbidities, and elderly residents in long-term care institutions. In 2019, the scope was expanded to include contacts of index patients with moderate infectiousness (sputum smear-negative, culture-positive *Mycobacterium tuberculosis*) who have either a history of intensive exposure within households or risk factors related to chronic comorbidities that affect the immune system. This further broadens the coverage of LTBI services.

Since 2016, the number of individuals receiving LTBI treatment in Taiwan has been increasing annually, with contacts remaining the primary target group for LTBI treatment. However, as the new incidence rate of TB in Taiwan continues to decline, the number of contacts has correspondingly decreased. In order to achieve the goal of eliminating TB by 2035, the promotion of LTBI treatment in populations beyond contacts has become increasingly important. Future consideration should be put into adjustment of resource allocation, promotion of LTBI treatment services through cross-unit collaboration, and resource integration to meet the needs of a broader target population.

b. TB cluster monitoring and management

Population-dense institutions are a key location for monitoring TB clusters. From 2011 to 2018, of places where confirmed TB cluster events occurred: 27% were campuses (46/171), 27% densely populated institutions (46/171), 22% workplaces (37/171), 13% others (22/171), 9% medical institutions (16/171), and 2% military and correctional facilities (4/171). Current monitoring methods for cluster

events rely heavily on public health personnel manually cross-referencing the reported activity locations of diagnosed TB cases, consuming a significant amount of time and human resources. Therefore, since 2014, there has been a plan to establish geographic information for TB cases utilizing a monitoring strategy based on a Geographic Information System (GIS). Considering that the contacts of TB cases in cluster events have a higher risk of developing the disease, the strategy is complemented with LTBI treatment to enhance the sensitivity of cluster event monitoring, prevent the occurrence of TB in contacts, and ultimately improve the effectiveness of control and prevention. Furthermore, maintaining good ventilation and implementing comprehensive infection control measures in ordinary times are fundamental aspects to proactively prevent outbreaks of cluster events.

c. Provision of childhood Bacillus Calmette–Guérin (BCG) vaccination and monitoring of side effects

According to the analysis of tracking data for the birth cohorts from 2002 to 2008 in Taiwan, the risk of developing tuberculous meningitis is 47 times higher in infants who did not receive the BCG vaccine compared to the vaccinated group. This underscores the protective benefits of the BCG vaccine. To prevent severe forms of TB like tuberculous meningitis in young children, vaccination with BCG is implemented as a TB control and prevention strategy in most countries worldwide. Currently, Taiwan has not reached the standard set by the International Union Against Tuberculosis and Lung Disease (IUATLD) for discontinuation of BCG vaccination, so a complete cessation of BCG vaccination is not recommended. However, based on active monitoring of adverse reactions to the BCG vaccine, cases of BCG osteomyelitis occurs in younger infants post-vaccination. To reduce the incidence of BCG osteomyelitis, the recommended BCG vaccination schedule was adjusted in 2016 to vaccinate infants at 5 to 8 months old, rather than within the first 24 hours after birth. The BCG vaccination rate for the

birth cohort from 2012 to 2017 has remained at 96%, and the vaccination rates for cohorts born before and after the schedule adjustment are comparable at the age of one year. Considering that the incidence of TB in children under 5 years old in Taiwan has reached levels similar to advanced countries in Europe and the Americas, a new policy was implemented in 2016. Children who are one year old or older (including first-grade elementary school students), have not received the BCG vaccine and have no history of TB exposure may receive the BCG vaccine without undergoing the tuberculin skin test.

D. Implementing infection control in high-risk environments

To provide a high-quality care environment and prevent the spread of pathogens within hospitals, long-term care institutions, and correctional institutions in order to avoid transmission among patients, residents, family members and staff, TB infection control has been incorporated into hospital accreditations and into the infection control assessment criteria for hospitals, long-term care institutions, and correctional institutions. Its significance is actively promoted, while collaboration with relevant associations is continuously undertaken to facilitate educational and training efforts. In addition, TB-related infection control measures such as strengthening infection control assessments, guiding hospitals at all levels to implement appropriate isolation for patients with positive acid-fast bacilli sputum smears, designating personnel responsible for TB case management, and establishing mechanisms for the diagnosis and treatment of TB are reinforced to cultivate proactive capabilities within institutions to reduce the risk of infection.

E. Enhancing public awareness of TB control and prevention

To enhance public awareness of TB control and prevention, large-scale advocacy activities are organized annually in response to 'World Tuberculosis Day.' Additionally, news releases on TB-related topics are distributed, and information is disseminated through social media platforms such as Facebook, Instagram, Twitter, and the 1922 Epidemic Prevention LINE@. Public service

announcements are also broadcasted on radio and television combined with the use of 1922 Epidemic Prevention hotline to provide consultations and education on TB prevention, treatment, and testing. Interviews related to TB control and prevention are conducted on radio stations. Various promotional materials on TB are developed to support health authorities in conducting related awareness campaigns. In 2017, a survey on awareness of and attitudes toward latent tuberculosis revealed that 75% of the public perceived a low risk of infection. People who have developed habits such as undergoing regular chest X-ray examinations and seeking prompt medical attention for suspected symptoms also had relatively lower overall perceived risks. Generally, the public's satisfaction and confidence in the government's efforts in TB control and prevention were approximately 58% and 64%, respectively. Ongoing efforts will be made to use diverse channels and targeted approaches for TB control and prevention outreach.

(III) Patient-Centered Integrated Care Strategy

A. Enhancing the willingness of TB patients to seek and receive treatment for TB

In order to reduce barriers to medical care, improve treatment success rates, and prevent the spread of the disease, the co-payment of medical care for TB patients has been included in the budget of the TCDC. In 2018, the “Operational Regulations for Payment of Medical Service Fees for Statutory Infectious Diseases by the Ministry of Health and Welfare” were revised to include the co-payment of hospitalization expenses for isolation treatment of statutory infectious diseases (e.g. TB), co-payment of medical expenses for the treatment of TB patients/contacts/individuals with latent infections, as well as relevant treatment fees imposed on TB patients/contacts/individuals with latent infections not included in the NHI program. Subsidies are provided annually for the co-payment of medical expenses related to the treatment of TB patients, contact examinations, and LTBI treatment. As reducing barriers to medical care for TB patients is an important goal proposed by the WHO, public budget allocation for co-payment will continue along with

encouragement to primary medical care, combined with the principles of fairness and justice to provide comprehensive health protection for the public.

To continuously reduce barriers to medical care for financially disadvantaged cases with TB, existing social and political resources are integrated for ongoing referrals to welfare units to obtain subsidies. Additionally, to understand the baseline of the financial burden on TB patients and their families in Taiwan, a financial burden assessment survey was conducted in 2018. Its results revealed that the expenditure categories for general TB patients were 47.7% for direct non-medical expenses, 31.7% for income loss, and 20.5% for medical expenses (DS-TB). For MDR-TB patients, the majority of expenditures were on direct non-medical expenses (51.8%), surpassing indirect expenses (42.2%) and direct medical expenses (6%). Among the average total non-medical expenses, nutritional supplements and food supplements accounted for the most items. The non-medical expenses resulting from treatment, along with the loss of family income, can lead to catastrophic spending for socioeconomically vulnerable groups, potentially causing severe consequences such as unemployment. Therefore, collaboration across social welfare, labor, and non-governmental organizations is needed to assist in reducing the barriers to medical care for financially disadvantaged TB cases.

B. Enhance TB patient care services

(A) Shorten diagnosis timeframe

Based on recent domestic research data, it was found through data reconciliation with the NHI database that 3.7% of patients taking two or more types of anti-tuberculosis drugs did not undergo TB reporting. Factors contributing to underreporting include age (25 to 44 years old), recurrent cases, foreign nationality, extrapulmonary TB, seeking medical attention at clinics, and fewer medical visits. Additionally, analysis of reporting timeliness revealed that 82% of patients were reported within 7 days of treatment, while 18% of patients were reported after 7 days of treatment. Factors associated with delayed reporting include advanced age (75 years of age or older), recurrent cases, local nationals, negative

sputum smear, negative sputum culture, seeking medical care at large hospitals, and fewer medical visits. As there are still a very small number of unreported TB patients and some cases experiencing delayed reporting, active efforts are being made to improve factors affecting the completeness and timeliness of reporting, and to strengthen the TB surveillance system. For patients whose TB complex laboratory tests showed positive results, an affirmation plus automatic reporting protocol was established in 2018 to improve the timeliness of reporting from medical facilities. Furthermore, since 2016, revisions have been made to the TB reporting requirements to include “patients receiving anti-tuberculosis drug treatment” as a subject of mandatory reporting. In the same year, a nationwide initiative was launched to enable healthcare institutions (including clinics and health centers) to automatically connect to and upload information on TB and LTBI treatment medications to the TCDC platform, enhancing the monitoring of TB drug prescriptions and abnormal medication use.

In addition, research on delayed diagnosis in Taiwan revealed a median delay of 7 days for patients, a median delay of 23 days for healthcare institutions, and a total delay of 44 days. Among these cases, patients with positive sputum smears experienced a healthcare institution delay of 13 days, while patients with negative sputum smears experienced a healthcare institution delay of 37 days. Due to the long latency period of TB, there are often no obvious or specific symptoms at the onset of the disease, leading to a delay in seeking medical attention. The diagnosis of TB requires a comprehensive assessment of clinical manifestations, imaging information, and laboratory tests. With the advancement of diagnostic technologies, efforts are being made to shorten the timeframe for delayed diagnosis.

(B) To improve the professional competence of healthcare practitioners and introduce new drugs/diagnostic technologies

To address concerns related to the diagnosis and the application process for second-line anti-tuberculosis drugs, highly experienced

specialists in TB clinical practice have been appointed to the "Tuberculosis Care Consultation Committee" to offer a consultation platform for healthcare professionals seeking specialized advice when encountering diagnostic uncertainties in TB cases. The committee holds regular meetings, reviews cases through written documentation, and conducts on-site visits for challenging cases. Since its launch in 2011, the consultant group has facilitated discussions on approximately 5,200 instances per year regarding diagnostic uncertainties in TB patient care, reviewed around 1,600 cases related to the applications for second-line drugs, and conducted approximately 40 on-site visits to address challenging cases each year. Through these procedures, the group not only addresses specific clinical concerns but also contributes to the practical education of healthcare professionals involved in TB care, thereby enhancing the overall standard of TB care.

In addition, the early and effective diagnosis of cases, along with consequent provision of accurate treatment, is the first crucial step in TB control and prevention. Therefore a systematic review of TB prescriptions has been initiated in collaboration with the NHIA, using a purposive sampling approach to scrutinize prescriptions for deviations from established standards and correct inappropriate medication practices. Sampling for the review is primarily focused on prescriptions flagged through discussions in regional case review meetings where committee members suggest improvements, but not amended or responded to accordingly after communication with the healthcare institution and the original treating physician. Cases submitted for review by the Tuberculosis Care Consultation Group with treatment doubts and objections from the original treating physician to are also included. Since the inception of this operation in 2014, approximately 50 to 100 cases are reviewed at random annually. The prescription compliance rate has increased from 38% to 73%, indicating that the prescription review process has positively impacted the accuracy of prescriptions, thereby enhancing the overall quality of TB healthcare.

To enhance the clinical competency of physicians in the diagnosis and treatment of TB, and to ensure the correct use of anti-tuberculosis drugs, a panel of 16 experts was convened in 2017. Following guidance from the WHO's "The End TB Strategy" and taking into account recent international TB treatment guidelines, the 6th edition of the "Guidelines for Tuberculosis Diagnosis and Treatment" was revised and published in October of the same year. This edition serves as a reference for clinical physicians, aligning with the evolving situation of TB and the healthcare circumstances in our country. In recent years, there has been a continuous introduction of molecular diagnostic technologies for accelerated identification of the TB bacterial group and drug resistance testing. New anti-tuberculosis drugs for second-line treatment and short-course regimens for LTBI have also been incorporated. These advancements aim to effectively shorten the treatment duration for drug-resistant and LTBI individuals, saving manpower and improving treatment success rates.

C. Optimizing laboratory diagnosis and service quality

Since 2008, the TCDC has been promoting the Tuberculosis Accredited Laboratory System and continually encouraging laboratories that have not participated in accreditation to join the program. The current accreditation covers pathogen isolation, identification, drug susceptibility testing, smear microscopy, pathogen molecular detection, and Xpert molecular testing. This ensures methodological consistency, reduces testing time, and aligns with the standard testing methods recommended by the WHO. Participation in proficiency testing, external quality control for acid-fast bacilli smear microscopy, and regular staff education and training are provided and encouraged. Laboratories with discrepancies in internal or external quality control and abnormal test results undergo on-site visits, receive improvement suggestions, and are monitored for effectiveness. Through the Tuberculosis Accredited Laboratory System and the hierarchical division of labor among national-level laboratories, a comprehensive and high-quality TB testing service network is established to enhance the quality of TB testing in Taiwan,

monitor epidemiological indicators, and strive for high-quality and rapid testing.

Currently, the classification and division of testing, methodological consistency in testing items, personnel certification and regular training, standardization of laboratory testing methodologies, automatic uploading of reporting systems, and the establishment of a dynamic monitoring system for testing quality indicators have been completed. Through guidance, standardized quality control systems have been established in clinical laboratories, with periodic visits for assessment. Key indicators for monitoring the timeliness and quality of TB testing have been defined and regularly reviewed. These key indicators include a contamination rate of 2-5% for solid culture media, a 99% completion rate for smear microscopy within 24 hours, a completion rate of 60% for 21-day incubation of positive cultures, a 90% target for 7-day identification time for *M. tuberculosis* complex, a 65% achievement rate for turnaround of 28 days for *M. tuberculosis* complex identification since sputum collection. For the year 2018, an 89% achievement rate for turnaround time of 28 days for *M. tuberculosis* identification for initial sputum from new patients, a 90% completion rate for 28-day drug susceptibility testing, and a 99% achievement rate for specimen transport to the laboratory within 3 days were achieved. Continuous improvement will be pursued based on ongoing refinement of methods and processes.

D. Enhancing the quality of TB case management

(A) Implementing standardized management procedures for TB cases

To enhance the quality of medical care for individuals undergoing treatment for TB or LTBI, a pilot program was initiated in 2018 to replace the current patient handbook with the "Smart Care Card." With this lightweight card that conceals private information, patients can conveniently carry it for medical appointments. Besides granting exemption from medical copay, the card allows clinical physicians to instantly access the latest information from the Tuberculosis Management System, including up-to-date details on tests and medication, along with

other relevant information (including cross-institutional data), so they can provide patients with more comprehensive medical care.

To implement TB control and prevention policies in daily case management processes and ensure the quality of TB case management, monthly on-site audits are conducted by both central and local authorities. Across all 22 counties and cities nationwide, specific townships or districts are rotated each month for TB case management audits. The achievement rates for various management priorities consistently exceed 90%.

(B) Enhance the quality monitoring of case management

The development and launch of web-version of "Tuberculosis Management System" were completed in 2001. As the system has been in use for nearly 20 years, the original framework design was failing to meet the demands of new operational requirements and information security standards. With advancements in information technology, hardware and software, a redesign and reconstruction project was initiated in 2018 to address the operational bottlenecks of the current system. The goal was to provide an innovative information environment and support the realization of the 2035 policy goal to eliminate TB. The redesigned system not only enhances information security mechanisms, but also improves scalability and maintainability. This results in increased efficiency in data access and report generation, along with a strengthened mechanism for interoperability with other systems. Additionally, to assist in case management, appropriate data validation mechanisms have been implemented within the system to provide management reports for data quality audits.

(C) Expansion and enhancement of the DOTS program

With the advancement of mobile communication and wireless network technologies, plus the government's strong promotion of the "Cloud Computing Industry Development Program," it is now feasible to implement the eDOT Program through mobile devices and corresponding applications (Apps). This approach aims to replace on-site medication care

for those who cannot be physically monitored. Initially, the program targeted individuals with LTBI, ensuring their regular medication and providing side effect assessment services. This initiative accompanies patients through the lengthy treatment process to improve the completion rate. After evaluating the maturity and stability of the functions of eDOT App, the program expanded its coverage in 2017 to include special cases, such as short-term travelers, tour/bus/taxi drivers, other mobile workers, and temporary returnees among new immigrants and Taiwanese businesspeople. In 2018, a total of 710 cases, including individuals with LTBI, received medication services through the eDOT App.

E. Enhanced care for challenging or special cases

(A) Management of drug-resistant cases

In order to improve the cure rate of DR-TB, Taiwan established the "Taiwan MDR-TB Consortium (TMTC)" in 2007, which enhances patient adherence to medication by following a "patient-centered" care approach and providing community-based DOTS-plus services. The government also provides an ample and quality supply of second-line drugs free of charge to ensure that DR-TB patients receive comprehensive care and treatment. The effectiveness of the TMTC has been remarkable, with over 90% of DR-TB patients receiving treatment and care within the established framework. In 2016, Taiwan achieved a treatment success rate of 74.4% for MDR-TB cases followed up for 24 months, surpassing the WHO's global average success rate for MDR/RR-TB worldwide.

Furthermore, tracking analysis of RR-TB cases in Taiwan revealed that within 0.5 to 3 years after reporting, 67 cases progressed to MDR-TB. The development of MDR-TB was found to increase with prolonged treatment duration. Further analysis showed that, if all RR-TB cases were provided with second-line drug susceptibility testing, an annual reduction of approximately 32 million Taiwan dollars in healthcare expenditures (excluding other non-essential costs) could be achieved. For every 1 unit of testing cost, there could be a future cost reduction ranging from 57 to 213 units of medical expenses. Based on this analysis, TCDC's reference

laboratory has been providing second-line drug susceptibility testing services for MDR-TB cases since 2011, with service expansion to include RR-TB cases since 2014, providing reference for the clinical treatment of patients.

To continue providing medical services for domestic cases of DR-TB and challenging cases with severe adverse reactions or allergies to first-line anti-tuberculosis drugs, the government allocates funds to import and supply second-line anti-tuberculosis drugs such as capreomycin, terizidone, and clofazimine through special projects. This ensures an ample variety of anti-tuberculosis medications for use within the TMTC. Additionally, in 2015 and 2016, the government applied for the importation of novel drugs bedaquiline and delamanid for the first time, encouraging pharmaceutical companies to obtain domestic drug licenses which in turn enabled treatment resumption for many challenging cases. Drug quality assessments and certifications issued by international organizations such as the WHO, Médecins Sans Frontières (MSF), and the IUATLD are being continuously referenced to ensure consistent quality of imported drugs.

Currently, there are several newly developed drugs or short-course prescriptions such as Pretomanid showing promising treatment outcomes in clinical trials. Continuous attention should be given to these developments, and timely introduction of these treatments is necessary to shorten the infectious period and treatment duration, thereby enhancing epidemic control effectiveness.

(B) Special case management

Continuous collaboration with social welfare units is carried out for cases with poor treatment compliance, economic vulnerability, mobile populations or non-cooperation. Referral services are provided for financially vulnerable cases to assist them in accessing relevant resources, thereby improving treatment compliance.

Newborns are a susceptible population for infectious diseases such as TB, easily contracting them through vertical transmission from the mother or close contact, leading to poorer outcomes or irreversible physical

damage. Educational materials containing preventive measures for diseases like TB are created for pregnant women. Through obstetric hospitals and clinics, relevant information is provided during prenatal check-ups to achieve the goal of preventive education.

Furthermore, by strengthening the monitoring of TB cases in pregnant women and children, along with source tracing operations and follow-up on treatment outcomes, the examination of contacts of pregnant women and children has been implemented. From 2016 to 2018, a total of 955 infants and children under 5 years old have completed treatment for LTBI, effectively reducing their future risk of developing the disease.

(C) Effectiveness of management and care for chronic infectious cases

For chronic infectious TB patients who experience treatment failure or are unable to continue treatment due to severe side effects, financial support is provided for hospitalization, nutrition, and living expenses to encourage and persuade them to undergo isolation treatment in designated hospitals to curb the risk of ongoing transmission from the infectious source within the community. In 2014, there were still 13 cases on the management list. Through proactive prevention and care efforts, as of 2018, only one sputum-positive case remains incompletely cured.

(D) Migrant population receiving treatment in Taiwan

For foreign cases diagnosed with TB in Taiwan, in addition to maintaining accurate case reporting information and providing case management and DOTS medication care, if a foreign born case comes from a country with a high burden of TB or MDR-TB, rapid molecular testing services for sputum samples are provided to expedite the diagnosis process. This ensures timely and appropriate treatment, assisting them in completing the treatment smoothly in Taiwan to prevent community spread. To help them understand TB and facilitate correct diagnosis, informational brochures on TB treatment and sputum collection techniques are provided in different languages (English, Vietnamese, Thai

and Indonesian). Local health personnel deliver these materials during face-to-face visits to foreign individuals with TB. Currently, approximately 50% of migrant workers in Taiwan receive TB treatment and care services with their employers' consent each year.

(E) Isolation and treatment measures for non-cooperative patients

Since 2014, proper proceedings and rights must be announced to individuals subject to isolation treatment to protect their personal freedom. Currently, there are still a few non-cooperative cases in the community posing a risk of transmission, which necessitates immediate invocation of the Communicable Disease Control Act to enforce essential isolation and preventive measures to reduce the probability of community spread and safeguard public health. In 2018, a total of 46 patients underwent isolation treatment, with the main reasons being homelessness (38%) and non-compliance with medical treatment/directly observed therapy (36%).

(F) Management of cases with unknown whereabouts

To monitor the whereabouts of TB cases, a new feature has been added to the Tuberculosis Management System for cases that have become untraceable or left the jurisdiction during treatment. With the "Application for Tuberculosis Case Entry Notification" functionality, local health bureaus can submit requests through the platform. The system then automatically reconciles the data of these untraceable or departed TB cases with the Immigration Agency's entry and exit system on a daily basis. When such cases re-enter the country, the system will automatically send email notifications to the personnel responsible in the health bureaus of the respective counties or cities, thereby enhancing the efficiency of TB case management.

(IV) Strengthening Operational Research and Innovating Technologies

A. Automated systems for monitoring epidemic trends

To simplify administrative tasks for frontline TB staff, reduce manual data entry workload and enhance the efficiency of public health and medical information transfer, various automatic interfacing mechanisms have been actively promoted between TB care hospitals and TB laboratories since 2014. For example, all 34 medical institutions accredited by the TCDC for TB testing have achieved a 100% daily automatic upload of TB test reports to the TCDC. Additionally, a new "Tuberculosis Accredited and Contract Laboratory Test Result Automatic Notification Procedure" was introduced in 2018. The median completion time for automatic notification to hospitals is 0.73 days (average 1.4 days), shortening the notification time from the statutory 7 days to within 1 day. This not only boosts the efficiency and accuracy of notifications and streamlines the administrative process for medical institutions, but also allows public health authorities to promptly access reported cases for timely TB control and prevention efforts.

In 2016, a nationwide initiative was launched to enable medical institutions, including clinics and health centers, to automatically interface and upload information regarding the treatment of TB and LTBI to the TCDC platform. This facilitates real-time access for public health personnel to patient prescription details and medication anomalies. Currently, the national coverage rate for interfacing and uploading has reached 95%. To achieve the goal of bilateral data exchange between public health and medical institutions, and to allow hospital staff to promptly access value-added information from the TCDC's TB database (including care quality indicators for TB or LTBI treatment cases), the TCDC introduced a new feature in 2018 that allows hospitals to interface and retrieve data directly from the TCDC, integrating it seamlessly with hospitals' medical information systems.

In the area of value-added applications, a collaboration was initiated with the NHIA in 2018. Through a data file interface, medical institutions' data on TB cases and contacts were linked and transmitted back to the Tuberculosis Management System. This enables public health personnel to promptly access information on examinations, treatments, and chronic disease risk factors for cases or contacts. Additionally, the "Medical

Institutions Interface to Retrieve Value-Added Information for Tuberculosis Care Cases Subsidy Program" was launched to encourage hospitals to promptly transfer relevant information on TB care quality from the Tuberculosis Management System back to their respective care hospitals. This promotes real-time bilateral transfer of TB prevention and care information between the public health system and hospitals.

B. Strengthening operational research and developing new strategies

Through commissioned projects for TB control and prevention technology, preliminary results have been achieved in the development of diagnostic tools or techniques, establishment of target population TB control and prevention models, adoption of internationally recommended prescriptions for TB/LTBI treatment, development of tools for assessing adverse reactions to treatment, and research on anti-tuberculosis drugs suitable for the Taiwanese population. Several studies have even been filed for patent applications for their findings. Additionally, research outcomes, such as new treatment prescriptions for LTBI and adverse reaction monitoring plans, active surveillance of adverse reactions to second-line drugs, rapid molecular testing for high-risk populations with MDR-TB, analysis of relapses in fully treated TB cases, and studies on TB risk factors and their impact on cumulative risk of developing the disease, serve as evidence-based foundations for policy formulation.

(V) Expanding International Collaboration on Control and Prevention

A. Implementing international collaborations in global disease control and prevention

Actively participating in various international activities and inviting experts and scholars to Taiwan to provide recommendations and guidance on Taiwan's TB control and prevention policies, as well as sharing concrete achievements in TB control and prevention, not only increase international visibility but also effectively align Taiwan's strategies and outcomes with

international standards. Significant international collaboration cases in recent years involve a total of 27 representatives from 14 countries including the United States, the Philippines, Vietnam, Thailand, mainland China, Japan, South Korea, Russia, Switzerland, Chile, Australia, Singapore, Malaysia and Indonesia. They joined 103 domestic experts to discuss topics such as new prescriptions for MDR-TB and rapid screening.

In addition, in response to the WHO's global goal of eliminating TB, a parallel session on "Strategies for ending TB by 2035" was held during the "2017 Global Health Forum in Taiwan" on October 22, 2017. Four experts from both domestic and international backgrounds were invited to discuss strategies for eliminating TB. The total number of participants was approximately 200, contributing to the promotion of Taiwan's achievements in TB control and prevention and enhancing Taiwan's international visibility.

In 2018, the health authorities of the Indonesian government newly established their national health insurance TB care system. To understand Taiwan's TB care management model, a delegation including officials from the Indonesian Ministry of Health, their National Tuberculosis Program and the Tuberculosis Monitoring System led by officials from their Center for Health Financing and Insurance, along with experts from the United States Agency for International Development (USAID) and a World Bank consultant, visited Taiwan for an exchange program from July 30 to August 2. During the visit, Taiwan shared its TB control and prevention strategies, quality payment under health insurance, and the DOTS program. The delegation also had the opportunity to visit the NHIA, local health units, and healthcare institutions for further exchanges.

In 2019, under the framework of the Global Cooperation and Training Framework (GCTF), Taiwan collaborated with the United States and Japan to organize the "International Workshop on the Programmatic Management of Drug-Resistant Tuberculosis" from April 30 to May 3. The workshop brought together 15 TB control and prevention professionals from 8 Asian countries. They participated in training courses focused on the management of DR-TB, covering various aspects such as management, treatment, diagnosis, and overall programmatic approaches. Through the exchange of experiences

between countries, the workshop aimed to enhance regional collaborative capabilities in managing DR-TB and to prevent the global threats posed by infectious diseases.

B. Participation in international activities to facilitate cross-border exchanges

Taiwan's international visibility is continuously enhanced through publication of research papers and active participation in global events. Every year, representatives are sent to the Union World Conference on Lung Health, where Taiwan showcases its TB research findings through posters or oral presentations. In 2016, experts from the TCDC were invited to participate in the WHO consultation on the programmatic management of LTBI to share Taiwan's initiatives in LTBI management. In 2017, they were invited by the non-profit organization Vital Strategies, an IUATLD affiliate, to serve as instructors for the "TREAT TB" project in the Philippines initiated by USAID, aiding in the development of research capabilities, such as research design, data processing, statistical analysis and contribution of results to journals, for TB control and prevention. As they proactively expand Taiwan's activities overseas, they also attended an evaluation and professional guidance program in Nepal co-organized by the Nepali government and The LHL International Tuberculosis Foundation, a Norwegian non-governmental organization. In 2017, an expert from the TCDC was invited by the health authorities of South Korea to attend an international advisory meeting on BCG vaccine clinical trials, sharing experiences on BCG vaccine production and side effect monitoring in Taiwan. Moreover, at the invitation from Russia, they participated in an international conference on tuberculosis control and prevention in 2018: the preparatory meetings for the UN high-level TB meeting. In 2018, they attended the Getting to Zero TB by Addressing LTBI in Asia conference in Hanoi, Vietnam, organized by Stop Tuberculosis Partnership Japan, to share their experiences in Taiwan's TB control and to discuss diagnostics and treatment of LTBI with experts from other high TB burden Asian countries. In 2019, they participated in the Epidemiology Review co-organized by WHO and Vietnam's National Lung Hospital, gaining insights into Vietnam's TB prevention and vaccination strategies, as well as

into the WHO assessment models and methods for efficacy of TB prevention projects in member states. Through these international engagements, Taiwan enriches its experiences and connections in promoting TB prevention, control, and vaccination policies globally.

IV. Execution of Strategies and Methods

(I) Main Tasks

- A. Strengthening disease control infrastructure and prevention network
- B. Proactive discovery and early intervention for target groups
- C. Patient-centered care and case management
- D. Preventing onset and interrupting transmission

(II) Breakdown of (Annual) Implementation Strategy

Execution strategy / Work items		Execution Year				
		2021	2022	2023	2024	2025
Strengthening disease control infrastructure and prevention networks	Implementing cooperation and division of work					
	between central and local authorities					
	Strengthening the connection between					
	public health and medical systems					
	Cultivating non-governmental organizations to					
	expand the control					

	and prevention network					
	Promoting the cultivation of talent in TB control and prevention					
	Optimizing the quality of laboratory diagnostics and services					
	Strengthening monitoring and management systems					
	Enhancing relevant research and developing new strategies					
	Enhancing public knowledge and capabilities in TB control and prevention					
Active case finding among target population and early intervention	Promoting a strategy for active detection in target populations					
	Enhancing TB contact investigations					
	Active detection, LTBI screening and treatment in long-					

	term care institutions					
	Active detection and expedited reporting improvement strategy in MARs					
	Entry screening for foreign nationals, and active detection as well as LTBI testing and treatment for new immigrants					
	Improvement program to reducing delayed diagnosis					
Patient-centered care and case management	Enhance the quality of TB treatment					
	Optimize the quality of TB case management					
	Expansion and quality improvement of the DOTS program					
	Medical care for DR-TB					
	Care for challenging or special cases					
Preventive measures to block transmission and	Raise public awareness of TB and LTBI					

development of active disease	Implement infection control in high-risk environments					
	BCG vaccination and evaluation of new vaccines					
	Treatment and management of LTBI in target populations					

(III) Course and Methods of Execution, and Division of Labor

A. Strengthening the disease control infrastructure and prevention network

(A) Implementing cooperation and division of labor between central and local authorities

The central government formulates national TB control and prevention policies and coordinates collaboration across departments and units, such as legal amendments, national control and prevention resources integration, and sufficient budget allocation. Through joint efforts, it promotes various TB control and prevention initiatives. For new or revised important policies, the central government organizes hierarchical briefings to ensure that primary workers or clinical physicians understand the reasons and methods behind policy planning, thereby facilitating policy implementation. Simultaneously, policy evaluation, analysis, and research are conducted to serve as empirical evidence for policy promotion and subsequent adjustments. Additionally, operational communication and review meetings are convened as needed to discuss and share experiences regarding the TB control and prevention performance of each city and county, enhancing overall epidemic prevention efficiency and facilitating smooth implementation of control and prevention efforts.

To enact the Communicable Disease Control Act and to realize the spirit of local autonomy, the central government is responsible for policy formulation and planning, and for provision of necessary assistance to local governments. Local governments should cooperate with central government policies, supervise their personnel, and ensure the effective implementation of various control and prevention measures to achieve the purpose of hierarchical responsibility. At each level, personnel handle control and prevention tasks in accordance with existing regulations and workflows. Through a hierarchical inspection and guidance mechanism, the implementation and quality of various control and prevention measures are ensured.

Furthermore, the central government considers project proposals submitted by counties and cities when providing partial support in terms of human resources and budget. The aim is to encourage local governments to enhance their control and prevention efforts and improve their operational capacity, alleviating challenges arising from insufficient manpower and maintaining the quality of control and prevention measures. Additionally, routine assessment and incentive strategies are formulated to stimulate healthy competition among counties and cities. Monitoring indicators are developed at the county and city levels, encompassing both process and outcome metrics, to achieve national control and prevention and to strengthen the TB control and prevention capabilities of counties and cities.

Regarding the division of labor at the local level, in accordance with the " Regulations Governing Subsidies to Municipality or County (City) Government by the Central Government," local entities are required to not only receive financial support from the central government but also independently raise funds or actively seek special or project-specific control and prevention funds. They should align with central government policies and, based on local characteristics, tailor county- and city-level TB control and prevention plans, as well as indicators for supervision and assessment. Local governments may propose innovative control and prevention projects, for which the central government provides

appropriate financial subsidies to strengthen the efforts of county and city governments. Additionally, governments are to integrate and develop localized resources, collaborating with medical, public health, and non-governmental organizations (such as organizations involved in tribal health promotion projects) within their jurisdiction. This is to enhance local ownership in implementing TB control and prevention efforts. By efficiently utilizing organizational resources and coordinating support across counties, cities and entities, the joint promotion of TB control and prevention is facilitated. This collaborative approach ensures smooth implementation of control and prevention efforts, ultimately enhancing the overall effectiveness of TB control.

(B) Strengthening the integration of public health and healthcare systems

Close integration of public health and medical care is the cornerstone of TB control and prevention. Through the effective implementation of a viable referral system, the processes of TB screening, referral, treatment, and subsequent care can be seamlessly connected to ensure the provision of optimal care services for TB cases, individuals receiving LTBI treatment, and contacts. It also guarantees that the treatment for each case is successfully completed.

(C) Cultivating non-governmental organizations to expand the control and prevention network

By fostering non-governmental organizations, we aim to expand the TB control and prevention network., through which organizations can work together towards promoting TB control strategies towards prevention, medical care and patient care to provide the public/patients with a more comprehensive and friendly support environment. Additionally, various professional and local organizations, such as specialized medical societies, nursing associations, school health nursing associations, anti-tuberculosis associations, various densely populated institutions, professional associations, local organizations that promote TB control and prevention,

or other social support systems, are continuously integrated to extend the reach of TB control and prevention efforts .

(D) Promoting the cultivation of talent in TB control and prevention

The annually decreasing number of TB cases in Taiwan plus frequent turnover of medical and epidemic prevention personnel will lead to the loss of experience in the diagnosis and treatment of TB. Therefore, there should be proactive planning for medical student education. Through inviting local experts and scholars, relevant epidemic prevention and medical education training programs related to TB should be conducted. Practical courses such as clinical internships, drills, case sharing and visits should be organized to increase the clinical experience and enthusiasm of clinical physicians in the diagnosis and treatment of TB, facilitating effective relay of experiences in control and prevention. Additionally, by integrating various specialties including psychology and psychiatry, an experiential model for treating challenging cases can be established.

Platform for continuous education is constantly provided, utilizing various channels, opportunities and teaching methods to assist personnel involved in TB control and prevention along with subsidized or commissioned professional organizations. The platform will cover education and training for various personnel such as physicians, TB case management personnel, campus epidemic prevention personnel, tuberculin testing and BCG vaccination personnel, as well as public health, nursing, and laboratory personnel. Certification system and certification exams for TB case managers are also planned to enhance the professional knowledge, attitude, and technical quality of TB control and prevention personnel, improve care quality, and enhance the ability to address patient issues. Ultimately, these efforts will indirectly improve patient compliance with medical advice, ensure the implementation of contact investigations, and facilitate effective follow-up management, raising the professional standards of TB control and prevention in Taiwan.

Furthermore, diversified learning methods are established, allowing healthcare and public health personnel to enhance their TB control and

prevention professional skills without the limitation of time and space. Specifically, for personnel encountering TB control and prevention work for the first time, online courses enable a rapid grasp of essential tasks, alleviating the challenge of ineffective relay of experiences in control and prevention due to frequent turnover. Certification with relevant professional credits is also provided to those who complete the learning programs to improve and encourage the motivation in participants to actively engage in learning.

Clinical and healthcare professionals, laboratory personnel, and public health workers in Taiwan are continuously nurtured to become international-level. In addition to promoting international TB treatment training programs lasting 1-3 months, selecting and subsidizing new-generation clinical physicians to participate in international TB treatment-related training courses, other initiatives like the New Southbound Policy are also incorporated. Local TB clinical, laboratory, and public health experts are referred to participate in international cooperation projects in collaborating countries. Through ongoing involvement in international TB control and prevention assistance, it aims to attract young healthcare professionals, laboratory personnel and public health workers, igniting their enthusiasm and increasing their willingness to sustain commitment and contribute to TB control and prevention efforts.

(E) Optimizing diagnostic testing and service quality

The testing strategy should be based on traditional methods, with testing processes refined progressively to enhance laboratory quality accreditation systems and the accuracy of routine examinations. Since bacteriological testing results are crucial for diagnosing TB, the accurate and rapid diagnosis of cases and the interruption of transmission can be achieved by developing new diagnostic tools. Furthermore, there is a continuous effort to expand the construction of a TB bacillus genome database to assist in monitoring trends and formulating control and prevention measures.

In recent years, the Whole Genome Sequencing (WGS) has been recommended by WHO and adopted by communities worldwide in TB control and prevention strategies. WGS is primarily applied in the diagnosis and treatment of drug-resistant cases and management of public health investigations on TB transmission. It provides rapid and comprehensive identification of drug resistance in emerging and existing TB treatment drugs, facilitating patient-centered personalized precision medicine, reducing side effects, and improving cure rates. WGS can also address limitations in the analysis of existing genotyping, which can lead to blind spots in determining TB transmission. As the use of this technology becomes more widespread, the time and cost associated with completing WGS are decreasing, which is advantageous for enhancing laboratory services in areas such as molecular rapid testing, drug development, drug resistance monitoring, strain genotype monitoring, cluster event investigations, etc. Therefore, there will be a continuous expansion of resources to incorporate new technologies, revolutionizing TB testing methods and processes to achieve the interim goals of the plan.

a. Enhancing testing efficiency

(a) Promoting standardized testing mechanisms to ensure quality and timeliness of reporting

Laboratory methodologies are standardized to promote more efficient testing processes. Regulations are made on the adoption of approved testing methods by accredited laboratories recognized by the TCDC. Timely and accurate testing reports are established.

(b) Accelerate the clinical application of new diagnostics

Regularly assess globally emerging TB testing technologies, such as novel TB and drug resistance detection methods recommended by the WHO (e.g., Xpert Ultra). Following evaluations of clinical applicability and cost-effectiveness, optimal options are promoted for utilization in clinical testing. Application of clinical molecular testing is standardized, and the use of molecular biology methodologies for identification and drug

resistance testing is promoted, complementing traditional testing methods and significantly reducing turnaround times.

(c) Strengthen classification and division of labor in testing

In accordance with Article 4 of the "Regulations Governing Laboratory Testing for Communicable Diseases and Management of Laboratory Testing Institutions," and the "Operating Guidelines for Recognized Infectious Disease Testing Institutions," continuous efforts are made to carry out contracted TB testing and laboratory outsourcing to provide high-quality TB bacteria testing services. Additionally, online laboratory quality monitoring is conducted to analyze various quality indicators with the aim of improving testing efficiency and quality.

In addition to supporting public health and relevant testing for suspected TB cluster events, the TCDC assists in supervising the quality of TB laboratory testing. The TCDC is responsible for implementing an external quality control system, assisting in monitoring laboratory anomalies and investigations, providing consultation and guidance, and enhancing the capacity of TB laboratories. Furthermore, it conducts regular training programs to improve the technical competence of TB laboratory testing personnel and reinforces biosafety education. These periodic training sessions effectively enhance the professional knowledge and testing accuracy, and ensure occupational safety of domestic TB laboratory testing professionals, in line with the implementation of the TB laboratory testing personnel certification system.

The TCDC is responsible for the execution of special TB testing such as genotyping and strain identification, the establishment of strain bank/genetic bank, the establishment of a standard laboratory operating system, the establishment of a national TB laboratory quality control system, academic research and development in TB testing technology, and the guidance, support, and assessment of TB testing units nationwide. To provide the latest and real-time worldwide testing methods and information for policy formulation, close attention is paid to the global progress of emerging TB testing technologies. Based on expert consensus,

various TB testing guidelines including testing techniques and quality control are developed or revised. Regular laboratory personnel training sessions are organized to ensure the quality control of accredited laboratories. Additionally, in line with epidemic prevention needs, plans are in place to collect strains from newly reported TB cases nationwide each year to establish a domestic genotyping database, which will be gradually digitized to facilitate disease monitoring and investigation.

b. Implementation of quality assurance systems

In terms of quality management and improvement, collaboration with domestic certification organizations and relevant testing associations will be established to oversee the consistency of quality management and to promote the enhancement of technical systems. Quality indicator monitoring will be established to promote internal quality indicators within laboratories. Through dynamic monitoring of quality indicators, any abnormal results will be detected early, allowing for immediate correction to prevent the release of erroneous reports. This information will also be used to update quality indicators, contributing to the establishment of laboratory credibility. Education and training initiatives will be implemented to guide the establishment of standardized quality control systems in clinical laboratories. Regular evaluations will be conducted to ensure the implementation of internal and external quality control systems.

c. Monitoring and confirmation of special Mycobacterial strains

With testing data uploaded from accredited laboratories, drug resistance status of TB bacteria in Taiwan is monitored to assess the quality of TB case management, which allows for early intervention to address issues. Additionally, the WHO's "One Health" concept, which advocates the inseparable relationship between human and animal health, is incorporated with the "Tuberculosis Monitoring and Management System" for integrated analysis to monitor zoonotic TB and adverse effects of BCG vaccination, among other aspects.

d. Improvement and development of TB diagnostics

Academic research institutions are encouraged to collaborate with the biotechnology industry to conduct joint research, evaluation and development of TB-related studies, as well as emerging testing methods and technological platforms. In alignment with the WHO's molecular testing classification system for TB, clinical molecular testing projects in Taiwanese TB laboratories are standardized to promote a graded testing network for nucleic acid detection and genotyping within the testing framework. Emerging international testing methods are tracked, timely incorporated and evaluated for their feasibility in TB bacterium testing in Taiwan. This aims to simplify procedures and enhance testing efficiency.

(F) Strengthening surveillance and management system

The WHO continues to advocate for countries to strive and improve the reliability of TB reporting data along with the convenience and completeness of monitoring systems. Therefore, in addition to implementing the Ministry of Health and Welfare's "Health Cloud" epidemic cloud sub-project, this project clearly defines the future information system framework and role functions. The primary goals include early detection of TB, appropriate diagnosis and treatment, patient care and cross-domain collaboration. The project is dedicated to enhancing the overall system coverage, analytical efficiency, and quality. It incorporates cloud computing and big data analysis tools to strengthen the integration, value addition, and statistical information release of epidemic data across various departments. The aim is to leverage collective efforts and enhance the overall effectiveness of control and prevention measures.

For the design of the management system, a people-centric approach is adopted to facilitate the management of cases and contacts. This ensures that both horizontal and vertical caregivers have consistent access to cross-institutional care management information, thereby preventing redundant operations by local public health, DOTS care personnel, hospital case managers, and laboratory and healthcare personnel. Through an efficient operating model, the system aims to promote the detection of

high-risk populations and the management of comorbidities in cases. In terms of data flow, standardization, multiple input/output channels and single-point management are implemented to avoid information chaos that could lead to misunderstandings affecting control and prevention efforts. Regarding system users, in addition to frontline workers, considerations are given to information transfer and needs for data indicator value-added service of managers at all levels.

a. Cross-agency information automated integration and value-added services

(a) Diverse entry points to interface information needed for epidemic prevention

To tackle the time and stability issues associated with manual data exchange, continuous efforts will be made to establish interoperability of the TB care hospital information systems at all levels. This will involve automated importation of information related to tests, drug resistance, and medication tracking. Additionally, a mechanism for reconciling TB medication usage in medical institutions will be established to prevent issues such as unreported or unmanaged drug use. Value-added information will also be enhanced for feedback to the clinical care end of TB. Continuous efforts will be made to enable hospitals to retrieve treatment care alerts for their respective cases. This will enhance the horizontal integration of public health and medical information and reinforce partnerships. Management over HIV/TB co-infection, treatment of LTBI, and detection and alert for anomalies in management of high-risk groups such as foreigners and new immigrants will be strengthened. The introduction of demographic information will enable the planning of control and prevention measures to be more tailored to the characteristics of different regions or populations. Routine epidemic monitoring data, supplemented by other health and socio-economic population-based information, will provide more comprehensive, in-depth, and complete data for epidemic analysis and improvement of various preventive measures.

To ease the administrative burden on healthcare personnel and case managers in medical institutions, the TB management system's information related to the quality of TB care will be promptly transferred and integrated into the information systems of healthcare institutions to strengthen the functions of disease reporting, care management and alerts. Implementing this operational procedure will assist healthcare institution case managers, infection control and laboratory personnel in promptly receiving alerts on the treatment and care of TB and LTBI within their institution. By enabling healthcare institutions to retrieve value-added information on TB testing and medication for their respective care cases, the delivery of comprehensive and high-quality care services to TB patients and contacts is facilitated.

(b) Automatic detection of and dynamic alert on suspected cluster events

Detection, analysis, and early warning of cluster events are essential measures to control the spread of TB. Current practices, whether used by central or local health authorities or hospitals, revolve around the core of the TB management system. This involves registering and managing cases, conducting tests, tracking treatments, and managing contacts, all of which are routine system management tasks. However, for more rapid and effective detection of suspected cluster events, there is a need for comprehensive integration of temporal changes, geographical features, and strain-matching information. Therefore, the Ministry of the Interior's GIS Cloud and the application of "basic statistical areas" are introduced to analyze suspicious associations through routine scheduled processes without disclosing personal information. This assists local health authorities in efficiently assessing the relationships and transmission chains among infected cases, addressing the challenges in epidemiological investigation for chronic infectious diseases.

(c) Strengthening the detection and management of mobile populations and challenging cases

Taiwan has various populations, including Taiwanese businesspeople, workers, new immigrants and students, who frequently travel between China, Southeast Asia, and other countries with a high burden of TB. This constant movement poses challenges for regular medical care and follow-up, particularly when individuals are diagnosed with TB. Managing medication adherence and testing after leaving the country becomes a significant challenge for health authorities. Continuous data exchange on TB patients with the immigration agency will be maintained, allowing health authorities to apply for cross-border reconciliation and automated notification for cases that are lost to follow-up or have left the country. In the future, enhanced use of cross-border reconciliation data will help identify and manage cases that frequently enter and exit the country or stay abroad for an extended period, preventing loss of follow-up and potential drug resistance issues. Furthermore, for the management of TB cases and their contacts, alerts will be generated automatically through the system for cases undergoing transitions, seeking treatment across different hospitals, interrupting treatment, or showing non-cooperation. Expanded Inclusion of overseas residents, foreign workers and new immigrants in routine surveillance statistics will be applied to understand the impact of Taiwan's business, exchange, and demographic activities on TB control and prevention.

- b. Phased opening of monitoring information and integrated application of big data analysis tools
 - (a) Enhance the application of epidemic information at local health authorities

After collecting TB management information through various entry points, the data will be processed during the night through the data warehouse platform, and information will be grouped and enhanced. Data sets will then be generated based on the cases' respective counties or cities. Once a local government has a comprehensive cybersecurity plan in place approved by the TCDC, it can integrate the data back into the designated server for analysis to meet epidemic control needs.

(b) Application of TB control and prevention database

To continuously assess the implementation effectiveness of Taiwan's TB control and prevention policies, statistical analyses of relevant data will be conducted. When necessary, cross-analyses will be performed based on factors such as gender, age, ethnicity, and region as reference for evaluating the implementation of strategies and for review.

To promote collaborative efforts in epidemic control and prevention and showcase achievements, ongoing operations in the independent jurisdiction of the TCDC and the Health and Welfare Data Science Center will provide data extraction, reconciliation, or linking services for projects that have obtained approval from ethics committee and passed project sign-off. After thorough review and approval, these services will facilitate cross-domain/agency information integration for research purposes. Through the data warehouse, non-personally identifiable daily statistical data for people with active TB along with static annual indicator information at the township or district level and above will be disclosed in a cloud platform environment. This disclosure aims to provide the basis for the development of Application Programming Interfaces (APIs) or apps by various sectors and the public, which will leverage academic and private sector resources to collectively enhance epidemic prevention efforts.

(G) Strengthening operational research and developing new strategies

TB control and prevention are crucial global public health issues that face significant challenges such as aging populations, MDR-TB, HIV infection, and the coexistence of chronic diseases. Currently, there is a lack of effective new vaccines and affordable, highly sensitive diagnostic tools, so active participation and investment in technological research are essential to prepare for these challenges.

Firstly, through commissioned research or independent initiatives by the TCDC itself, collaboration with academic institutions, medical professionals, industry representatives and government organizations will be arranged to develop foundational research as well as diagnostics,

clinical treatment, epidemiology, and prevention strategies. Operational research will be strengthened, establishing an evidence-based foundation in epidemiology to inform policy formulation and adjustments. Ongoing monitoring of epidemiological data and observation of policy implementation will provide insights into the effectiveness of intervention measures.

On the other hand, a systematic screening and assessment program will be implemented targeting high-risk populations. This initiative is targeted at coordinating the needs of public health, clinical treatment, and diagnostic aspects. A multidimensional approach that integrates public health assessments, social sciences and digitization will also be incorporated to enhance the prevention, diagnosis and treatment of TB, develop new strategies and tools, and to explore diverse healthcare models suitable for different populations.

In addition, the introduction and evaluation of new diagnostic tools, treatments, and prescriptions will be pursued. Active participation in international trial networks will be emphasized, incorporating tools for the diagnosis of LTBI and TB. The assessment and promotion of new molecular technologies will be prioritized, integrating diagnostic techniques and establishing point-of-care tools for the care and determination of TB. Ongoing evaluation of the safety, efficacy, and timing of new prescriptions and novel vaccines will also be maintained.

Based on the research plan and the local assessment results after introducing new diagnostic tools, treatments and prescriptions, data is provided for policy considerations. The academic visibility and industrial achievements of Taiwan are to be enhanced through paper publications and patent applications. Supervision and removal mechanisms will be implemented to align research plans with policy implementation through continuous review and improvement of research plans which will keep them up-to-date. Research project outcomes will be used as the basis and empirical evidence for policy implementation., allowing for rigorous and comprehensive policy executions that align with TB-related research

worldwide. The goal is to enhance the capacity for TB control and prevention through research and development.

(H) Enhance public awareness and knowledge of TB control and prevention

Looking at the current situation of TB, whether internationally or domestically, it reflects the phenomenon of health inequality. TB has long been associated with vulnerable populations. Addressing the root causes of TB requires the collective efforts of various sectors to raise awareness of TB control and prevention among the general public. Primary prevention, the first level of disease prevention in the Three Sections and Five Levels of Prevention, focuses on promoting health which involves modifying and adjusting general health environments, behaviors and lifestyles, and implementing health check-ups to reduce the occurrence of diseases. Therefore, from the perspective of health promotion and considering the public's health as the core value of public policy, TB control and prevention is a shared responsibility among different departments. Coordination and communication between different departments should be sufficiently established for collaboration on formulating comprehensive TB control and prevention strategies. Creating a supportive environment for TB prevention and enhancing the public's relevant knowledge will promote voluntary community actions. Coupled with active case-finding strategies and screening and treatment for LTBI, this approach aims to prevent the occurrence of TB outbreaks from the front end.

According to past policy survey results, it is evident that public awareness of the early symptoms of TB needs to be strengthened, and a majority of the public lacks clear and comprehensive understanding of TB, leading to misconceptions that may contribute to issues of discrimination. In order to enhance the overall TB control and prevention literacy among the public, various communication channels will be utilized to disseminate information related to TB control and prevention. This will include creating creative promotional materials and educational resources, and employing diverse marketing channels to conduct health education for different target groups. For specific target audiences that may be harder to reach,

such as temporary workers, Taiwanese businesspeople or residents in MARs, collaboration across departments or agencies will be facilitated to reinforce the concepts of self-monitoring and seeking early medical attention, thereby reducing incorrect behaviors resulting from misconceptions. In addition to continuously conducting TB health education and promotion activities based on public needs, regular effectiveness assessments will be carried out to adjust the direction of health education. Furthermore, aligning with the global TB advocacy focus, efforts will be expanded to organize activities for World Tuberculosis Day awareness campaigns.

B. Proactive detection and early intervention in target populations

(A) Promoting a strategy for active case finding among target populations to

For the target population, depending on their illness and immune status, clinical presentations may include atypical or extrapulmonary TB, leading to delayed diagnosis. Use of new diagnostic tools such as molecular detection techniques in these individuals expedites case detection, enhances testing accuracy, reduces diagnostic delays, clarifies drug resistance, and facilitates timely and appropriate treatment. This approach also helps prevent cross-infection and the occurrence of cluster events during medical visits. Additionally, chest X-ray examination is considered a screening tool for TB in high-risk populations with multiple risk factors. Quality control measures for chest X-ray screening will be developed to ensure the accuracy of screening results, thereby expanding the network for active TB case detection.

In addition, compromised immune system is a major contributing factor to the increased risk of TB. Factors influencing immunity include HIV infection, diabetes, chronic kidney disease, cancer, immunosuppressant therapy, smoking and malnutrition. Research data indicate that individuals with specific diseases have higher risks of TB incidence, treatment failure, and mortality compared to those without these conditions. For example, individuals with HIV infection have a 20-37 times higher risk of developing TB than those without HIV infection, and individuals with diabetes have a

threefold higher risk of TB incidence compared to non-diabetic individuals. Therefore, besides conducting health education and raising prevention awareness among high-risk populations, continuous communication and collaboration with relevant agencies and organizations or integration with other projects involving various departments are essential. Assessment of TB symptoms, screening for LTBI and treatment will be incorporated into clinical guidelines, making them routine inquiries and evaluation objectives during initial and follow-up visits. Suspected cases should be referred to specialists for further evaluation and treatment, with the outcomes being subject to efficacy assessment to expand the scope of control and prevention efforts.

Regarding health education and monitoring of the mobile population, communication and collaboration through departments, agencies, public/worker unions and non-governmental organizations are employed to obtain lists and distribution of the mobile population. This is done to analyze the characteristics of these groups and formulate TB surveillance and prevention mechanisms tailored accordingly. To tackle the difficulty in managing populations that are homeless, working temporary jobs, or frequently traveling to and from high TB burden countries due to work or residency, health education and awareness campaigns are strengthened to enhance recognition of TB symptoms along with health awareness among these groups. These populations are at a higher risk of disease due to prolonged exposure to high-risk environments. Therefore, a systematic approach is employed to strengthen prevention and monitoring to resolve difficulties for public health personnel in tracking their distribution and movements. This facilitates the smooth execution of contact tracing and case management in the event of illness.

In addition, this project will continue to monitor the development of emerging diagnostic tools internationally. We will select emerging diagnostic tools that are suitable for the characteristics of Taiwan and provide them for use on high-risk populations, ensuring cost-effective measures to reduce disease transmission.

(B) Enhance TB contact investigation and LTBI treatment

Tracing and examination of TB contacts are crucial components of TB control efforts. Through contact tracing and examination, the source of infection can be identified, infected individuals can be promptly referred for medical care, and community transmission chains can be interrupted. Additionally, contact tracing examination allows for early monitoring of potential cases, early diagnosis, and timely treatment. For LTBI cases, appropriate treatment can be provided to prevent future active disease. Besides continuous promotion of a "contact-centered" management model to enhance the efficiency of contact management, functions related to the management of TB case contacts in the current TB management system are expanded to integrate with the NHIA's medical data, helping public health officials promptly determine whether contacts have completed chest X-ray examinations, reinforcing the implementation of contact tracing and examination operations and improving management efficiency. Furthermore, collaboration with the NHIA will be pursued to assess the inclusion of LTBI treatment cases in the payment standards. An LTBI treatment platform will be established to facilitate various operations thereon, integrating medical and public health systems to provide more comprehensive care services.

Based on research data in Taiwan, the incidence rate among contacts is 8 to 240 times higher than that of the general population. To better implement this work, it is essential to reference both international execution models and local experiences to establish an advanced contact tracing model domestically. Education and training courses on contact tracing skills for frontline public health personnel are actively promoted and implemented to enhance the quality of investigations and ensure the accurate identification of contacts with a high risk of developing the disease. In addition, indicators related to contact investigation and examination are developed to evaluate the quality of implementation by counties and cities, ensuring that frontline public health workers effectively carry out contact investigation and examination tasks. The goal is to achieve early detection of infected contacts or cases and provide

timely and appropriate treatment to prevent subsequent disease development.

Furthermore, public budget is allocated to support a portion of the copay for contact examinations, encouraging contacts to undergo regular check-ups according to a predetermined schedule and safeguarding the medical rights of contacts. The goal is to facilitate the early detection of those who have been infected or have developed the disease. Providing tracking and treatment services can reduce sources of transmission and minimize opportunities for community spread. In cases of child contacts exposed to highly contagious MDR-TB or extensively drug-resistant tuberculosis (XDR-TB) patients, isolation treatment measures should be implemented for the contacts during the contagious period of the index case. Alternatively, emergency placement mechanisms could be activated for child contacts to prevent prolonged exposure to an environment with MDR-TB bacteria, thereby reducing the risk of subsequent infection and disease development.

(C) Proactive detection and management of LTBI in long-term care institutions

According to estimates from the National Development Council (NDC), Taiwan has officially entered an “aging society” with the proportion of elderly people in its population reaching 14% in 2018. It is projected to become a "super-aged society" by 2026, with the elderly accounting for over 20% of the total population. As Taiwan's society experiences population aging, the prevalence of chronic diseases and functional impairments among the elderly has risen, leading to a significant increase in the demand for long-term care.

In 2018, the TB incidence rate among the elderly population was 4.1 times the national average. Among newly reported cases, individuals aged 65 and older accounted for 60% of the total cases, with a continuous increase over time. The elderly population is more susceptible to TB due to prolonged exposure, the presence of other chronic diseases, and compromised immune systems, leading to the activation of latent

tuberculosis bacteria and the onset of the disease. The WHO guidelines have identified populations in dense living facilities as high-risk groups for TB. However, considering the elderly population's comorbidities and the atypical clinical manifestations in older individuals, diagnosing and managing TB becomes more challenging. Poor indoor ventilation in long-term care institutions may further contribute to the occurrence of cluster incidents. Therefore, the implementation of TB prevention and management in long-term care institutions is a crucial and pressing issue.

Based on research projects and pilot programs conducted by the TCDC from 2017 to 2018, it was found that the LTBI positivity rate among residents and staff in long-term care institutions was 19%. Untreated individuals with a positive LTBI test result had a high probability of developing TB, with an incidence rate of 2,000 cases per 100,000 population. Additionally, early diagnosis of TB cases was achieved through these initiatives. Building upon the results of the previous research and pilot programs, the current project aims to implement a national TB control and prevention program in long-term care institutions. The strategies include:

- a. Active case finding**
- b. Testing and treatment for LTBI**
- c. Symptom screening**

The plan involves introducing molecular testing technology and LTBI testing into long-term care institutions to address the limitations of traditional sputum culture identification, which has a long reporting time, and chest X-ray examinations, which only detect active cases. This approach aims to shorten the time for TB diagnosis, strengthen the TB screening mechanism within institutions, and promptly diagnose both active TB cases and LTBI. By providing appropriate treatment, the program aims to effectively prevent the spread of TB within these institutions. In collaboration with various government departments and the Institute of Labor, Occupational Safety and Health, Ministry of Labor, the project also seeks professional input to address common ventilation problems in long-term care institutions and propose improvement strategies. Additionally,

recommendations on early ventilation planning in new constructions will be provided to help maintain a well-ventilated environment in long-term care institutions and establish low-infection-risk settings.

(D) Active case finding and strategies for improving timely reporting in MARs

The current prevalence of TB in MARs in Taiwan still meets the conditions recommended by the WHO for systematic screening. In recent years, efforts have been made to reduce the impact of factors such as inconvenient transportation on the willingness of residents in remote areas of the MARs to undergo active case finding examinations. This is achieved by actively utilizing relevant equipment and vehicles, coupled with important festivals and promotional campaigns. Mobile chest X-ray screening are conducted in the MARs to enhance the utilization and effectiveness of active case finding services. In collaboration with county and city health bureaus, specialized chest physicians are hired to support rural health clinics to improve the quality of healthcare in remote areas and enhance the accessibility for TB patients to medical services, thereby reducing barriers to seeking medical attention for residents in MARs.

The current active case finding for TB in MARs mainly relies on chest X-ray screening. While this approach has benefits in discovering cases actively and avoiding delayed diagnosis which have contributed to a visibly greater reduction in the incidence rate of TB in MARs, the incidence rate is still about three times higher than the national average. Therefore, additional strategies are needed to overcome limitations in certain areas, such as narrow and steep roads, obstacles to the X-ray mobile unit, mobility issues for those unable to stand for chest X-ray screening, and limitations for individuals unable to participate in screening activities due to work or education commitments. These limitations highlight the need to increase screening service channels and accessibility. The project aims to improve overall TB active screening coverage by combining medical institutions with the education system. Thus, the current project will continue to refine relevant strategies. For high-risk populations in remote areas with limited medical resources and lower medical accessibility, the

internationally recommended chest X-ray screening methods will be employed, complemented with the previously mentioned X-ray screening quality control plan, to provide mobile inspection services. Emerging technologies, equipment, and diagnostic tools will also be introduced from the international community to facilitate early diagnosis and treatment. According to the analysis of active case finding data in MARs in 2017, the median interval from abnormal X-ray screening to notification was 47 days. To address the issue of delayed diagnosis in these areas, the project plans to comprehensively utilize WHO-recommended rapid molecular testing (Xpert) for sputum examination. The goal is to equip at least one molecular rapid testing instrument in each mountainous aboriginal (MA) health center.

In addition, for the registered residents in MARs who do not actually reside there, the active case finding strategy involves collaboration with the main medical institutions where MA people primarily seek medical care. This strategy complements the existing chest X-ray screening services and enhances service accessibility. After evaluation by the local Health Bureau, collaboration is established with hospitals/clinics within the jurisdiction that have X-ray equipment plus experience in and capacity for TB diagnosis and treatment, and are frequented by MA people. A reminder for chest X-ray examination is embedded in the clinic system (including MA people from other counties and cities). This initiative proactively offers chest X-ray examinations and TB risk and symptom assessments to MA people seeking medical attention. Collaboration is also initiated with clinics that are commonly visited by MA people. These clinics actively assess the risk and symptoms of TB in their outpatients. Individuals showing any TB-related symptoms are then referred to health centers or hospitals with X-ray equipment for chest X-ray examinations or sputum collection for Xpert testing to effectively expand the coverage of screening.

In addition, awareness and education on the symptoms of TB are simultaneously promoted to enhance public awareness of personal health. Through collaboration with educational institutions, teamwork with junior and senior high schools in MARs are carried out to encourage students to

advocate the importance of chest X-ray screening to their families, and assist family members in undergoing screening for TB symptoms. Notifications are given to those with symptoms to undergo chest X-ray examinations. If individuals reside in areas inaccessible to the X-ray mobile unit, or are physically immobile or bedridden, and have not undergone chest X-ray examinations in the current year, public health personnel will visit their homes to collect sputum samples. The samples will be tested using rapid molecular detection for TB bacteria. Individuals with abnormal test results will be referred to medical care by public health personnel. This approach aims to increase the overall coverage of active TB screening, shorten the period of potential transmission, disrupt community transmission chains, and reduce the incidence of TB infections in the community. By promoting active screening activities, early detection of cases can be achieved to prevent adverse treatment outcomes, complications, and negative socio-economic impacts associated with TB cases. This contributes to lowering the prevalence and mortality rates of TB in MARs and addressing health inequality within this population.

(E) Screening for migrant population from high TB-burden countries upon entry and active detection, as well as testing and treatment for LTBI in new immigrants

The health management of migrant population at high risk of TB is enhanced through interdepartmental collaboration, using technological projects and other relevant initiatives to assess the feasibility of screening and treating LTBI in migrant workers. Current strategies employed by advanced countries in managing and preventing TB among immigrants are also referenced, along with analyses of the prevalence of TB among migrant population in Taiwan, to review the screening measures and subsequent preventive strategies for migrant population in Taiwan. Additionally, collaborations with relevant units such as the National Immigration Agency and support groups for new immigrants are coordinated to promote culturally integrated health education, raising

awareness among migrant population about monitoring TB symptoms and seeking early medical attention.

Given the frequent exchanges between Taiwan and neighboring countries, particularly with mainland China and Southeast Asian nations, many of which have a high burden of TB or MDR-TB, and are major sources of new immigrants, foreign students, and migrant workers, it is imperative to strengthen Taiwan's surveillance of TB among migrant population. According to relevant regulations such as the 'Employment Service Act' and the 'Regulations Governing Management of the Health Examination of Employed Aliens,' migrant workers in Taiwan are required to undergo health examinations within three days of entry and subsequently at 6, 18, and 30 months of employment at designated domestic hospitals, in addition to submitting qualified health examination certificates from their home country during the application process. Furthermore, based on relevant regulations such as the Immigration Act, migrant population (including new immigrants) and foreign students applying for residency in Taiwan are also required to provide health examination certificates, including screening for pulmonary TB. Suspected cases identified by hospitals are reported, and public health authorities intervene in epidemic prevention. Those meeting the criteria are provided with appropriate medical services to prevent the introduction of infectious diseases from overseas and ensure domestic epidemic prevention security.

From the TB trends in high income countries, it is expected that, the proportion of foreign cases is expected to increase as the domestic TB epidemic continues to decline each year. Taking the TB trend in the United States for example, their percentage of foreign TB cases has risen from 30% in 1993 to 70% in 2016. Genotyping of TB strains have revealed that 86% of TB cases in immigrant populations are attributable to reactivation of LTBI, with only 14% being newly infected after entering the United States. In Taiwan, surveillance data indicates that foreign TB cases constitute approximately 6-8% of the total, with new immigrants accounting for 8-12% of foreign TB cases. Although it does not yet pose an immediate threat to the epidemic, frequent cross-border interactions and close proximity to

high-burden TB countries increase the potential challenges of cross-border TB transmission in Taiwan.

International researches on the risk of TB among immigrants indicate that new immigrants are more susceptible to developing active TB from LTBI due to stress caused by significant cultural and lifestyle changes. The probability of developing TB within the first few years after migration is particularly high. In Taiwan, approximately 60% of TB cases among new immigrants are reported within 5 years of applying for residency. Moreover, over 80% of new immigrants in Taiwan come from high-burden TB countries. As immigrants usually become citizens after leaving their home country and joining our society for certain years, this project recognizes the potential public health impact and the humanitarian obligation to care for the health of our residents, and entails collaboration with relevant authorities, including the National Immigration Agency. The aim is to provide active TB case finding, LTBI screening, and treatment services for new immigrants who have been in Taiwan for less than 5 years. The goal is to detect cases early and reduce the risk of TB development among new immigrants, contributing to the prevention of cross-border TB transmission in Taiwan.

(F) Enhanced plan to reduce delayed diagnosis

Due to the fact that contracting infectious diseases is still considered unmentionable by most people, patients are unwilling to let others know about it. In recent years, the control and prevention of TB have been remarkable, and the number of cases has dropped to below ten thousand, so the general public even believes that TB no longer exists. People either forget the ongoing threat it poses to health in the community, or mistakenly think of TB as a disease that only occurs in vulnerable populations. The general public overlooks its severity, inadvertently restricting the promotion of various prevention strategies. With lapses including insufficient awareness of the importance of testing for LTBI and preventive treatment, when individuals show symptoms of TB, they may not realize the need to seek prompt medical attention for sputum testing

and chest X-rays, leading to delayed diagnosis and the continued spread of the disease in the community. Therefore, it is necessary to use a variety of creative promotional methods to attract the attention of and educate the public about the symptoms of TB and how to seek medical help. For patients in pulmonary departments, administrative measures can be used to remind clinicians to conduct follow-up X-ray examinations or sputum tests for diagnosis, aiming to reduce delayed diagnosis and shorten the time the disease spreads in the community.

On the other hand, as the number of new cases continues to decline domestically, opportunities for clinical physicians to diagnose and care for TB patients also decrease. Faced with individuals showing symptoms of TB, there may be a lack of sufficient awareness, and familiarity with TB-related diagnosis and treatment may decrease. Therefore, it is necessary to establish a reminder mechanism through continuous continuing education and administrative measures to reduce delays in medical diagnosis. In addition to ongoing in-service training for healthcare professionals, this project will prioritize the integration of emerging diagnostic technologies, gradually incorporating molecular diagnostic techniques into routine testing processes. It will also involve reviewing and adjusting the current TB case reporting procedures through laboratory notification strategies. By strengthening the diagnostic capabilities of non-TB specialists/medical students or establishing a referral network, the goal is to shorten the diagnosis time for TB cases, increase reporting efficiency, reduce unnecessary medical interventions for the public, and ensure effective allocation and use of healthcare and epidemic prevention resources.

C. Patient-centered care and case management

(A) Enhancing the quality of TB care

a. Increasing the willingness of hospitals to provide TB care

Case management quality is continuously assessed through infection control standards, while case management in hospitals is promoted via collaboration with the NHI program to implement quality payment plans, with incentives provided for hospitals and clinical physicians to enhance

their willingness to manage TB cases. For residents in MARs, TB control and prevention are incorporated into the standardized "Integrated Delivery System" (referred to as IDS Plan) platform in the hope of encouraging clinical physicians to engage in TB diagnosis and related preventive treatment services through increasing funding for quality improvement initiatives. This approach indirectly fosters the willingness of clinical physicians to participate in TB treatment, promoting sustainable talent development.

b. Introducing new drugs to reduce treatment-related side effects and shorten the duration of treatment

Domestic needs are evaluated, and international developments in clinical treatment as well as research benefits for TB, MDR-TB, and LTBI are considered. Emerging drugs with less side-effects or new short-course regimens, such as Pretomanid, are introduced for clinical use to shorten the treatment duration for TB patients or those with LTBI. By ensuring an ample variety of treatment drugs domestically and providing physicians with choices for the most suitable treatment combinations for individual cases, the occurrence of drug side effects can be reduced. This not only enhances patients' willingness to undergo treatment and their quality of life during the illness, but also minimizes additional expenses for both patients and the government in terms of costs of healthcare and disease control.

c. Implementing hospital case care quality and enhancing management efficiency

"Patient-centered care for TB cases" is the primary goal of TB case management. We continue to collaborate with the NHIA to promote the TB quality payment system, encouraging medical institutions to include TB patients in high-quality case management services and ensuring the quality of medical care for TB cases. Additionally, through the "audit standards for infection control inspections in hospitals," we set evaluation criteria for hospital TB management, including having dedicated personnel

responsible for TB case management and health education, having a TB diagnosis and treatment mechanism, and implementing comprehensive in-hospital contact tracing and TB case management procedures as part of infection control measures to ensure the implementation of the management system.

Through the interface operation between the hospital's medical information system and the Tuberculosis Management System, various clinical information such as laboratory test results, drug resistance data, medical orders, and care records for TB cases are automatically written into the "Tuberculosis Management System" from the hospital side. The integrated system data is then fed back to the hospital side, allowing hospital staff to instantly access various information about TB cases. This allows public health and medical personnel more time to carry out TB case management tasks, effectively achieving real-time integration of public health and clinical medical information. This enhances the completeness and accuracy of case-related care information. At the same time, it reduces manual work and time spent on data maintenance, and minimizes human errors. This allows TB case managers more time to provide services and care for challenging TB cases.

To keep up with the evolving TB diagnosis and treatment technologies as well as disease control and prevention policies, continuous education and training programs for hospital TB case managers are implemented. Through a well-designed educational training program and interactive discussions, experiences related to the care of special cases are shared to continuously strengthen and enhance the care experiences and professional knowledge of case managers. The goal is to establish an information platform that enables seamless flow of data among the medical, laboratory, and public health systems. This platform assists TB care personnel in staying updated with the latest medical information and provides tailored care services based on the specific needs of patients.

- d. Enhancing healthcare quality management and professional standards for physicians

The sixth edition of the Taiwan Guidelines for Tuberculosis Diagnosis and Treatment was revised and published in 2017. Widely referenced by clinical medical societies, public health organizations and hospital management, it has also been adopted by the NHIA as the basis for medical expense reviews. Continuous reference to international trends and emerging knowledge in TB treatment, regular and ad hoc meetings are convened with domestic experts and relevant medical specialty societies to jointly review and update Taiwan Guidelines for Tuberculosis Diagnosis and Treatment. This facilitates the exchange of clinical experiences among healthcare professionals, enhancing the diagnostic and treatment standards for TB among clinicians. Ensuring the accuracy of prescribing anti-tuberculosis medications, this approach promotes treatment completion for individuals, reduces the risk of developing drug-resistant strains, and lowers the chances of recurrence. Additionally, it enables clinical healthcare personnel to understand public health policies, transforming the content of important national programs into professional knowledge and fostering a bottom-up approach to support the implementation of relevant strategies.

We have gathered clinical experts in TB in Taiwan to establish a Tuberculosis Clinical Consultation Group. This group provides guidance and recommendations for suspected TB cases and addresses related issues arising from other medical treatments. The consultation group assists in confirming diagnoses and offers reviews and suggestions for the use of second-line anti-tuberculosis drugs. The aim is to ensure that all cases receive accurate and appropriate diagnosis and treatment. In addition, the group assists in various TB education and training programs, covering topics related to clinical issues to help establish a communication channel between public health and medical professionals. We continue to collaborate with the NHIA to implement programs aimed at enhancing medical quality. This includes conducting chart reviews for cases managed by the TCDC, assessing the appropriateness of prescriptions made by healthcare providers, and addressing prescriptions that do not align with treatment guidelines. This ensures that clinicians issue correct and

guideline-based treatment prescriptions, maintaining a high quality of medical care.

We are developing a prescription appropriateness checking program within the Tuberculosis Management System. This program facilitates relevant authorities to review and discuss prescriptions that raise concerns. Through the automatic integration of medication data systems, it alleviates the workload of frontline personnel. By ensuring the accuracy of TB medication, we aim to enhance medical quality, providing precise treatment and achieving the initial step in preventing and controlling TB.

e. Stably providing quality anti-tuberculosis treatment medications

Regarding the current quality control of anti-tuberculosis drugs on the market, we will continue to collaborate with Taiwan's Food and Drug Administration (referred to as TFDA) to conduct monitoring operations to ensure drug safety and efficacy assessments. Additionally, we will collect information on the price, dosage form, and compliance with relevant TFDA operational regulations for first-line and second-line anti-tuberculosis drugs with domestic drug licensure. This is to monitor the supply and demand and quality stability of anti-tuberculosis drugs in the current market. By understanding the supply situation of drug raw materials through various channels domestically and internationally, for anti-tuberculosis drugs that may be affected by raw material shortages, we will assess the domestic raw material and drug inventory, and evaluate the national safety stock level to propose preemptive measures.

The research, development, and market status of new drugs worldwide is monitored. If a new drug is deemed suitable for domestic patients through evaluation but lacks domestic drug licensure, we will establish a special import procurement channel, such as purchasing from the Global Drug Facility (GDF) or commissioning domestic professional pharmaceutical companies for importation. This ensures that new drugs or formulations for treating TB are available domestically in a timely manner and guarantees a stable supply source.

Market supply and demand situation for anti-tuberculosis drugs along with their raw materials are continuously monitored. For second-line anti-tuberculosis drugs that are less commonly prescribed due to lower market demand or are not yet domestically licensed, and are obtained through special import arrangements, the TCDC will procure and establish a distribution mechanism. This aims to provide physicians with more treatment options for patients needing non-standard prescription treatments due to factors like drug resistance or adverse effects, thereby enhancing the likelihood of successful treatment for these cases.

Furthermore, for special anti-tuberculosis drugs purchased with government budgets, domestically produced drugs must pass certification by the TFDA, and the transportation and storage of drugs must comply with Good Manufacturing Practice (GMP) standards. For foreign-manufactured drugs, they must be approved by stringent drug regulatory authorities, the WHO List of Prequalified Medicinal Products, or the Expert Review Panel of the Global Fund, to ensure the provision of stable and high-quality anti-tuberculosis drugs. Regarding the special import of anti-tuberculosis drugs, the promotion of drug injury relief review and payment operations is initiated to safeguard patients who experience unexpected severe adverse reactions when using these specially imported drugs, providing appropriate assistance and fully ensuring patient medication safety.

(B) Optimizing the management quality of TB cases

a. Implementing standardized management processes for TB cases

To address the management process, a "Tuberculosis Control Manual" is developed, detailing various workflow procedures for frontline staff to access and follow at any time, assisting in providing comprehensive services for each patient. The handbook also incorporates all procedures related to TB case management into foundational and ongoing education and training materials. This will help frontline staff to understand the close relationship between TB case management and disease treatment outcomes while reinforcing their professional expertise. The goal is to

provide standardized guidelines for TB case management, facilitate the transfer of case management experience, and strengthen communication between public health personnel and healthcare institutions, ensuring the quality of patient healthcare.

Tuberculosis “Smart Cards” and TB case diagnosis and treatment survey forms are used as communication tools between public health and healthcare sectors, facilitating immediate and ample communication between the sectors in addressing issues arising during a patient's treatment process, such as medication side effects or various diagnostic uncertainties. Additionally, while respecting individuals' privacy, the tuberculosis “Smart Card” will be considered through collaboration with the NHIA for the feasibility of its incorporation into the second-generation health insurance card, aiming to simplify the healthcare procedures for the public.

Establishing the TB case management schedule in the Tuberculosis Management System includes defining the management content and considerations required for each stage of the management process. Through systematic planning, public health case managers can have a clear understanding of the tasks to be performed for each TB case, from case enrollment to the discharge process. This aims to establish a standardized management workflow.

b. Strengthening the quality monitoring of case management

High-quality case management relies on the ability of management personnel to promptly grasp patients' service needs and medical information, intervening in a timely manner to provide appropriate services and address treatment uncertainties. To ensure that each case receives high-quality case management and care services, the National Tuberculosis Patient Database is utilized for real-time monitoring of case management quality. Routine monitoring reports are generated to assist county and city health bureaus in understanding deficiencies and areas that need improvement in case management. This facilitates the development of improvement measures. Additionally, through a

hierarchical and tiered audit system between the central and local levels, supervisory-level county and city health bureaus and regional centers of the TCDC are responsible for conducting random on-site inspections of cases. They provide timely consultation and guidance to frontline management personnel. An integrated information network of medical institutions, laboratories and public health system is being constructed. Within the Tuberculosis Management System, this network provides essential information such as automatic warning and notification for management, offering a user-friendly interface for frontline public health personnel to enhance management efficiency.

(C) Expansion and quality improvement of the DOTS TB control program

Implementation of the WHO-recommended DOTS program is being continued. Considering the increasing aging population in Taiwan, the use of DOTS observers will still be necessary to provide medication-related care services. This approach aims to accompany patients in facing the discomfort, side effects, and the challenges of long-term medication, ensuring regular and persistent drug adherence, thereby avoiding the potential impact on treatment effectiveness and the development of drug-resistant bacteria, which could lead to more serious public health issues. Public health personnel, with the assistance of DOTS observers, can have more time to address challenging case management tasks. Additionally, to reach individuals who may not comply with traditional DOTS, efforts are made to assist every patient in taking their medication. Leveraging advancements in technology and widespread use of mobile communication, cloud-based technologies such as e-DOTS that use real-time video calls for medication support are introduced. This service is extended to individuals with LTBI, mobile populations with TB (e.g., short-term travelers, tour bus/taxi drivers, other mobile occupational groups, temporary returnees among new immigrants, and Taiwanese business travelers abroad), with the gradual expansion of the scope of service recipients being evaluated to realize the principle of "patient-centered care."

Data can be directly entered and uploaded to the management system through mobile devices to save time used on administrative works for DOTS observers and public health nursing staff. This approach also allows for real-time data maintenance. In addition, a standardized management model is implemented, including on-site inspections of the DOTS medication delivery process by observers, location tracking methods, and various incentive measures. Supervision is conducted on both the process and outcome aspects, utilizing technology to enhance execution quality and efficiency. Furthermore, there is ongoing evaluation of the labor conditions and work quality of DOTS observers hired by each county and city, ensuring proper utilization of manpower and safeguarding the rights and interests of DOTS observers.

(D) Medical care for DR-TB

In recent years, there have been significant achievements in the control and prevention of TB in Taiwan. The number of cases of MDR-TB resulting from treatment failure or loss to follow-up has gradually decreased. The focus of the current stage is on new cases, particularly those of RR-TB. However, with high TB burden countries in nearby regions, their epidemic situation including drug-resistant cases may have a certain impact on the effectiveness and efforts of TB control and prevention in Taiwan. Since the establishment of the TMTC, Taiwan has implemented various public health policies to achieve outstanding treatment outcomes. While maintaining the current standards of management and care quality, there is an expectation that the introduction and use of new drugs will further shorten the treatment duration, reducing barriers to medication adherence for patients and alleviating the workload of public health personnel.

Regarding the monitoring of DR-TB cases, there will be continued efforts to strengthen the current surveillance and reporting mechanisms for RR-TB. Besides the comprehensive implementation of RR-TB strain re-examination procedures, rapid molecular testing will be provided for TB cases reported with a high risk of RR-TB to facilitate early diagnosis and

epidemic detection of DR-TB. By integrating GIS, a database of MDR-TB strain genetic database will be established to understand the distribution and trends of MDR-TB in the country. Furthermore, there will be an emphasis on enhancing the implementation of contact tracing examinations for MDR-TB, along with initiating source investigation mechanisms. These efforts aim to effectively interrupt the subsequent transmission of MDR-TB.

In terms of healthcare, the TMTC continues to be implemented to admit and care for patients with DR-TB and those with challenging cases. In addition to specialized medical services, patients are required to undergo advanced DOTS programs to enhance the success rate of their treatment. According to the WHO's recommendations for DR-TB cases receiving new anti-tuberculosis drugs, new short-course MDR-TB treatment prescriptions, and XDR-TB treatment prescriptions, active TB drug-safety monitoring and management (aDSM) is advised. This involves systematic and continuous monitoring of adverse drug reactions, timely detection of drug-related adverse events, reporting, and appropriate management.

(E) Care for difficult or special cases

For cases with poor treatment compliance or lack of cooperation, there is a high likelihood of developing DR-TB or experiencing adverse treatment outcomes. Therefore, tailored management strategies and monitoring (warning) mechanisms are formulated for specific cases that generally may not comply with treatment. Immediate intervention measures are also provided for such special cases to mitigate the risk of treatment failure.

a. Cases with medication side effects

Through regular visits by public health personnel, referrals from medical institutions, and the operation of the TB consultation group, we can monitor the occurrence of medication side effects and provide patients with appropriate treatment modalities in real time, thereby reducing the risk of non-compliance due to medication side effects.

Additionally, by reviewing cases of drug injury relief applications, we can retrospectively confirm whether public health personnel have conducted side effect monitoring in accordance with regulations, systematically providing feedback and guidance on the frontline execution status and using case studies to remind and share experiences.

b. Elderly population

Considering the exacerbation of the aging population issue in Taiwan, individuals aged 65 and above account for approximately 60% of all cases, and this proportion is increasing annually. In addition to the continued implementation of the DOTS program, through the efforts of observers delivering medication, assessing and caring for potential side effects, elderly individuals are accompanied through the discomfort and side effects of disease treatment. This assistance ensures the completion of long-term treatment regimens. The elderly population typically experiences concurrent chronic conditions such as renal failure and diabetes, significantly impacting the prognosis of diseases in the elderly. Therefore, the care network is to be expanded through integrating prevention and treatment resources, and linking with plans from other departments/agencies, such as community care centers and collaborative networks for diabetes care, simultaneously addressing multiple health conditions to improve prognosis and reduce the risk of treatment failure and relapse. Furthermore, long-term care or social resources are to be incorporated to facilitate family in referring patients to short-term respite services, allowing seniors to comfortably receive various clinical treatments.

c. Management of comorbid cases

In areas with a high prevalence of both HIV infection and TB, TB remains a leading cause of death. In 2017, approximately 300,000 people worldwide died from HIV-associated TB, posing a significant challenge to global TB control and prevention efforts. Immunodeficiency, particularly due to HIV infection, is a major contributing factor to the increased risk of

developing TB. Research data indicates that HIV-infected individuals have a 20 to 37 times higher risk of TB compared to those without HIV infection. Therefore, the WHO has identified HIV-infected individuals as a high-risk group for TB and recommends prioritized comprehensive screening and treatment for LTBI in this population. On a global scale, the strategy outlined in the 2035 Global Tuberculosis Elimination Plan focuses on the "Search-Treat-Prevent" approach to reduce the progression of HIV-infected individuals to active TB cases. The inclusion of recommendations for the diagnosis and treatment of LTBI in HIV care guidelines is suggested to align with the goals of the 2035 Global Tuberculosis Elimination Plan. In Taiwan, the co-infection rate of TB among people living with HIV is relatively low, accounting for about 1% of newly reported TB cases (3% in the age group of 15-49). The country will continue to implement the HIV/TB collaborative management principles, regularly analyze trends in TB cases with concurrent HIV infection, and take immediate actions based on the analysis results. Efforts will also be made to enhance the active detection of TB among individuals living with HIV, improve awareness of TB symptoms, introduce high-sensitivity diagnostic technologies, and facilitate early diagnosis and appropriate management of TB to improve outcomes.

According to literature, diabetes increases the risk of developing TB by 2 to 3.6 times, and the risk is further elevated in individuals with poor blood glucose control. TB patients with coexisting diabetes have a higher rate of treatment failure and death compared to non-diabetic patients. Additionally, TB patients with diabetes face a higher risk of TB recurrence after completing treatment, highlighting the importance of TB control and prevention in individuals with diabetes. To address this issue, there is a need to enhance bidirectional active case finding, increase awareness among individuals with diabetes regarding TB symptoms, understand the blood glucose status of TB cases, and develop educational materials for TB prevention. Collaboration with organizations and associations related to diabetes care should be coordinated to integrate TB control and prevention into diabetes care education and training. Healthcare

professionals involved in diabetes care are encouraged to participate in TB prevention efforts, ensuring a synergistic approach to both blood glucose control and TB prevention.

For other lifestyle habits and coexisting diseases such as smoking or dialysis that may impact the onset and treatment of TB, there is a plan to integrate relevant resources. This involves establishing connections with other departments and programs, expanding the network for prevention and treatment, developing care measures tailored to these populations, and incorporating education and training in consideration for the care of TB patients with coexisting diseases. The aim is to enhance the quality of care provided by case managers and improve their ability to deliver integrated care.

d. Chronic infectious pulmonary TB cases

To encourage patients with chronic infectious pulmonary TB to undergo long-term hospitalization at designated hospitals, financial assistance will be offered for their hospitalization, covering nutritional support and living expenses. Public funds will be allocated to cover ward fees, consultation fees and copayment during hospitalization to ensure that patients adhere to regular treatment and to cut off the source of community transmission. The introduction of new and evidence-based medications or treatment methods is actively supported for appropriate cases to receive treatment, rejuvenating hope for the treatment of chronic patients.

e. Financially disadvantaged cases

To ensure that financially disadvantaged individuals can attend regular follow-up appointments as prescribed by the doctor, a portion of the medical expenses will be covered by government budget to alleviate barriers to medical care. For those who are not covered by the NHI, government budget will be allocated to assist in covering full medical expenses, enabling these populations to complete their treatment. In addition, through referral applications for various social assistance

resources and collaboration with long-term care resources, assistance will be provided to families in referring patients to short-term care services for respite care. This allows TB cases to comfortably receive various clinical treatment procedures. Social assistance resources will also be integrated to facilitate referrals for cases in need, reducing barriers to medical care as well as financial obstacles. This aspect will be systematically monitored to assist frontline workers in providing a comprehensive assessment of social welfare needs and subsequent referral mechanisms for specific populations.

f. Mobile Population

To address the management challenges with special cases, such as Taiwanese businesspeople and temporary workers who travel irregularly for work and may find it difficult to comply with treatment schedules, cooperation with the National Immigration Agency has been established. A return-to-Taiwan alert system is implemented specifically for TB cases leaving Taiwan, enabling early tracking of their movements and enhancing management. For cases that have difficulty coordinating with DOTS observers for medication delivery, an assessment is conducted to explore alternative methods for directly observing the patient taking medication, allowing public health management personnel to monitor and understand the TB patient's adherence to the treatment plan. In the case of homeless individuals, local health bureaus should collaborate with social services to assist in relocating them to shelters and, in partnership with non-governmental organizations, provide financial support.

g. Treatment of migrant population in Taiwan (Including new immigrants)

In alignment with the care and support approach for TB cases in Taiwan, we will continue to provide case management and DOTS services. For individuals from countries with a high burden of TB or MDR-TB, we offer molecular rapid testing services on sputum specimens to expedite diagnosis, enabling timely and appropriate treatment. Additionally, we provide TB treatment guidelines and instructional materials on sputum

collection techniques in various languages (English, Vietnamese, Thai and Indonesian). These resources are furnished by local health personnel during in-person visits to foreign TB cases, aiming to assist them in understanding TB-related information and facilitating accurate diagnosis to ensure successful completion of treatment.

Furthermore, we will incorporate social demographic information to tailor control and prevention strategies more closely to specific characteristics of different localities or populations. This approach aims to enhance the detection and alert procedure for the management of high-risk groups such as migrant population and new immigrants. It also enables the provision of comprehensive care services in a timely manner.

h. Loss to follow-up cases

Through multiple channels, including the household registration system, NHI medical records, telecommunications communication, police information, and the immigration system, efforts are made to locate and trace individuals who are deemed lost to follow-up or who have gone missing. In collaboration with the NHIA, real-time feedback on the medical treatment locations of missing persons is obtained through the NHI Card system. This serves as one of the means for public health personnel to trace individuals, locate them, and persuade them to return for medical treatment, thereby reducing the risk of community transmission.

i. Non-adherent cases

Local authorities can invoke the "Communicable Disease Control Act" in a timely manner to implement necessary control and prevention measures for non-adherent and infectious TB cases. This may include administrative penalties and imposition of mandatory isolation measures, strengthening the enforcement of public authority to prevent non-adherent patients from becoming sources of community transmission. Additionally, to enhance the fulfillment and quality of non-adherent case management, efforts will be sustained to strengthen due management

process and integrate various resources to address the challenges in managing such cases.

D. Preventing onset and interrupting transmission

(A) Increase public awareness of TB and LTBI

Based on past practical experiences with delayed pursuit of medical care by TB cases and with contacts refusing treatment for LTBI, it is evident that public awareness of early symptoms of TB and the concept of LTBI still needs strengthening. Moreover, the majority of the population has limited and unclear knowledge about TB, leading to misconceptions that can result in discrimination issues. In order to enhance the public's knowledge of TB control and prevention, this project will utilize diverse media, including press conferences with invited celebrities or experts to explain the concepts of TB and LTBI and share treatment experiences. It will also involve creating informative videos and posters for display in medical facilities, using the Taiwan CDC Facebook page to hold interactive quizzes, and leveraging platforms like Facebook and YouTube for broader dissemination of the importance of TB and LTBI treatment. The goal is to increase public awareness, understanding, and concern about TB, as well as to enhance individuals' awareness of personal health and healthcare, ultimately promoting physical, mental, and social well-being.

(B) Implementing infection control in high-risk environments

a. Infection control strategies for long-term care and correctional facilities

Taiwan is currently facing the challenges of an aging population and a declining birthrate, leading to an increasing demand for long-term care. Given that approximately 60% of recent TB cases in Taiwan occur in individuals aged 65 and above, there is a growing need to address TB in the elderly population. Additionally, the communal living characteristics of long-term care and correctional facilities contribute to the potential risk of TB transmission and infection. To prevent the vulnerability to TB within these facilities, infection control strategies such as ventilation self-management mechanisms and inspection in long-term care institutions

are formulated and gradually implemented to fit their unique characteristics. These infection control strategies aim to mitigate the risk of TB infection and transmission within the institutional settings.

(a) Providing guidance on the establishment of ventilation management mechanism in institutions

Institutions are encouraged and guided to strengthen ventilation and air conditioning systems to improve indoor air quality, enhance ventilation, and promote air exchange with the external environment in compliance with policies and the "Indoor Air Quality Management Act" and its related regulations. This helps reduce the risk of TB transmission within institutions. New institutions are required to adhere to relevant regulations such as the "Standards for the Establishment of Long-Term Care Institutions" to provide residents and staff with a well-ventilated and safe environment, maintaining a low risk of infection within the institution.

(b) Promote respiratory hygiene and cough etiquette

Promotional materials for respiratory hygiene and cough etiquette, including posters and pamphlets, are created and displayed in communal areas such as accommodation area and lounges to remind staff, residents, and visitors to wear masks and seek prompt medical attention if they have a fever or respiratory symptoms, aiming to protect their own health and that of others.

(c) Implementing a health management mechanism

Health management is implemented for both staff and service recipients; relevant infection control guidelines are developed based on the characteristics of the institution, whereas infection control inspections are carried out to ensure that relevant staff members in the institution implement various infection control measures. The infection control framework within each institution is strengthened to enhance emergency response and handling of cluster incidents to reduce the risk of TB infection and protect the health of institution staff, residents, and visitors.

(d) Enhance education and training for staff members

TB control and prevention health education is conducted to improve correct awareness and vigilance among service recipients. In case of suspected symptoms, they should seek medical attention promptly to reduce the risk of respiratory disease transmission and prevent cluster incidents, safeguarding the safety and health of both staff and service recipients.

b. Hospital infection control strategy

The lack of infection control strategies creates an environment conducive to the transmission of MDR-TB and XDR-TB among healthcare workers, patients, and individuals sharing the same space. Therefore, referencing the WHO publication "Implementing the WHO Policy on TB Infection Control in Health-Care Facilities, Congregate Settings, and Households," we aim to develop context-specific infection control strategies. Recognizing that infection control is a crucial component in preventing the spread of TB, these strategies can effectively interrupt the transmission of *Mycobacterium tuberculosis* in healthcare settings where there is insufficient attention to TB transmission.

(a) External assessment mechanisms such as Infection control inspections in hospitals are sustained to supervise the implementation of TB infection control measures in hospitals. TB prevention, control and management tasks are promoted, including arrangement for designated personnel to take charge of TB and LTBI case management and health education initiatives, healthcare worker health monitoring, establishment of a TB treatment mechanism, and comprehensive in-hospital contact tracing and TB case management. By incorporating them into the hospital infection control audit criteria, regular external audits ensure the effective implementation of the tuberculosis management system.

- (b) Patient diversion mechanisms are enhanced by promoting the establishment of suitable patient diversion strategies within hospitals through practical experiences sharing or external assessment mechanisms such as infection control audits. This aims to reduce transmission risks, and addresses the challenges faced by hospitals in Taiwan due to a large number of outpatient and emergency department visits, coupled with factors like healthcare staff shortages and space constraints, which have made patient diversion a challenging practice.
- (c) Promotional materials for respiratory hygiene and cough etiquette, including posters and videos, are created for healthcare institutions to display or play regularly in all entrances, waiting areas and wards. Marketing strategies are developed through various channels such as the internet and magazines, with patients and their visiting family members involved in the promotion of respiratory hygiene, cough etiquette, and hand hygiene to establish public awareness on proactive mask-wearing and proper hygiene practices when experiencing fever or respiratory symptoms to protect themselves and others.

c. TB control and prevention strategies for schools/tutoring centers

While the incidence of TB among student populations is much lower than the national average in Taiwan, whenever a TB incident occurs on a school campus, parents often attribute it to inadequate hygiene management by the school, which can lead to media events. To reduce the occurrence of such incidents, in collaboration with the Ministry of Education, we have compiled the "Tuberculosis Control on Campus." We will continue to work together to promote TB prevention education in schools at all levels during normal times. This aims to enhance the correct understanding and awareness of TB among faculty, staff, and students so that they can seek medical attention promptly if suspicious symptoms arise. Additionally, in accordance with the "Indoor Air Quality Management Act" and its related regulations, indoor ventilation, air

exchange, and the regular cleaning of air conditioning equipment are emphasized to prevent disease transmission due to poor ventilation.

When a TB case occurs on a school campus, educational and health authorities should promptly collaborate on epidemic investigations, contact tracing, inspections and related procedures. Indoor air quality assessments by experts should also be conducted to reduce the spread of the epidemic and prevent its recurrence.

Collaborations with educational institutions are enlisted to enhance classroom ventilation, promote self-health management, conduct regular cough monitoring, and perform periodic health check-ups. Following the abnormal chest X-ray tracking process outlined in the school's new student physical examination/regular examination protocol, cases with TB-related abnormal results are reported to health authorities for further follow-up to prevent the occurrence of clusters.

d. TB cluster monitoring and management

To ensure the maximum effectiveness of epidemic prevention measures, public health personnel should be able to monitor TB clusters in real time and intervene early. Therefore, a cluster monitoring strategy based on GIS for TB cases is established in combination with genotypic information of TB strains to create a nationwide molecular epidemiology blueprint for TB. This allows for the tracking of epidemic trends, enabling not only close monitoring of medical institutions, schools, and densely populated institutions such as nursing homes, but also comprehensive monitoring of disease reporting in communities with a high incidence of TB. By enhancing monitoring sensitivity, timely initiation of epidemic investigations and preventive interventions can effectively prevent the spread of the epidemic.

When a TB cluster occurs, more detailed contact tracing, symptom screening, and related investigations are often required to clarify potential sources of infection or infectious hotspots. Compared to the general investigation of TB cases, clusters often require more intensive manpower and resource allocation. To strengthen the investigative capabilities of

public health personnel, in addition to conducting education and training to enhance TB case investigation and epidemiological investigation skills, there is a need to improve detection equipment and the ability to handle events and environmental improvements, including ventilation investigations, to prevent similar events from recurring. When a cluster infection is confirmed, experts will be invited to form a TB cluster infection expert meeting, which can help provide recommendations on the scope of contacts, tracking frequency, LTBI treatment plans, and more. Using testing methods, LTBI infection assessments and follow-up interventions for contacts in cluster can be better conducted to reduce the risk of illness among contacts. Regarding indoor ventilation, environmental safety experts from the Ministry of Labor and others will be consulted to provide improvement measures for environmental facility risk factors.

An audit mechanism for the monitoring and management of cluster is established to perform periodic audits for those meeting the definition of suspected cluster. These audits supervise the implementation of epidemiological investigations and track the progress of epidemic prevention measures. For specific clusters, a project-based reporting approach is employed to monitor the progress and discuss relevant epidemic prevention measures, thereby accumulating experience and enhancing the ability to handle such events. By integrating individual geographic information and strain genotyping information, a nationwide molecular epidemiological blueprint for TB is constructed. This strengthens the abilities of public health personnel to conduct epidemiological investigations, handle events and improve the environment, further complementing epidemic prevention efforts.

(C) BCG vaccination and assessment of new vaccines

According to domestic tracking data analysis results, it is evident that the risk of tuberculous meningitis is 47 times higher in children who have not received the BCG vaccine compared to those who have been inoculated. This underscores the protective benefits of the BCG vaccine. We will continually review vaccine administration policies and closely

monitor the development progress of new international TB vaccines (such as M72/AS01). If an effective adult vaccine is successfully developed and approved during the current project period, it will be timely introduced to prevent disease and safeguard the health of our people.

Currently, the internationally highlighted vaccine development project is that of the M72/AS01 vaccine, aiming at preventing and treating TB and funded by the non-profit organization Aeras with support from pharmaceutical companies and the Bill & Melinda Gates Foundation. The second phase trial results of this vaccine were published in the online edition of the New England Journal of Medicine. The research was conducted in Kenya, Zambia, and South Africa. Among 1,786 adults who received two doses of the vaccine, 10 individuals developed pulmonary TB, while in the control group of 1,787 individuals who received a placebo injection, 22 individuals developed the disease. The average follow-up time was 2.3 years, and the efficacy of the vaccine in this mid-term clinical trial for adults was only 54%. However, this outcome represents a significant milestone in the fight against TB.

Based on relevant information assessment, Taiwan is unable to meet the internationally recognized standards for completely discontinuing BCG vaccination in the short term. Therefore, we will continue to procure an ample reserve of BCG vaccines to provide for policy targets and facilitate vaccination. This approach aims to prevent occurrences of tuberculous meningitis and mortality or lifelong disabilities due to disseminated TB in children. In addition, ongoing efforts are being made to minimize the probability of adverse reactions following BCG vaccination, including analyses of the safety and stability of BCG vaccine strains, implementation of standard procedures for monitoring transportation and storage processes, certification programs for the technical training and evaluation of vaccination personnel, provision of sufficient information and assistance in newborn screening to parents. These measures aim to reduce the occurrence of post-vaccination side effects. Simultaneously, we are implementing a system for reporting and monitoring the side effects of BCG vaccines to assist parents of children experiencing side effects in

applying for relief under the "Regulations Governing Collection and Review of Vaccine Injury Compensation Fund," providing the public with appropriate assistance and tangible relief.

(D) Treatment and management of target populations with LTBI

The treatment of LTBI is advocated by the WHO as a more proactive and crucial strategy for further eradicating TB. Literature indicates that approximately 5-10% of LTBI patients have a lifelong risk of progressing to active TB, with the majority developing the disease within the first 5 years after initial infection. Therefore, WHO recommends that in high-income and upper-middle-income countries with a TB incidence rate lower than 100 cases per 100,000 population, specific high-risk populations should be targeted for systematic identification and treatment of LTBI cases. To prevent the progression of LTBI to active TB, in addition to screening and treating all age groups of TB contacts, consideration should be given to implementing treatment plans for high-risk LTBI cohorts, including residents in long-term care institutions, elderly populations, new immigrants, HIV-infected individuals, injection drug users, individuals in correctional facilities, patients using immunosuppressant therapy, and other high-risk individuals with comorbidities. Furthermore, it is advisable to strengthen the functionality of management information systems, including alerts and reminders, and explore the feasibility of short-course treatment prescriptions. This facilitates case management and tracking, enhances management efficiency, and improves the willingness to and completion rates of treatment for individuals with LTBI.

To ensure the screening services for LTBI, apart from using TST for contacts under 5 years old, more sensitive and accurate diagnostic tools such as IGRA, are currently provided for contacts aged 5 years and older, as well as high-risk populations. IGRA assists healthcare professionals in diagnosing LTBI and serves as the basis for evaluating the need for subsequent LTBI treatment. If new diagnostic tools are developed internationally and are recommended, efforts will also be made to actively

introduce and incorporate them into guidelines upon confirmation that they meet the actual needs in the country.

In addition, individuals undergoing LTBI treatment must adhere to directly observed preventive therapy (DOPT) to achieve optimal effectiveness. Strengthening and implementing hands-on care will be emphasized to enhance the quality of management for cases undergoing LTBI treatment.

a. Individuals with HIV infection

The WHO has classified individuals with HIV infection as a high-risk group for TB, recommending prioritized comprehensive LTBI treatment for this population. In recent years, responding to WHO's recommendations, the TCDC has commissioned medical institutions in both the northern and southern regions to implement LTBI treatment programs for individuals undergoing opioid agonist therapy or those with HIV infection. The research team in the northern region reported a LTBI positivity rate of 25% among this population, while the southern region team reported a rate of 30.8%. In collaboration with local health bureaus, the research teams have carried out LTBI screening and treatment for this population, with the preliminary results of the pilot program including 232 enrolled individuals, showing a positivity rate of 27% and a treatment initiation rate of 53%.

The Taiwan Guidelines for Tuberculosis Diagnosis and Treatment published by the TCDC have aligned with WHO guidelines by categorizing individuals with HIV infection as a high-risk group for TB, which identifies them as a target population for LTBI screening and treatment. As of 2018, the cumulative number of reported cases in Taiwan is approximately 30,000, and the current plan involves including individuals with HIV infection into the screening and treatment targets for LTBI. In collaboration with local health bureaus and designated medical institutions for HIV care, the plan aims to gradually implement LTBI screening and treatment programs for individuals with HIV infection to effectively reduce the risk of TB incidence through the treatment of LTBI in individuals with HIV infection.

b. Individuals in correctional facilities

WHO points out that correctional facilities, due to factors such as overcrowded environments, poor ventilation, inadequate access to nutrition and insufficient healthcare during confinement, are prone to the spread of infectious diseases. Correctional facilities function like small communities, with daily movement of correctional and medical staff, and frequent contact with visitors. Therefore, any health issues among the incarcerated population can impact those in close contact with them, leading to the potential spread of infectious diseases to the general community. In response, WHO proposes a control and prevention program for TB in correctional facilities, including early detection of TB patients, establishing procedures for isolating and referring suspected TB cases for medical care, ensuring that incarcerated individuals with TB receive complete anti-tuberculosis drug regimens, implementing contact investigations and examinations within correctional facilities, and monitoring cluster incidents. These recommendations have been a significant part in Taiwan's efforts in TB control and prevention in correctional facilities over the years. Additionally, the treatment of LTBI is recommended by WHO as an effective strategy for controlling the TB epidemic. In 2018, Japan conducted an analysis of LTBI among incarcerated individuals in correctional facilities, with research results indicating a high completion rate for LTBI treatment within correctional settings, highlighting the favorable conditions for conducting LTBI treatment in a confined environment.

In 2000, domestic scholars conducted an epidemiological investigation of TB in correctional facilities in Taiwan. The study screened 51,496 incarcerated individuals, among whom 107 were diagnosed with pulmonary TB, resulting in an incidence rate of 259 cases per 100,000 population. In 2013, the proactive detection rate in correctional facilities was 111 cases per 100,000 population. Based on data reviewed in 2016-2017 in Taiwan, approximately 140 incarcerated individuals were diagnosed with TB within correctional facilities. In 2013, Taiwan conducted screening for LTBI in correctional facilities, revealing that about 25% of

incarcerated individuals tested positive for LTBI status. Through an initiative project, efforts were made to enhance the completion rate of supervised treatment, resulting in a significantly higher rate compared to settings outside prisons, plus it was feasible to maintain the safety and reliability of the treatment through DOTS services.

Therefore, to proactively prevent the transmission of TB in correctional facilities, in addition to the current proactive detection of TB cases, implementation of TB treatment and management for incarcerated individuals, and contact investigations and examinations for individuals in correctional facilities, the present project will involve collaboration with correctional institutions. It will utilize the Ministry of Justice's established system for entry and exit (or transfer) in correctional facilities to promote screening and treatment for LTBI among individuals with more than 6 months of sentence. Through more proactive and effective preventive measures, the aim is to reduce the probability of TB incidence, safeguarding the health of both incarcerated individuals and staff within correctional facilities.

c. Contacts of MDR-TB Cases

Rifampicin and isoniazid are the two most crucial first-line anti-tuberculosis drugs in the treatment regimen for TB. The current prescription for the treatment of LTBI in contacts also primarily involves the use of isoniazid and rifamycins. Therefore, for contacts of TB patients with resistance to these two drugs, the options for the treatment of latent infection are relatively limited. For instance, contacts of patients with TB resistant to neither isoniazid nor rifampicin may choose a 9-month course of isoniazid or a 3-month course of isoniazid plus rifapentine. For contacts of patients with isoniazid-resistant TB, a 4-month course of rifampin may be prescribed. In the case of contacts of patients with rifampicin-resistant TB, the only available option is a longer 9-month course of isoniazid.

MDR-TB refers to resistance to both rifampicin and isoniazid, and contacts cannot be treated for LTBI with non-DR-TB LTBI prescriptions. Research data on LTBI treatment for contacts of MDR-TB cases remain

limited, albeit gradually increasing worldwide. Moreover, prescriptions need to be individually tailored by experts based on the drug resistance profile of the index case. Therefore, in the updated LTBI treatment guidelines released in 2018, the WHO recommended providing LTBI treatment for contacts of MDR-TB cases, but no advice was given on specific LTBI treatment prescription. Current international research results consistently support the effectiveness of LTBI treatment for contacts of MDR-TB cases. Furthermore, the CDC in the United States also suggested that, under expert guidance, clinicians can conduct LTBI treatment for contacts of DR-TB cases.

As of now, Taiwan has not provided prescription treatment for LTBI in contacts of MDR-TB cases. Instead, a follow-up approach is implemented to conduct chest X-ray examinations semi-annually for a duration of 2 years. This monitoring strategy aims to facilitate early detection and treatment in the event that contacts develop active TB. According to TB reporting data, approximately 70% of the MDR-TB cases reported in the past two years were categorized as new cases (individuals found with MDR-TB upon initial diagnosis). Effective strategies for implementation of LTBI treatment are still needed to reduce the chances of new cases emerging. The latent period of TB can extend for several decades before the onset of active disease. Contacts who have not developed the disease and have not undergone LTBI treatment pose a prolonged concern for the MDR-TB epidemic.

Over the past decade, the number of reported cases of DR-TB has significantly decreased due to the establishment of the healthcare system for DR-TB, although the rate of decline has slowed in recent years. In addition to continually strengthening monitoring and reporting mechanisms, related control and prevention strategies involve proactively planning prospective program to provide treatment for LTBI in contacts of domestic MDR-TB cases. The LTBI treatment prescriptions are tailored based on the drug resistance profile of the index case. Utilizing IGRA and chest X-ray to diagnose latent infection in contacts, priority is given to contacts of index cases who have high infectivity and contacts belonging

to high-risk groups (younger age, immunocompromised). DOTS-plus medication delivery services are provided following the model used for DR-TB patients to effectively administer treatment and reduce the chances of developing active disease.

V. Timeline and Resource Requirements

(I) Project Timeline

- A. This project commenced in 2016 as part of a 20-year long-term initiative, organized into five-year phases.
- B. The second phase of this project will run from January 1, 2021, to December 31, 2025.

(II) Funding Sources and Calculation Criteria

- A. Funding source: Annually allocated through the public budgeting process.

- B. Calculation criteria table: (Unit: thousand NT dollars)

Work Content	Execution Year				
	2021	2022	2023	2024	2025
A. Strengthening Epidemic Preparedness Infrastructure and Prevention Network					
Subtotal	106,344	106,418	111,022	110,547	110,073
Implementing central and local cooperation and division of work	31,921	31,602	31,286	30,973	30,663
Strengthening the Connection between Public Health and Medical Systems	1,500	1,485	1,470	1,455	1,440
Cultivating non-governmental organizations to expand the control and prevention network	5,000	4,950	4,901	4,852	4,803
Promoting the cultivation of talent in TB control and prevention	12,390	13,403	18,937	19,383	19,821

Optimizing the quality of laboratory diagnostics and services	24,990	24,740	24,493	24,248	24,006
Monitoring management systems	27,543	27,268	26,995	26,725	26,458
Enhancing the public's knowledge and capabilities in TB control and prevention	3,000	2,970	2,940	2,911	2,882
B. Proactive Identification and Early Intervention for Target Populations					
Subtotal	263,700	266,584	275,573	280,999	283,850
Promoting a strategy for active detection of target populations	1,500	1,470	1,441	1,412	1,384
TB contact investigations	28,000	27,440	26,891	26,353	25,826
Proactive detection and LTBI testing and treatment for the elderly in long-term care institutions	82,800	84,685	93,720	94,085	96,040
Active detection and expedited reporting improvement strategy in MARs	55,700	55,066	53,455	52,566	52,299
Screening upon entry for migrant population, active detection, and LTBI testing and treatment for new immigrants	95,700	97,923	100,066	106,583	108,301
C. Patient-Centered Care and Case Management					
Subtotal	725,758	718,951	717,765	712,172	708,705
Enhance the quality of TB treatment	155,996	156,659	159,636	158,650	159,234

Enhance the management quality of TB cases	1,720	1,703	1,686	1,669	1,652
Expansion and quality improvement of the DOTS program	360,109	356,488	353,903	350,454	347,840
Medical care for DR-TB	207,465	203,638	202,082	200,946	199,531
Care for difficult or special cases	468	463	458	453	448
D. Preventing Onset and Interrupting Transmission					
Subtotal	184,176	187,274	175,568	176,111	177,200
Raise public awareness of TB and LTBI	2,500	2,500	1,600	1,200	1,000
Implement infection control in high-risk environments	4,600	4,550	2,550	2,500	2,500
BCG vaccination and evaluation of new vaccines	5,360	5,173	8,990	8,810	8,634
Treatment and management of LTBI in target populations	171,716	175,051	162,428	163,601	165,066
Total	1,279,978	1,279,227	1,279,928	1,279,829	1,279,828

Note: Strengthening business research and developing new strategies may require an additional budget of 35,000 thousand NT dollars, to be obtained for related works through integrated projects and international cooperation.

(III) Funding Requirements (including annual breakdown) and Coordination with Mid-term Expenditure Estimates

A. Funding requirements

(A) The implementation period of this project is from the year 2021 to 2025, with a total funding requirement of 6,398,790 thousand NT dollars (excluding personnel costs). Broken down by year, the fundings needed are 1,279,978 thousand NT dollars for the year 2021, 1,279,227 thousand NT dollars for 2022, 1,279,928 thousand NT dollars for 2023, 1,279,829 thousand NT dollars for 2024, and 1,279,828 thousand NT dollars for 2025. Additionally, for tasks delegated to other agencies (organizations), each agency is responsible for allocating its own budget accordingly.

(B) Initial operational plans will be proposed annually for the budgets listed above, and executed after approval through the budget allocation process.

(Unit: thousand NT dollars)						
Annual Projects	2021	2022	2023	2024	2025	Total
Routine expenditure	1,259,965	1,260,214	1,260,915	1,260,829	1,260,828	6,302,751
Capital expenditure	20,013	19,013	19,013	19,000	19,000	96,039
Total	1,279,978	1,279,227	1,279,928	1,279,829	1,279,828	6,398,790

B. Coordination with mid-term expenditure estimates

The funding requirements for this project are estimated and allocated based on the works needed for future promotion activities. They will be reviewed during annual preparations of the preliminary project plan and of the budgets, with adjustments made to resource allocation and to the project budget in accordance with the legal budgets. Additionally, resources and funding are flexibly reallocated based on the actual needs of annual operational plans and the epidemic situation.

VI. Expected Outcomes and Impact

Through the implementation of this project, with a sufficient allocation of resources, we aim to align the achievements in TB control and prevention in Taiwan with global standards. The expected outcomes and impact are as follows:

- (I) This project aligns with the WHO End TB global initiative, setting a target to achieve TB incidence rate of 25 cases per 100,000 population or lower by 2025. Additionally, the United Nations has established Sustainable Development Goal 3.3, which considers the TB incidence rate as a crucial indicator for national development. By implementing control and prevention strategies to reduce the TB incidence rate, we aim to enhance Taiwan's international image, competitiveness, and attract foreign investment and international talent for exchange.
- (II) By integrating resources from various government agencies, we aim to enhance epidemic prevention and social welfare support, providing assistance to vulnerable populations. Our goal is to ensure that no family faces significant financial burdens due to TB, which aligns with the WHO's advocacy for 'Universal Health Coverage'.
- (III) Through the effective implementation of roles and responsibilities in various levels of control and prevention units, we aim to integrate nationwide resources for TB control and prevention to enhance management efficiency and execution quality.
- (IV) Through collaboration with educational institutions and healthcare professional organizations, and through active participation in international conferences and collaborative projects, we aim to cultivate talents in public health and medicine related to TB control and prevention. By continuously investing in control and prevention efforts, we seek to expand our country's capacity and perspective in TB control and prevention in alignment with international standards.
- (V) Utilizing information technologies such as cloud platforms and automated monitoring, we aim to streamline administrative processes and provide real-time monitoring data, enhancing the efficiency of management at all levels and facilitating the monitoring of execution quality.

- (VI) We will continuously introduce emerging diagnostic technologies to shorten the diagnosis period and improve accuracy, thereby reducing unnecessary medical interventions for the public and improving efficiency in the allocation and utilization of epidemic prevention resources. New prescriptions or medications may be introduced to shorten the treatment duration, enhance the quality of life for individuals undergoing treatment, reduce the timeframe for public health epidemic prevention efforts, and minimize additional expenditures on medical and epidemic prevention costs.
- (VII) To address different target populations, we plan proactive screening strategies to ensure early detection, referral, and prompt treatment, aiming to prevent subsequent community transmission of the epidemic.
- (VIII) A diversified TB control and prevention talent development program will be established to enhance medical treatment standards and the professional competence of epidemic prevention personnel. This program aims to familiarize clinical physicians with TB diagnosis and treatment, ensuring appropriate care for patients. Additionally, it empowers prevention personnel to deliver more sophisticated and comprehensive epidemic prevention measures.
- (IX) Public awareness of TB will be raised through diverse multimedia health education campaigns and the integration of efforts from various departments. The goal is to encourage early medical intervention and alleviate the stigmatization associated with TB.
- (X) By annually securing an additional budget of 190 million NT dollars, advancement projects for LTBI screening, treatment strategies and reduced diagnostic delays for target populations will be strongly promoted. This initiative is expected to annually reduce healthcare/disease prevention costs by approximately 658.3 million NT dollars. It is estimated that over 1,000 LTBI cases progressing to active TB can be avoided each year. By 2035, this approach could prevent more than 10,000 individuals from developing TB, thereby achieving the goal of TB elimination (10 cases per 100,000 population).
- (XI) The overall reduction in TB cases will effectively save TB healthcare expenses, enabling the government to allocate resources more appropriately.
- (XII) Through the implementation of this phase of the project, it is estimated that by 2025, assistance can be offered to at least about 31,000 TB patients to

complete their treatment, restoring health and minimizing opportunities for community transmission, further preventing subsequent infections and diseases with reduced incidence. In addition to saving lives and improving health, considering direct costs of medical utilization, indirect costs such as social productivity loss, productivity loss of family members caring for patients, and future economic losses from premature deaths, it is estimated that an additional loss of 3.9 billion NT dollars can be avoided. Simultaneously, it enhances Taiwan's international competitiveness and showcases an excellent international image of health and high quality of life.