CONTENTS

ABBREVIATION

ACF	Active Case Finding
ACSM	Advocacy, Communication and Social Mobilization
CCTBR	Cambodia Committee for TB Research
C-DOTS	Community Directly Observed Treatment, Short Course
CENAT	National Center for Tuberculosis and Leprosy Control
CHC	Cambodian Health Committee
CI	Contact Investigation
COMMIT	Community Mobilization Initiatives to End Tuberculosis
DOTS	Directly Observed Therapy, Short Course
DR-TB	Drug-Resistant Tuberculosis
FHI 360	Family Health International
GFATM	Global Fund to Fight AIDS, Tuberculosis and Malaria
IOM	International Organization for Migration
IPC	The Institut Pasteur du Cambodge
JATA	Japan Anti-Tuberculosis Association
KHANA	Khmer HIV/AIDS NGO Alliance
LHSS	Local Health System Sustainability
LTBI	Latent Tuberculosis Infection
MDR/RR-TB	Multi-drug-resistant/Rifampicin Resistant tuberculosis
MDR-TB	Multi-Drug-Resistant Tuberculosis
NECHR	National Ethics Committee for Health Research
NGOs	Non-governmental Organizations
NTP	National Tuberculosis Program
PMDT	Programmatic Management for Drug Resistant TB
PPM	Public-Private Mix
RR-TB	Rifampicin Resistant Tuberculosis
TB	Tuberculosis
TB-MIS	TB Management Information System
TPT	Tuberculosis Preventive Treatment
US CDC	United States Centers for Disease Control and Prevention
USAID	United States Agency for International Development
WHO	World Health Organization
XDR-TB	Extensively Drug-Resistant Tuberculosis

FOREWORD

Tuberculosis is one of the infectious diseases that poses a public health concern. Despite Cambodia has been excluded from the global list of TB high TB burden countries (2016-2020), the country is still under the "global TB watch list" for the period of 2021-2025. Based on the 2022 World Health Organization (WHO) Global TB report, Cambodia had a TB incidence of 288 per 100,000 population, while the mortality rate was 21 per 100,000 population in 2020. Since 2015, TB case notifications have gradually declined. In 2019, the Joint Program Review (JPR) declared that Cambodia is on track to meet the national commitments towards the End TB Strategy, TB-related targets of the Sustainable Development Goals (SDG), and actions agreed in the first United Nations High Level Meeting (UNHLM) on TB.

The year 2022 was the second year to implement the National Strategic Plan (NSP) to End TB 2021-2030 with the directions and key initiatives that the national tuberculosis program (NTP) and partners will undertake during the planned period to work towards achieving the Sustainable Development Goal (SDG) by 2030 in Cambodia. In addition, the NTP received technical and financial supports from different partners such as the GFATM to Fight AIDS, Tuberculosis and Malaria (GFATM), the United States Agency for International Development (USAID), WHO and other partners. This is crucial for the NTP to continue its key activities toward ending TB by 2035 in Cambodia.

With a peaceful and a great success in combating the spread of COVID-19 under the wise leadership of **Samdech Akka Moha Sena Padei Techo Hun Sen**, Prime Minister of the Kingdom of Cambodia, the national center for tuberculosis and leprosy control (CENAT) with all development partners worked together to successfully notify TB cases. I believe that, together, we can save lives of our people and make a difference.
Yes! We Can END TB

Director of CENAT

Dr. Huot Chan Yuda

1 – INTRODUCTION

The Ministry of Health of Cambodia has given high priority to tuberculosis (TB) control. With the support and encouragement from the Royal Government of the Kingdom of Cambodia led by the Prime Minister, **Samdech Akka Moha Sena Padei Techo Hun Sen**, as the Honorable Chairman of the National Anti-Tuberculosis Committee, as well as the involvement from all partners, TB control in Cambodia has achieved remarkable results in the last recent years. This achievement has been recognized by the WHO and other key partners.

In 2015, WHO reclassified the countries with a high burden of TB from 22 high TB burden countries in the previous list to 30 countries in the new list. By the end of 2015, Cambodia was one of the 9 countries among the 22 TB high burden countries that have successfully achieved Millennium Development Goal (MDG). Despite this great achievement, based on this classification, Cambodia was still one of the 30 countries with a high burden of TB in the world for the period of 2016-2020. From 2021 -2025, Cambodia is no longer in the list of 30 high burden countries but Cambodia is on the Global Watch List for TB.

According to the 2022 WHO Global TB Report, Cambodia had a TB incidence rate of 288 per 100,000 population, while the mortality rate was 21 per 100,000 population in 2020.

The followings are the main achievements on TB control in 2022 and direction/targets for 2023 and the years beyond.

2 - TB SITUATION IN THE WORLD

An estimated 10.6 million people worldwide fell ill with TB in 2021, of which only 6.4 million new cases were detected and reported to the WHO. In the same year, there were an estimated 1.4 million TB deaths among HIV-negative people and an additional 187,000 deaths among HIV-positive people. This makes TB the leading cause of death from a single infectious agent (ranking above HIV/AIDS).

3 - MAIN ACHIEVEMENTS

3.1 - Service coverage

The coverage of TB services has been maintaining at 100% in all RHs and HCs nationwide. Community directly observed treatment, short course (C-DOTS) has been expanded from 506 HCs in 2008 to 644 HCs in 2018 and to 1,147 HCs in 89 ODs in 2022. TB/HIV collaborative activity has been implemented in all ODs in 2022 (compared to only 57 ODs in 2008), and childhood TB activities have been also implemented in all ODs. The NTP has 11 MDR-TB treatment sites in 2022. In addition, NTP has implemented Public-Private for TB in 34 ODs in 2022.

3.2. Case detection

In 20202, the NTP has detected a total of 32,865 TB cases, of which 12,858 were bacteriologically confirmed new TB cases.

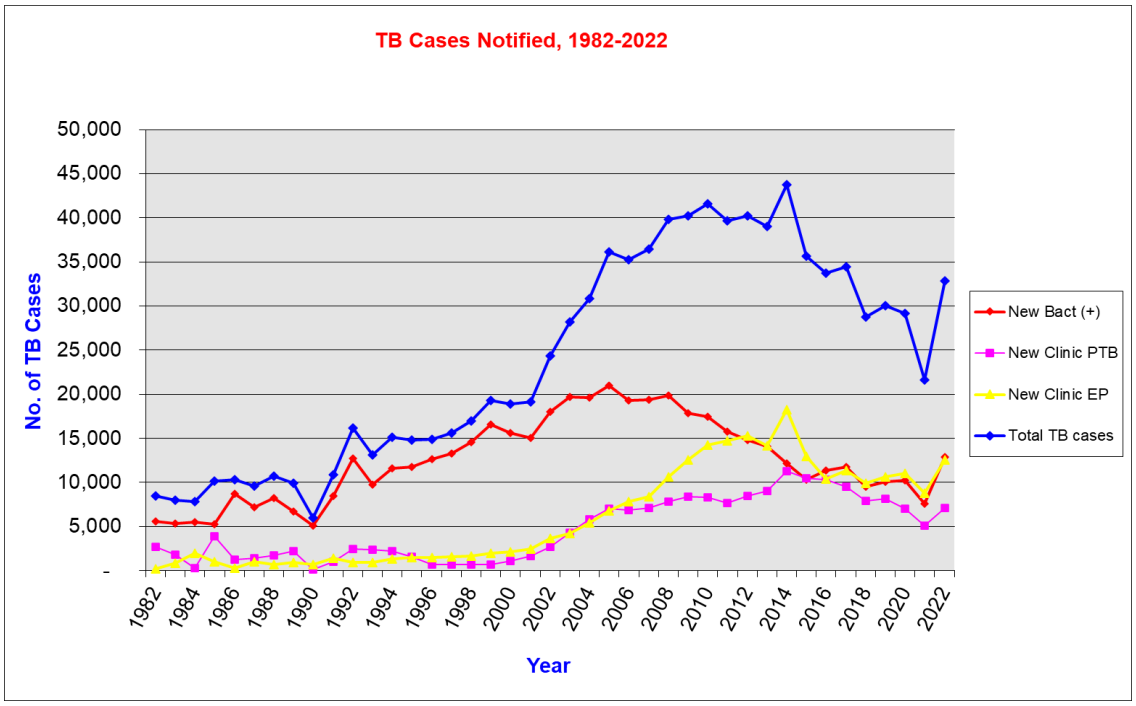

Figure 1: TB case notified from 1982 – 2022

3.3 - Treatment

The treatment success rate of TB has been maintained over 90% during the last 24 years. For instance, national TB program has achieved 95.5% of the treatment success rate in 2022 which surpassed the target of 90%. There were 414 deaths (1.9%) during treatment which is attributed to late detection of patients who were in an advanced stage of TB, 187 cases (0.9%) were failed and 254 cases (1.2%) were lost to follow-up. The reasons of death during TB treatment course were mainly due to late detection and treatment which aggravated the disease condition. For treatment failure, the main reason was poor treatment

failure, the main reason was poor treatment adherence whereas lost to follow-up was mainly due to poor understanding on the importance of full TB treatment course.

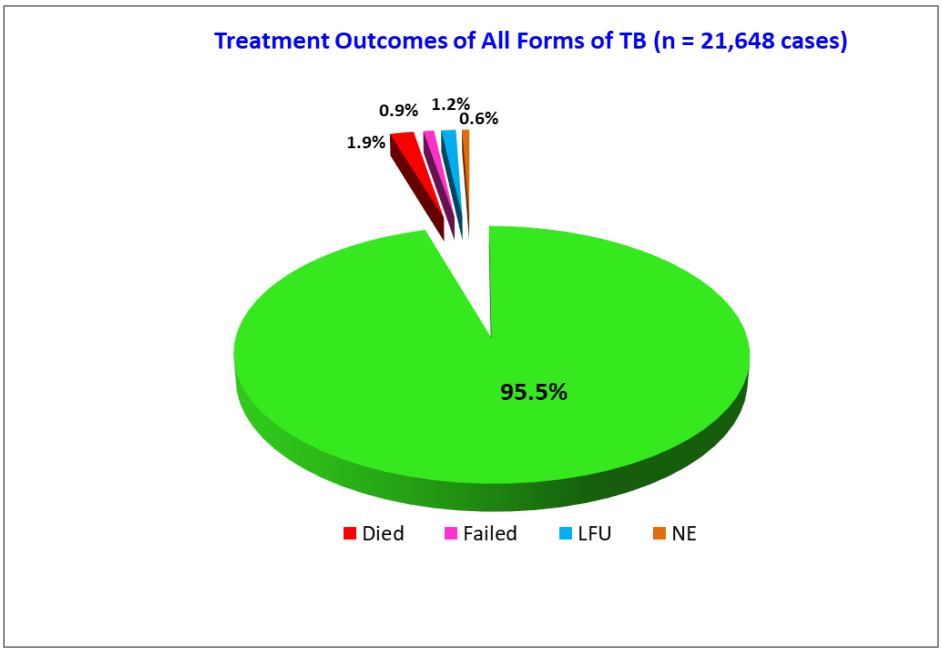

Figure 2: Treatment Outcomes of All Forms of TB, 2022

3.4 - Mortality and incidence of TB

In recent years, Cambodia has achieved remarkable results in TB control. The 2022 WHO Global TB Report showed the TB mortality rate dropped from 42 per 100,000 population in 2000 to 21 per 100,000 population in 2021, which is equal to a 50% reduction. Meanwhile, the incidence has also fallen from 579 per 100,000 population in 2000 to 288 per 100,000 population in 2021, which is equal to 50% reduction.

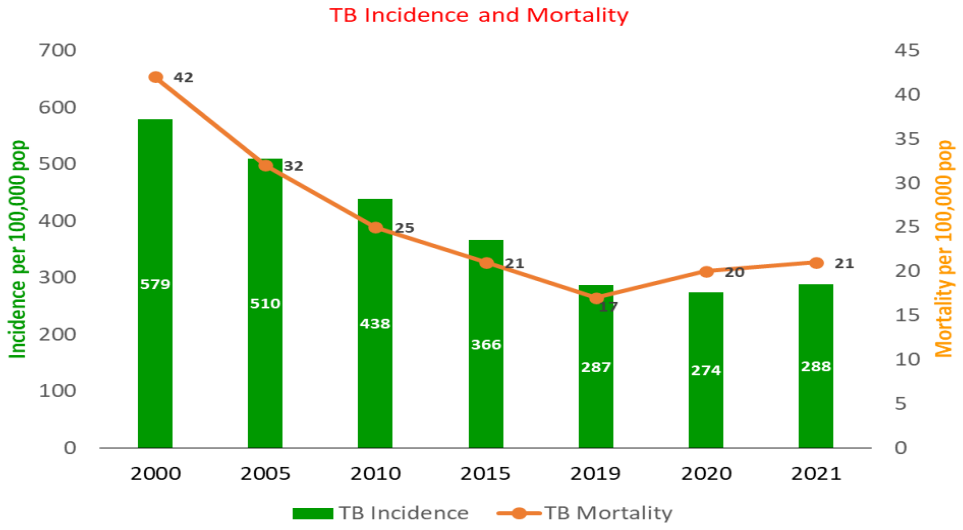

Figure 3: Trend of TB mortality and incidence from 2000 to 2021

Ministry of Health's NTP has already achieved MDG targets (1990 - 2015) in reversing incidence and reducing the prevalence and death rates of TB by 50% since 2011, which is four years ahead of schedule. Recently, NTP has also reached the 2020 milestone target of reducing the TB incidence by 20%.

4 - MAIN INTERVENTIONS

In addition to the key achievements mentioned above, the NTP also achieved significant results relating to the interventions against TB, as follows:

4.1 - Drug resistance TB

The NTP began implementing programmatic management for drug-resistant TB (DR-TB) (PMDT) in 2006 in collaboration with partners including WHO, Cambodian Health Committee (CHC), Médecins Sans Frontières-France (MSF-F), Médecins Sans Frontières-Belgium (MSF-B), United States Centers for Disease Control and Prevention (US CDC), and USAID. The third National Drug Resistant Survey conducted in 2017 shows that the estimated prevalence of RR-TB cases among the captured bacteriological confirmed cases is 0.9% for new cases and 9.4% among the previously treated cases. By the end of 2021, Cambodia has 11 MDR-TB treatment sites (CENAT, Khmer-Soviet Friendship hospital, Chey Chumneas RH, Kampong Chan RH, Svay Rieng RH, Takeo RH, Kampong Chhnang RH, Battambang RH, Cambodia-Japan Friendship RH Mongkol Borei, Siem Reap RH and Koh Kong RH), with a total of 57 isolation rooms.

4.1.1 - MDR-TB cases diagnosed and treated

In 2022, a total of 127 peoples with MDR/RR-TB (male 83, female 44, 33 cases live in Phnom Penh and 94 cases live in 18 different provinces) were detected and enrolled on treatment. Compared to 2021, there was 75% increase (from 72 cases in 2021 to 127 cases in 2022), but still considerably 44.5% lower than 2022 target (229 cases). All of the detected cases were initiated with different second-line treatment regimens: 67 (52.8%) cases received shorter all-oral treatment regimen and 60 (47.2%) cases received longer all-oral regimens. In addition, two other DR-TB cases with no resistance to rifampicin were notified by drug susceptibility testing (DST) and Xpert MTB/XDR testing, and received new WHO recommended regimen with 6(H)REZ-Lfx. (Figure 4).

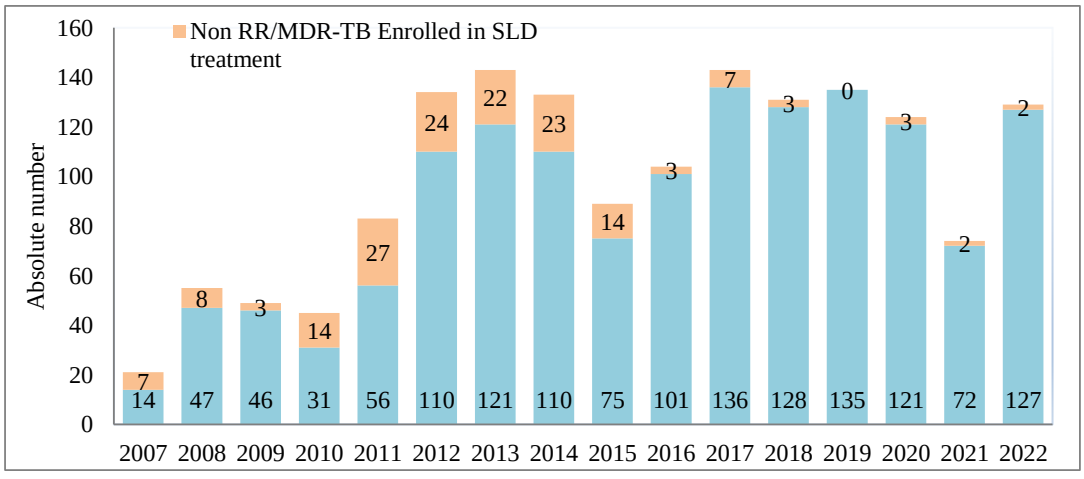

Figure 4: Number of DR-TB cases treated with second-line drugs from 2007 to 2022

4.1.2 – MDR/RR-TB Treatment Outcome

The overall MDR/RR-TB treatment success rate in Cambodia was higher than the average success rate of global level which was estimated only of 60% among MDR/RR-TB patients registered for treatment in the cohort 2019[1]. Cambodia has made a remarkable improvement in the treatment success rates for MDR/RR-TB in the last few consecutive years with a proportion of 70.6% in 2017, 80.4% in 2018, then was increased to 81.5% in 2019. (Figure 5).

In the MDR/RR-TB cohort of 2020, among a total of 121 cases (male 85, female 36), 54 patients received shorter all-oral treatment regimens (9 months), 48 patients were on short with injectable treatment regimen, and 19 patients were on longer treatment regimens (18-20 months). The treatment outcomes in this 2020 cohort are: 100 (82.6%) cured; 17(14.0%) died; 3(2.5%) failed and 1(0.8%) lost to follow up.

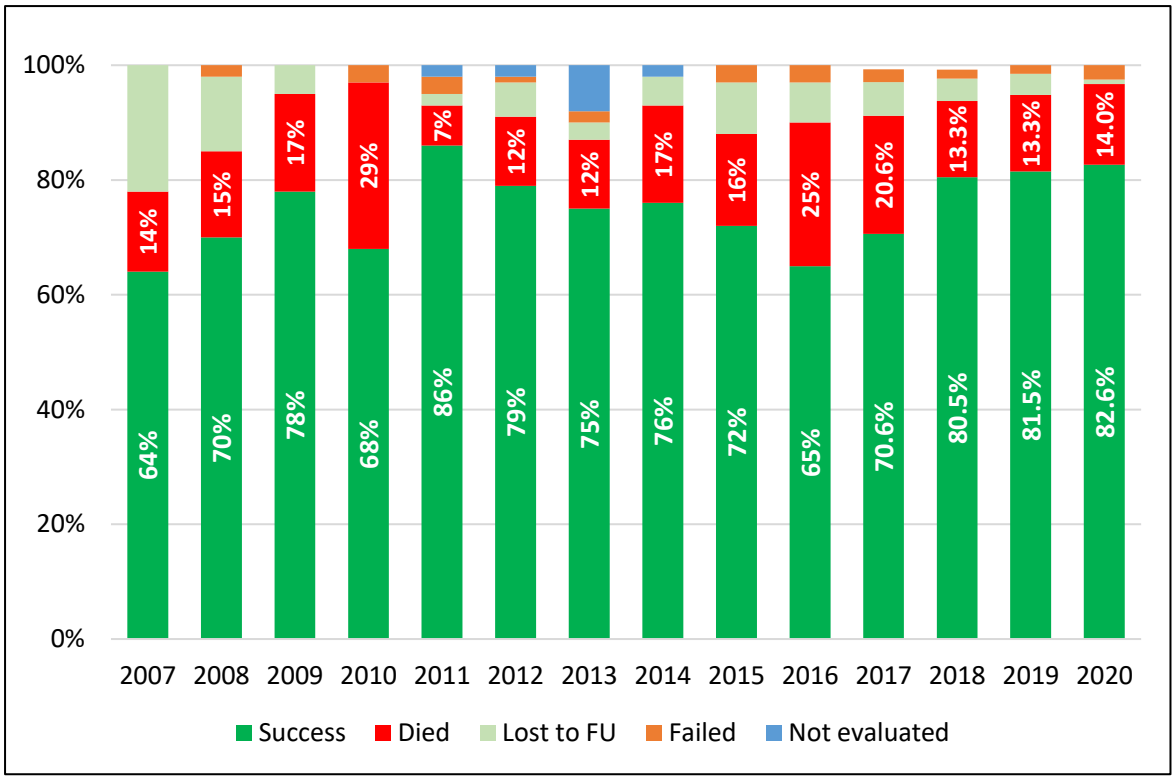

Figure 5: MDR/RR-TB treatment outcome cohort from 2007 to 2020

4.1.3 - Other Activities and MDR-TB Research

Moreover, in response to the new WHO consolidated guidelines on DR-TB treatment in 2019, NTP has revised the country guidelines for PMDT to align with the latest global recommendations. The main changes in the documentation included a revised case-finding algorithm for presumptive DR-TB, which is more comprehensive and tailored to the epidemiology and program reference for Cambodia. The new recommendations signal an important departure from the previous approach to MDR/RR-TB treatment. All-oral

[1] Global TB report 2022

regimens have been prioritized and are the preferred options of most patients and injectable TB drugs are not in the list of effective drugs to design both longer regimen and shorter treatment regimen anymore. Obviously, in Cambodia, a standard shorter regimen with an injectable drug for 4-6 months of the total course for the 9-11 months that we started since December 2017 also faced out from June 2021, and amikacin was systematically replaced by a new drug bedaquiline along with other second line drugs (total 7 drugs) based on the latest WHO recommendation.

During 2022, among 127 MDR/RR-TB patients enrolled for second line treatment, 67 (52.8%) cases were eligible for shorter all-oral regimen and 60 (47.2%) received long all-oral longer treatment regimens. At baseline all DR-TB patients have been collected sputum samples for testing susceptibility of second-line TB drugs using line probe assay (LPA) such as fluoroquinolones and second line TB injectable drugs, in which results 13 cases were confirmed resistant with fluoroquinolone. Based on the new definition, pre-Extensively Drug-Resistant Tuberculosis (pre-XDR-TB) is TB that is resistant to rifampicin and any fluoroquinolone (a class of second-line anti-TB drug in group A), whereas XDR-TB is TB that is resistant to rifampicin, plus any fluoroquinolone, plus a least one of the drugs in group A, such as bedaquiline and linezolid.

Regarding the PMDT transition plan 2019-2021, the National Center for Tuberculosis and Leprosy Control (CENAT) had allocated a proportion of MDR/RR-TB patients on all-oral shorter regimen for 9 months which is part of an operational research to align with WHO recommendation and phase out the use of the injectable-containing shorter regimen in the future. The study was conducted between Apr – Dec 2020. As a result, a total of 127 participants were enrolled in the study in which 76 patients in the control group who received standard shorter MDR/RR-TB regimen with injectable drug (called Short injectable, SI) and 51 patients in the intervention group received shorter all-oral regimens. By the end of treatment, a preliminary result showed that treatment success rates among control group and intervention group were 85.5% and 86.3% respectively. Patients' follow up for 12 months after treatment completion was also done to look for the relapse of the disease. After the follow up, the result showed that the sustainable treatment success rate of control group and intervention groups was 80.3% and 82.3% respectively. Data on the safety of the drugs between the two arms were also collected and the details of the drug safety and final report are expected be done in quatre 1 of 2023.

Furthermore, the NTP, in collaboration with relevant partners, such as CHC under the COMMIT project and WHO, has conducted two clinical review meetings and refresher trainings for healthcare providers working in the 11 MDR-TB treatment sites and some provincial TB supervisors to discuss the update of drug resistant program and standard operation procedure (SOP) for PMDT to build their capacity on MDR, focusing mainly on diagnosis and treatment using new formula including monitoring report by active drug safety monitoring and management (aDSM). In addition, NTP had organized a 5 days training course on PMDT for clinicians, nurses and PHD-TB supervisors from the 11 MDR-TB treatment sites which a total of 30 participants.

We still have challenges in strengthening and improving the quality of treatment and care, specifically for MDR-TB patients with special conditions and those presenting with resistance to second-line drugs such as Extensively Drug-Resistant Tuberculosis (XDR-TB) or pre-XDR-TB cases, including limitation for drug susceptibility testing to new drugs, such as bedaquiline and linezolid to be able to meet the new definition of XDR-TB case. In the future, we hope to improve the quality of care for MDR-TB patients by focusing on the appropriate use of active drug safety monitoring and management and regular patient monitoring to assess regimen effectiveness including patient-centered care and support as well. Moreover, novel all-oral regimens for MDR/RR-TB and pre-XDR-TB can now reduce treatment duration to only 6 months, compared with older regimens lasting 20 months or more. Based on the latest WHO recommendation and WHO consolidated guidelines on Drug-resistant tuberculosis treatment 2022 update, NTP commits update its own MDR-TB guidelines, in which we will introduce and expand these novel regimens in the country in 2023 as well.

4.2 - Collaborative TB/HIV activities

4.2.1 - Training

In 2022, with a great success of COVID-19 pandemic control, 4 sections of collaborative TB/HIV activity trainings were conducted with a total of 96 participants from provincial health departments, operational districts, and referral hospitals. In addition, through general TB trainings, instruction on TB screening among HIV/AIDS patients was also included.

4.2.2 - Supervision

The main objective of supervision is to monitor and follow-up the performance of collaborative TB/HIV activities and provide job coaching at the site levels if there is mistakes or misunderstanding during the implementation.

The challenges found and addressed in the field included (1) difficulty to collect sputum from PLHIV who have dry cough; (2) transportation of specimen of PLHIV to Xpert machine; (3) high workload for the staff at the field.

4.2.3 - TB/HIV Data:

HIV / AIDS among TB Patients 2022								
Quarter	Number of TB cases registered for treatment (including HIV+)	Number of TB Cases Registered for treatment (excluding HIV+)	Number of Known HIV+ before TB treatment	Number of TB Cases tested for HIV at VCT	**HIV+**	**HIV-**	**CPT**	**ARV**
1	7,184	7,148	37	6,402	26	6,376	48	60
2	8,509	8,447	62	7,681	29	7,652	77	89
3	9,051	8,988	63	8,139	39	8,100	89	101
4	8,155	8,118	37	7,324	39	7,285	58	74
Total	32,900	32,701	199	29,546	133	29,413	272	324

Table 1: HIV/AIDS among TB patients in 2022

The percentage of registered TB patients with unknown HIV status who were referred and tested for HIV (mostly at health centers where the activity has been implemented since the middle of 2014) increased gradually from 47.0% in 2007 to 94.2% in 2019, then decreased to 90.0% and 80.2% in 2020 and 2021 respectively, then increased back to 90.4% in 2022.

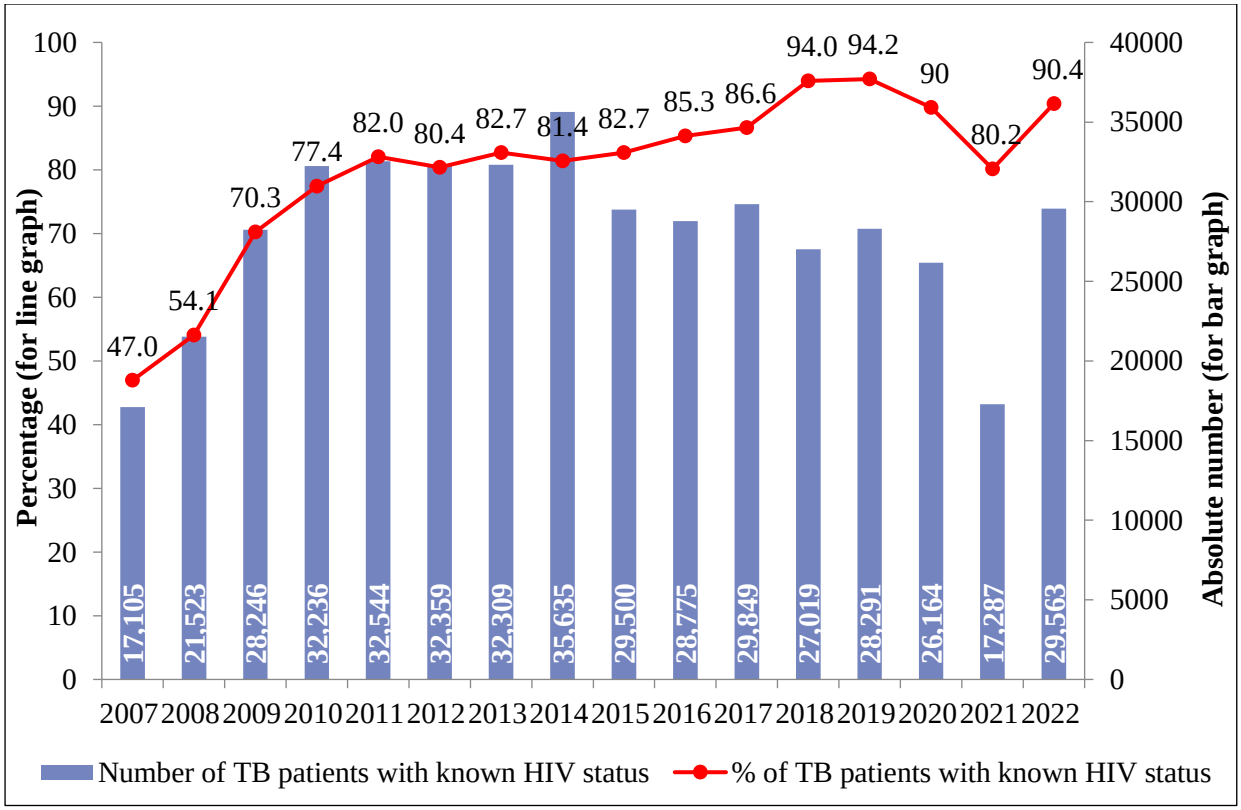

Figure 6: Percentage of registered TB patients tested for HIV from 2007 to 2022

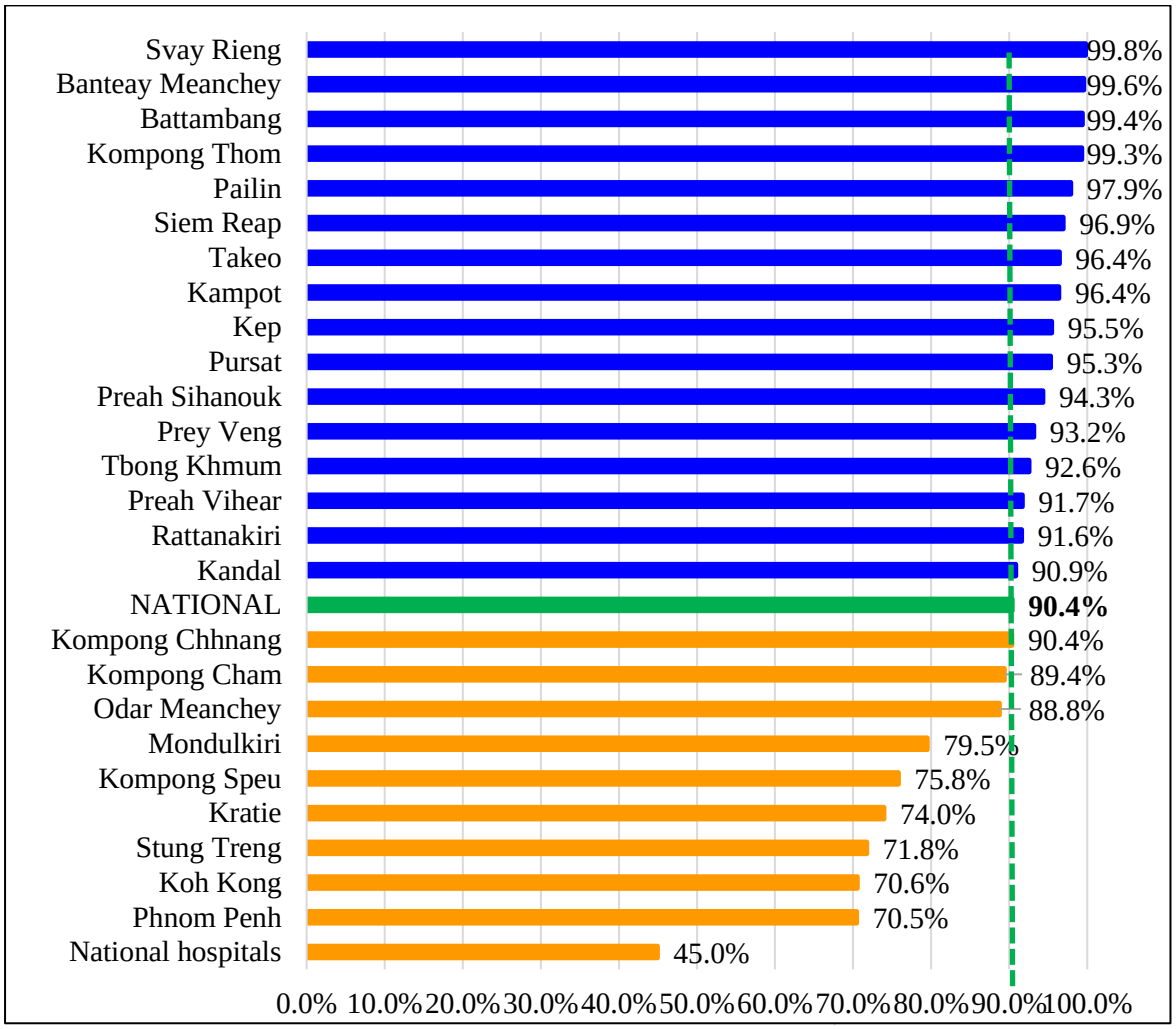

Figure 7: Proportion of HIV testing among registered TB patients by province, 2022

HIV-positive TB patients who received Cotrimoxazole Preventive Therapy (CPT) increased from 65.5% in 2010 to 99.1% in 2012 then fluctuated from above 88% to 98% between 2013 and 2020. In 2021, this proportion decrease to only 78.0%, but slightly increased to 81.7% in 2022. Anti-Retroviral Treatment (ART) among TB/HIV patients also increased from 44.7% in 2010 to 98% in 2014. This proportion remained high from 2015 to 2019 although it was fluctuated. In 2020, the proportion dropped to 88% but returned back to 92.9% and 97.6% in 2021 and 2022 respectively.

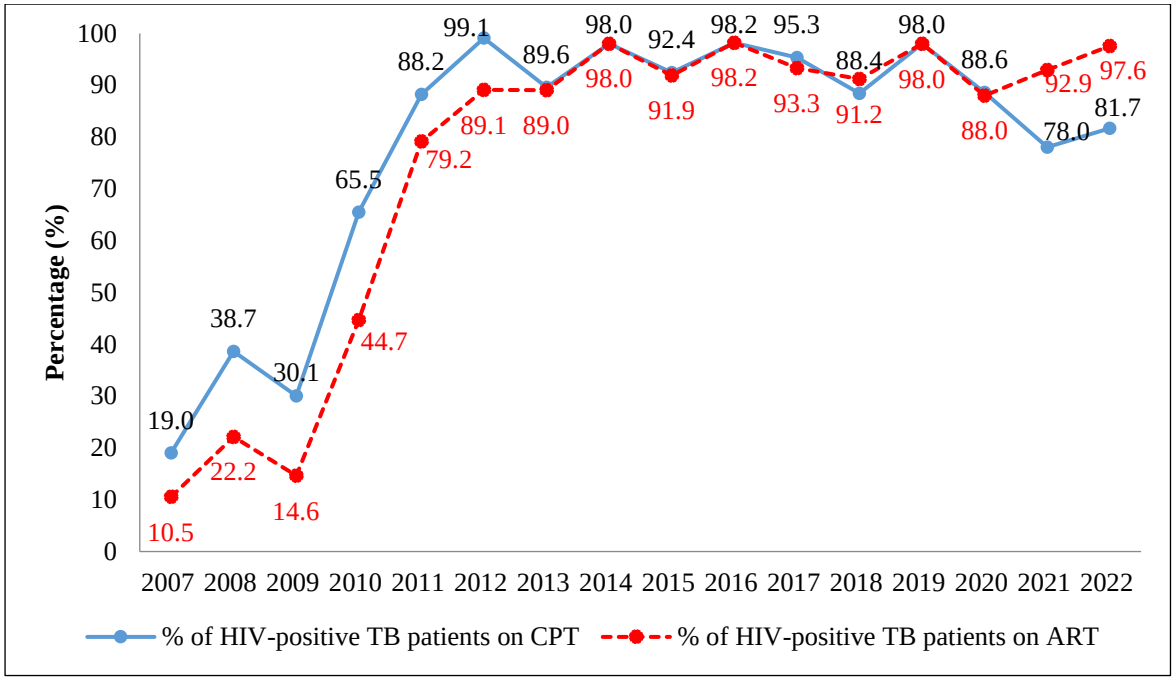

Figure 8: Proportion of HIV+ TB patient received CTP and ART from 2007 to 2022

4.3 - Diagnosis by bacteriological examination

4.3.1 - Diagnosis by Smear Microscopy

The total number of slides that the NTP used for TB smear examination in 2022 was 105,179 slides (detection and follow up), of which 89,186 slides were for detection. A total of 37,885 TB presumptive cases provided sputum for smear examination and the positivity rate among smear examination for case detection was 3.05%.

NTP has also conducted external quality assessment to strengthen the quality of smear examination. This is one of the laboratory quality assurance activities. Results showed that agreement rate was 99.4% with false positive and false negative rates of 3.5% and 0.3%, respectively, for the 3rd Quarter of year 2022.

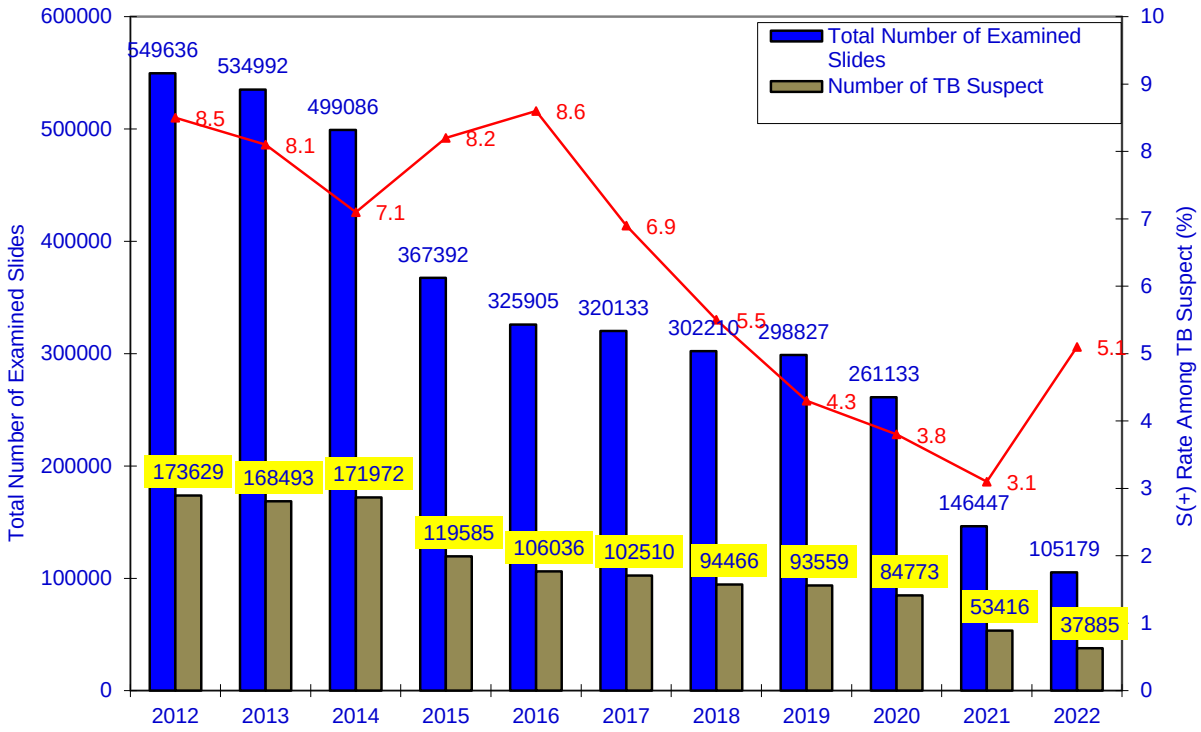

Figure 9: Smear microscopy report from 2012 to 2022

4.3.2 - Diagnosis by GeneXpert, Xpert MTB/RIF

After an official authorization from WHO in late 2010, NTP has used GeneXpert and Xpert MTB/RIF in Cambodia in 2011 to detect TB and resistance to rifampicin. Currently, NTP has 116 GeneXpert sets in which 92 sets (at 88 sites/hospitals) are used for routine activities and other 24 sets were used for active case finding activities and backup malfunctioning machines in the 88 sites.

Overall utilization of tests increased from year to year. Under the effect of Covid-19, utilization of the test has declined in 2021. In 2022, NTP used 133,290 tests with the results as follows: Rate of MTB detected and Rifampicin-resistance detected (RR) 0.17%, MTB detected and Rifampicin-resistance not detected (T) 9.33%, MTB detected and Rifampicin-resistance indeterminate (TI) 1.06% and error/invalid/no result (I) 4.89%.

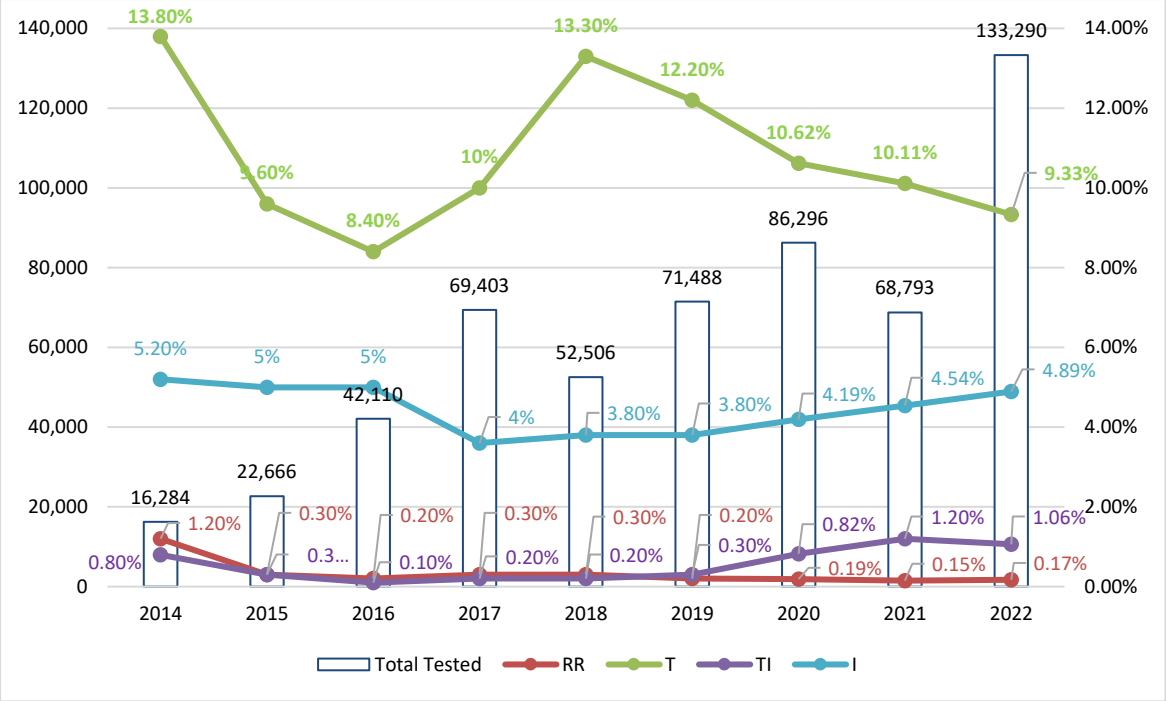

Figure 10: Test by Xpert MTB/Rif report from 2014 to 2022

In late 2022, NTP start using the Xpert MTB/XDR test using machine GeneXpert 10 colors to detect resistance of TB drugs such as Isoniazid, Fluoroquinolones, and second line injectable drugs at National TB Reference Laboratory and laboratory of Kampong Cham Provincial Referral Hospital.

4.3.3 - TB culture and drug susceptibility testing

In late 1999, the NTP with technical assistance from JICA introduced TB culture with solid medium. Step-by-step, the capacity to culture on liquid medium (MGIT) and rapid methods for identification of MTB started in 2011 at CENAT National Referral Lab (NRL), Battambang TB Laboratory and 2014 at Kampong Cham TB Laboratory. The first-line Drug Susceptibility Testing by using liquid medium (MGIT) was evaluated and introduced at CENAT NRL and later at Kampong Cham TB Laboratory (2014). The second-line Drug Susceptibility Testing by using liquid medium (MGIT) was evaluated by the supranational TB reference laboratory from the Research Institute of Tuberculosis of Japan (RIT) and has been in service since 2014.

In 2022, three culture center laboratories (CENAT NRL, Battambang and Kampong Cham) received 2,183 specimens for TB culture of which the positive rate was 8.24%.

4.3.4 - Training

In 2022, due to COVID-19 pandemic situation became better, training and refresher trainings have been conducted by respecting to MoH's measures. The National TB Reference Laboratory conducted one training course on sputum collection and smear making with 22 participants, two refresher training courses on Xpert testing with 30

participants, two courses on maintenance and service of GeneXpert with 334 participants. In addition, National TB Laboratory has also organized two workshops on External Quality Assurance (EQA) with 68 participants in total. These events were supported by the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM).

4.3.5 – TB Diagnostic Network Assessment

To reach End TB 2030 goal, the NTP under technical and financial support from USAID has conducted the TB diagnostic network assessment in Cambodia. As result, short- and long-term recommendations were provided for improving the quality of TB diagnostic, and scaling up TB case finding including drug-resistant TB as fast, accurate, and reliable. Key recommendations are:

- Develop a detailed national TB lab operational plan aligned with NSP
- Disseminate and implement the existing state-of-the-art diagnostic algorithms
- Strengthen the specimen referral system
- Ensure safe working conditions in all laboratories
- Strengthen the supportive supervisory structure
- Strengthen Data Systems

Achieving these recommendations will require the collaboration of all stakeholders, including technical partners and donors, led by the NTP, where the National TB Technical Laboratory Working Group plays an important role in supporting these processes.

4.4 - Childhood TB

Childhood TB remains one of the priorities of NTP. There were 8,037 childhood TB cases nationwide (all ODs) notified and treated in 2022 (see the figure below). Since August 2017, NTP has been using the new pediatric drug formulation for childhood cases, which is child-friendly, more effective and better than the old one.

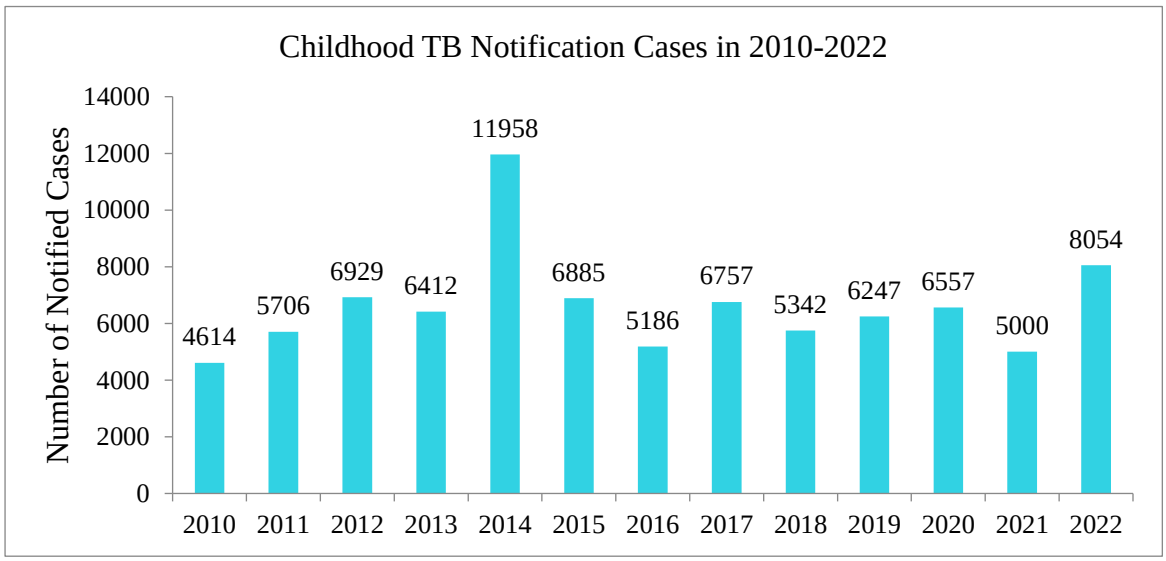

Figure 11: Childhood TB notification cases from 2010 to 2022

After Japan Anti-Tuberculosis Association (JATA) ended its USAID-TB/CARE I project implemented in 27 ODs in 2014, NTP had maintained and strengthened childhood TB activities in 25 ODs supported by USAID, and most of them were former ODs implementing childhood TB previously covered by JATA. By 2017, childhood TB activities supported by USAID were implemented by Family Health International (FHI 360) under Challenge TB project collaborated with Empowering Communities for Health (ECH) project of Reproductive and Child Health Alliance (RACHA). The childhood TB activities in 25 ODs of the 10 provinces namely Battambang, Pursat, Kampong Chhnang, Kampong Thom, Kampong Speu, Prey Veng, Svay Rieng, Kampot, Kampong Cham, and Tbong Khmum were ended by the end of first quarter of 2018. Although the above organizations completed its childhood TB activities after 2018, childhood TB case detection still continues to be implemented across the country throughout general TB activities.

4.5 – TB preventive treatment (TPT)

To reduce TB burden and to reach its target to end TB by 2035 as stated in the National Strategic Plan to end TB 2021-2030, Cambodia has made several efforts through different approaches. Providing TPT, a treatment recommended by WHO to prevent people with latent tuberculosis infection (LTBI) from developing active TB is among its core interventions. The NTP has initiated TB preventive therapy since 2008. In 2020, The NTP developed a SOP for LTBI management and TPT. With this SOP, three regimens including six months daily of isoniazid (6H), 3 months of weekly isoniazid and rifapentine (3HP) and 3 months daily of isoniazid and rifampicin (3HR) were adopted.

4.5.1 – Training on LTBI and TPT

In 2022, due to no training plan, trainings on LTBI and TPT was not provided to healthcare providers.

4.5.2 – TPT provision among close contacts to TB index cases

For those who are the close contacts to TB index cases, the identification of those who are eligible for TPT was done through contact investigation (CI). In 2022, CI was implemented in 99 ODs, of which 89 ODs was supported by GFATM and 10 ODs was supported by USAID through COMMIT project. As the results, a total of 14,887 people received TPT in 2022. Of those 14,887 initiated with TPT, 1,273, 4,312 and 9,302 were < 5 years old, 5-14 years old and ≥ 15 years old respectively.

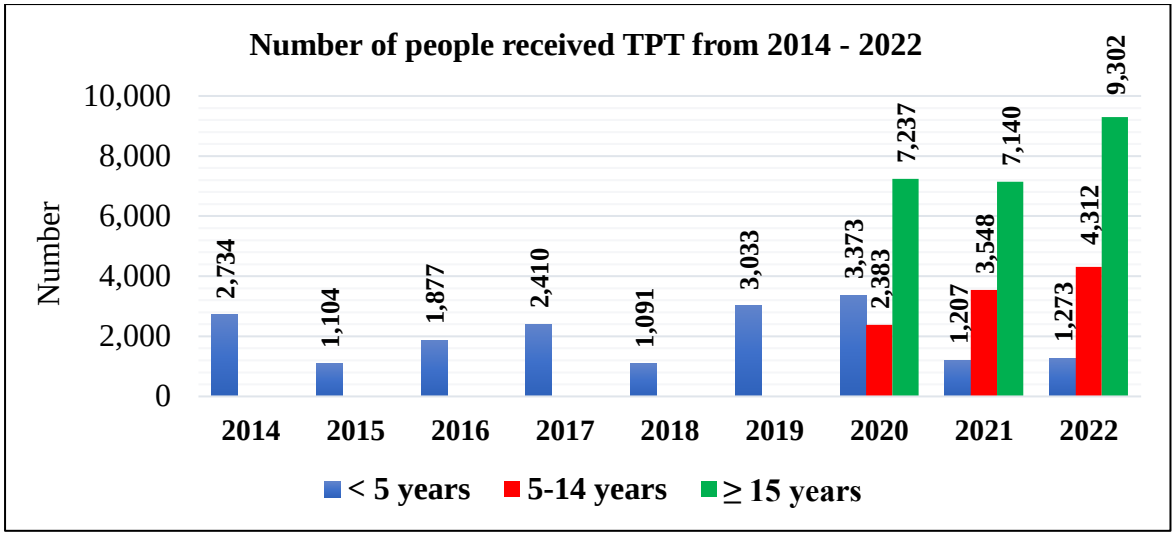

Table 12: Number of people with HIV negative received TPT from 2014 to 2022

4.5.3 – TPT provision among PLHIV

Since the middle of 2014, we have started introducing IPT for all PLHIV (new and ART clients) the number of PLHIV who are unlikely to have TB disease was steadily increased from 767 in 2014 to 2,954 in 2018. From 2019 onward, there was a big jump of TPT initiation for PLHIV to 8,611 in 2020. Due to COVID-19, this figure decreased to 6,232 in 2021. In 2022, the number increased to 7,400 cases.

To promote TPT provision among HIV / AIDS patients, in December 2021, the CENAT and the National Center for HIV/AIDS, Dermatology and STD (NCHADS) jointly issued a guideline to promote the implement new TPT regiments for eligible HIV-positive patients. As a result, in 2022, the number of people living with HIV receiving TPT has increased from 6,232 in 2021 to 7,400 in 2022. (Figure 13)

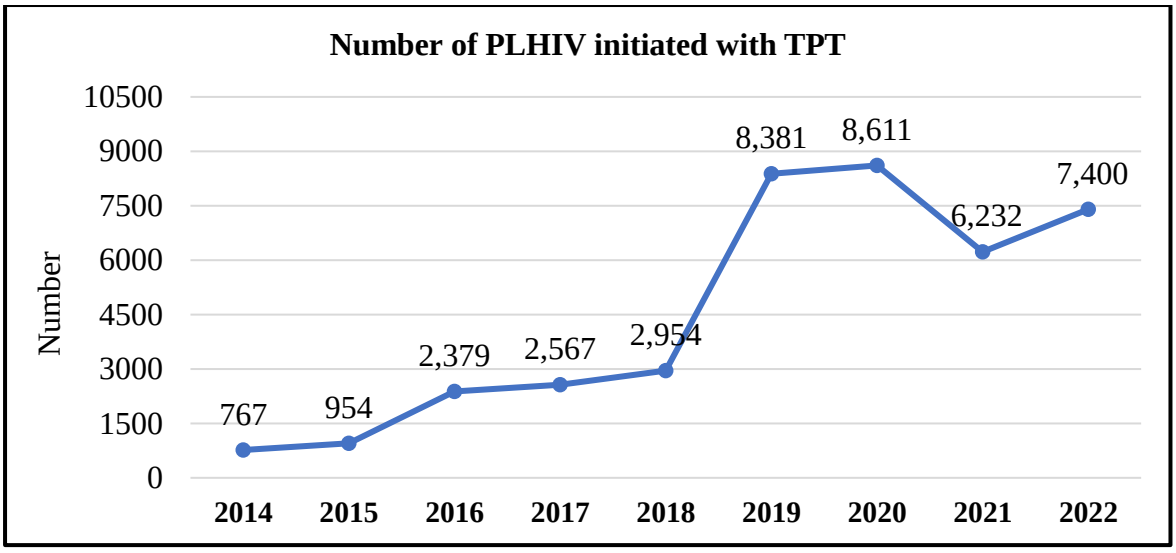

Figure 13: TPT enrollment for PLHIV from 2014 to 2022

4.6 - Drug and laboratory supplies

Proving highly important in TB Control, TB Drug Management is deemed the core element of the DOTS program. An uninterrupted supply of anti-TB drugs, reagents, and consumables is necessary for the sustained provision of quality TB diagnostic and treatment services through DOTS in all service delivery facilities nationwide. Ensuring uninterrupted of TB drugs, reagents, and consumables leads to better treatment success and reduces TB deaths.

The NTP closely collaborated with Ministry of Health's (MoH) Department of Drug and Food (DDF) and Central Medical Store (CMS) and TB partners such as GFATM, WHO, USAID, CHAI and others, to thoroughly monitor stock situation, distribution, and utilization of both 1st and 2nd line anti-TB drugs and drugs for TPT in order to ensure the uninterrupted supply and proper management of good quality of anti-TB and TPT drugs, reagents and consumables to TB networks.

In 2022, the NTP received first-line drugs (FLD) for treating adult TB patients from national budget and drugs for childhood TB were supported by the GFATM New Funding Model (GF-NFM) grant. In addition, the NTP also received second line drugs (SLD) for DR-TB treatment under the support of the GFATM New Funding Model (GF-NFM) grant and Global Drug Facility (GDF). The NTP also got supports from different partners such as USAID, WHO, UNITAID through CHAI and the Institut Pasteur du Cambodge (IPC) to purchase drugs for TPT.

The NTP always sends its officers to attend regular drug management meetings organized by relevant departments of Ministry of Health to report TB drug management activities of the national program and obtain information on the current national drug management update.

4.7 - TB infection control

In 2022, the NTP also successfully implement some key activities to strengthen infection control by collaborated with the Center for Health and Social Development by distributing 10,000 TB-Diabetes education booklets and 5,000 posters on TB education, as well as 97 posters with pictures on health education messages on cough prevention etiquette in 5 ODs including Saang, Leuk Dek, Pur Senchey, Sen Sok and O Raing Ov). In addition, some hospitals have resumed the functionality of the TBIC committee with action plans in place to strengthen TBIC. Moreover, the screenings for presumptive TB and for TB patients were done in a timely manner at in-patient (IPD) and outpatient (OPD) departments and separated systematically. Most of the TB care areas in OPDs and IPDs keep doors and windows opened for natural ventilation and air flow with well-displayed posters on infection control in waiting areas. The hospitals have built sputum collection booths with their local budget. In addition, the NTP also provided training on TB infection control to health officials working in health facilities.

In upcoming years, to overcome budget limitations and to further strengthen the TBIC activities in the country, the NTP will intensify its plans to strengthen resource mobilization and continue to collaborate with partners to improve TBIC implementation.

4.8 - Community DOTS (C-DOTS)

The main purpose of C-DOTS implementation is to improve case finding through referral of Presumptive TB as well as to ensure daily DOTS for TB treatment at community. Strengthening and scaling up the C-DOTS is one of NTP's priorities in order to bring DOTS service closer to the community to achieve case detection and treatment outcome; and to contribute to speeding up the progress towards the goal of ending the TB epidemic by 2030. As shown in the figure below, the number of health facilities implementing C-DOTS varies from year to year according to the support from NGOs, TB partners and donors. After Challenge TB project of FHI-360 under the USAID support has phased out from the second quarter of 2018, the C-DOTS remain only in areas supported by the GFATM in 644 HCs in 46 ODs in 2018 and in late 2019, we expanded to other 356 HCs in 30 ODs. So, since late 2019 up to the end of 2020, C-DOTS has been implementing in 76 ODs (1,000 HCs) by the five sub-sub-implementers namely CHC, CRS, HPA, Op-ASHA and RHAC. In early 2021, National TB control Program, with the support of Global Fund TB Grant 2021-2023, expanded its coverage to 10 more operational districts making its coverage increased to 89 operational districts including three split operational districts. Same as last year, C-DOTS was implemented 89 ODs (1,147 HCs) in 2022. As a result, through C-DOTS implementation, we detected 15,720 TB cases which accounts for about half (48%) of total TB cases in the country.

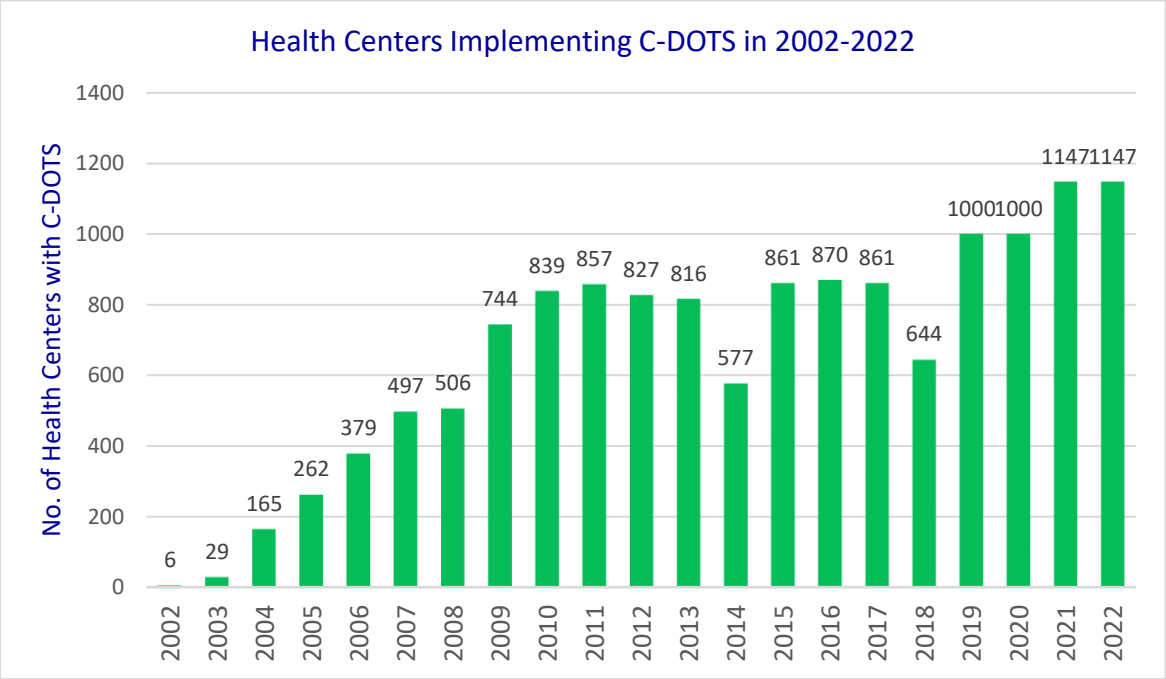

Figure 14: Health Centers Implementing C-DOTS from 2002 to 2022

Some constraints and obstacles remain our challenges in the implementation of C-DOTS. Insufficient funding support limits the C-DOTS implementation at all levels. The insufficient resources cause limited capacity of frontline TB health workers, especially funding for detection TB cases at households or at communities. We have limited resources to support VHSG / DOT watchers, as well as TB supervisors and health center staff. This issue is still a concern in the future as we have more works to be done with limited fewer human resources. In addition, we also facing other challenges such as turn-over of trained TB staff, limited capacity of TB health workers at HFs, and seasonal migration of VHSGs and/or DOT Watchers for employment seeking and these challenges need to be solved timely in order to make C-DOTS sustainable.

4.9 - Public-private mix DOTS

The provision of TB service through Public-Private Mix DOTS (PPM-DOTS) is the collaboration between the NTP and public and private healthcare providers to promote PPM-DOTS service. This approach aims to strengthen the referral of Presumptive TB from the private sector (including pharmacy, consultation room, private clinics etc.) to public health facilities for appropriate TB diagnosis and treatment. In collaboration with many NGOs and international partners, the NTP has intensified the implementation of PPM-DOTS since its start in 2005 up to 2014. This activity had been stopped since 2015 till 2020 due to lack of funding support. In late 2019 and early 2020, with support from USAID, the NTP invited a consultant, specialized in PPM-DOTS, to support the NTP in reviewing and developing a comprehensive PPM-DOTS strategy to incorporate into the 2021 - 2030 NSP and GFATM's FRA application. These are the efforts of the NTP to revitalize PPM-DOTS in the country.

Since 2021, PPM-DOTS has been reactivated under the support of GFATM which was implemented by the three SSIs of GFATM in 14 ODs of 7 provinces with participation of 70 cabinets and 35 pharmacies. In 2022, PPM-DOTS has been expanded to 34 ODs in 11 provinces with participation of a total of 325 PPM (82 clinics/polyclinics, 157 cabinets, 28 nursing rooms, 56 pharmacies, and 2 laboratories).

Key activities in PPM-DOTs included the identification of presumptive TB cases and make appropriate referral to public health facilities for further TB diagnostic workup and management. To strengthen this activities, ongoing supervisory visits and regular meetings were conducted in order to address any challenges faced by private providers on the activities' implementation.

NGOs	Province	ODs
CHC	**Kampong Cham**	Kg Cham-Kg Siem, Cheung Prey, Chamkaleu
	Svay Rieng	Svay Rieng, Romeas Hek, Svay Teap
	Tbaung Khmom	Krouch Chhmar, Pohnea Krek, Memot
	Prey Veng	Krong Prey Veng, Kampong Trabek, Peam Ro
CRS	**Banteay Meanchey**	Serei Sophoin, Mongkol Borei, Preah Netpreah, Poypet
	Battambang	Battambang, Maung Russey, Sampov Loun
	Siem Reap	Siem Reap, Angkor Chum, Sotrnikum
Op-ASHA	**Phnom Penh**	Chakto Muk, Mekong, Basak
	Kandal	Ta Khmau, Koh Thom, Kien Svay
	Takeo	Doun Keo Preykabas, Kirivong
	Kampong Speu	Kampong Speu Korn Pisey Udong
Total	**11**	**34**

Table 2: Target province and ODs with PPM implementation

Through these activities, a total of 3,012 TB patients were diagnosed and received appropriate treatment. Through this remarkable achievement, PPM activities will be expanded to other ODs in upcoming years.

In addition, the NTP continue to strengthen other activities, particularly the band of import first-line TB drugs and TB test in the markets.

4.10 - TB in congregational settings

In last recent years, the NTP has been focusing on TB control activities in congregational settings such as prisons and factories where TB transmission may be high.

4.10.1 - Prisons

With strong support from the Ministry of Health and the Ministry of the Interior, and in close collaboration with the prison department and other partners, great progress has been made in TB control activities in prison. The activities include TB health education for prisoners, referral of Presumptive TB to public health facilities diagnosis and subsequent treatment at prison health posts with a DOTS approach. The below table depicts the increasing TB control activities in prisons in the recent years. The number of prisons implementing TB control activities increased from 8 in 2009 to 26 in 2015. In 2022, TB control activities in prison was implemented under the supports of GFATM and CARITAS. Through passive and active case finding, 116 TB cases were detected.

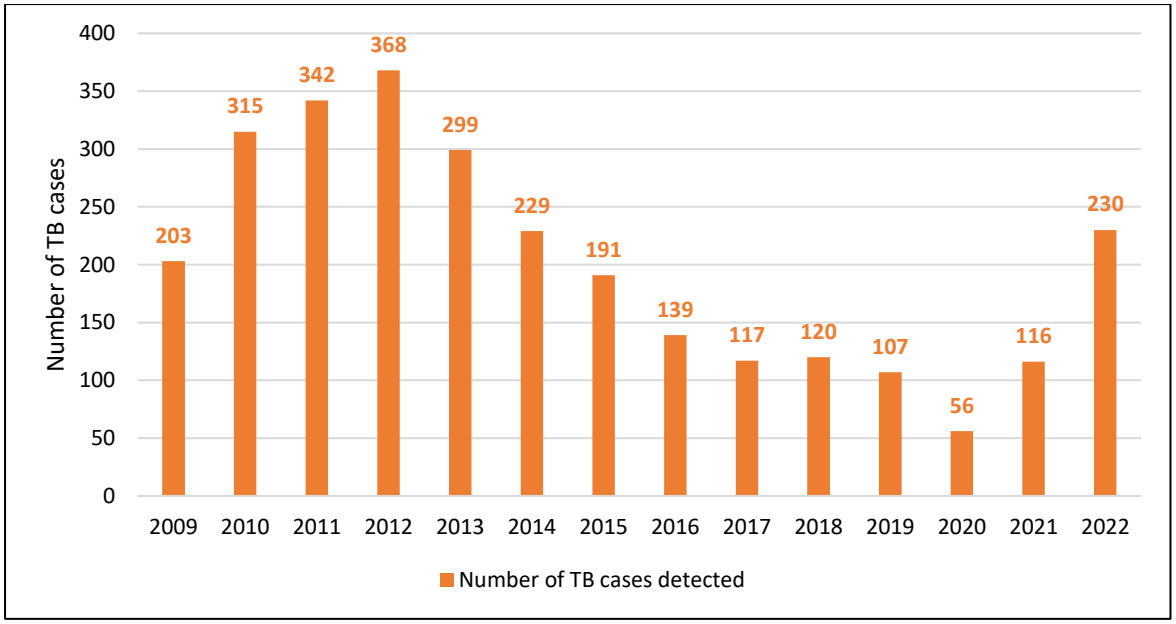

Figure 15: TB control activities in prisons from 2009 to 2022

4.10.2 - Factories and Enterprises

Factory and enterprises are ideal settings for TB transmission as employees work together in close proximity and have high interaction with others. The NTP in collaboration with Occupational Health Department of Ministry of Labor and Vocational Training, and with the support from partners especially from CATA, has been implementing DOTS pilot project in 6 factories and enterprises since 2007. The main activities include strengthening the capacity of health staff who are working at the infirmary of factories and enterprises, referring Presumptive TB to HCs for diagnosis, conducting supportive supervision, and conducting a quarterly meeting that aims to motivate staff and to prepare plan for the coming quarters. In 2022, ACFs were conducted in 11 factories and enterprises under the project's target. As the result, 9,091 workers were screened for TB and received education, of whom, 70 workers were presumptive TB and 6 were diagnosed with TB and received appropriate treatment.

TB control activities in factories and enterprises from 2007 to 2022 are shown in table below. The table shows that the number of workers covered by the activities fluctuate from year to year.

Table 3: TB Control Activities in Factories and Enterprises from 2007 to 2022

Year of implementation	Number of workers screened	Presumptive TB referred	TB cases detected
	(a)	(b)	(c)
2007	10,900	44	6
2008	22,701	149	22
2009	15,740	102	10
2010	21,077	99	24
2011	25,171	107	15
2012	25,881	127	16
2013	22,575	145	17
2014	19,402	139	11
2015	20,402	144	14
2016	18,443	68	10
2017	18,443	293	13
2018	16,843	321	5
2019	14,926	303	7
2020	8,720	90	4
2021	5,200	26	3
2022	9,091	70	6

4.11 - Summary of active case finding (ACF)

In 2022, the NTP has implemented Active Case Finding (ACF) in communities and in prisons as below:

- ACF in 10 ODs: Stung Trang, Stong, Svay Antor, Kampong Tralach, Kretie, Korng Pisey, Prey Kabas, Pearaing, Monkul Porey and Kang Meas. Through this activity, a total of 9,553 people underwent TB symptoms and chest X-ray screenings. As the result, 418 were diagnosed with TB, of whom 188 were bacteriologically confirmed TB cases. All identified TB received appropriate treatment.
- ACF in 13 prisons in 10 provinces including Kampong Cham, Banteay Mean Chey, Kampong Chhnang, Battambang, Kandal, Pursat, Takeo, Kam Pot, Siem Reap and Kampong Thom. Through this activity, a total 7,702 people were screened for TB symptoms and by chest X-ray. As the result, 127 TB cases were identified, of whom 64 TB cases were bacteriologically confirmed TB and one case was RR-TB. All identified TB cases received appropriate treatment.

In addition, Cambodia Anti-Tuberculosis Association (CATA) also implemented ACF under the “Community Mobilization Initiatives to End Tuberculosis (COMMIT)” project, funded by USAID. This activity was implemented among elderly aged 55 and over and high-risk populations in community. In 2022, ACF was implemented in all 10 target ODs in the four provinces and city (Kampong Cham, Tbaung Khmom, Kandal and Phnom Penh) have been implemented. As a result, a total of 34,989 people was screened by VHSGs, of which 16,633 (47.5%) were identified as presumptive TB and were screened by CXR. A total of 3,182 (19%) people provided sputum specimens for Gene Xpert testing. A total of

518 all-form TB cases were identified, of which 177 were bacteriologically confirmed TB and one case was Rifampicin resistance TB.

International Organization for Immigrant (IOM) also implemented active case finding among migrants at the Cambodia-Thai border, Banteay Meanchey province. Below were the key achievements in 2022.

Key Indicators	Achievements in year 2022
Number of migrants screened for TB symptoms	1,127
Number of migrants with presumptive TB	629
Number of migrants received CXR examination	611
Number of migrants tested with GeneXpert	450
Number of migrants with TB cases (all form) notified through ACF activity	99

Table 4: Key achievement on TB ACF amongst migrants in 2022

Challenges and solution of the implementation ACF amongst migrants

The integration of COVID-19 aspects into TB program has been considered as a main challenge in project implementation. Frequently updated COVID-19 guidelines in Cambodia and absence of guidance on the integration of COVID-19 into TB program hindered the approval process from the government partners to implement the TEAM2. The approach of providing the COVID-19 testing for health care workers, IOM staff and migrants before conducting ACF was agreed as part of the preventive measure and risk reduction for project implementation. However, this was solved after approval from PHD in May 2022.

4.12 - Summary of semi-active case finding (Semi-ACF)

The NTP has been conducting semi-active case finding in communities and prisons under the Greater Mekong Sub-region Project for Prevention and Control Program supported by Asian Development Bank (ADB) since 2018 in 13 provinces (13 ODs) located along Cambodia border. From November 2022, the project expanded its coverage to additional 12 provinces (12 ODs) under ADB's grant, making its coverage increased to 25 provinces (25 ODs).

In 2022, the NTP organized three workshops for healthcare providers in charge of TB in the 25 provinces and ODs, of which two workshops were to review general information of the project and to review key concepts on semi-ACF for healthcare providers in charge of TB from 13 provinces and ODs and 1 workshop was to review general information of the project and to review key concepts on semi-ACF for healthcare providers in charge of TB from 12 provinces and ODs.

The NTP organized two training sessions, in 2022, focused on basic knowledge of TB and key concepts on semi-ACF supported by ADB for 133 TB healthcare providers (19 female) in 13 provinces and 13 ODs.

As a result, in 2022, the OD TB supervisor in collaboration with TB officer at health center conducted 119 semi-ACF sessions in the villages with a total of 6,095 participants of whom, 3,150 were presumptive TB cases and 1,903 sputum samples were collected for testing. As the result, a total 162 TB cases were notified, of which 67 cases were bacteriologically confirmed TB cases.

Discussion and Material Distribution under Greater Mekong Sub-region Project for Prevention and Control Program supported by Asian Development Bank (ADB)

4.13 - Collaboration with KHANA

In 2022, Khmer HIV/AIDS NGO Alliance (KHANA) and sub-partners continued to contribute to TB response by implementing the project entitled “Community Mobilization Initiatives to End Tuberculosis (COMMIT),” which is a five-year project from 2019 to 2024, funded by USAID through TB-LON project, aiming to improve access to high-quality, person-centered TB, drug resistant-TB, and TB/HIV services; strengthen TB service delivery platforms; reduce TB transmission and disease progression, and accelerate TB research and innovations with improved impact on program implementation. COMMIT’s strategies align with the National TB Program/National Strategic Plan, WHO End TB Strategy, and USAID’s Country Development Cooperation and Global TB Strategies in reducing the TB burden in Cambodia. COMMIT focuses on finding undiagnosed TB patients and ensuring quality diagnosis and treatment in the targeted areas of the project in ten Operational Health Districts (OD) that require additional attention in the provision of TB-related services. All project activities have been carried out to help local people have easier access to services and information that can increase the search for persons that the TB care services are missing and provide them the treatment for every person who needs services.

4.13.1 - Contribute to improving case finding and access to high-quality services:

Through collaborative efforts, COMMIT was able to implement the planned activities and hit most milestones and targets across the ten existing ODs, namely: OD Por Sen Chey, OD Sen Sok, OD Leuk Dek, OD Sa-ang, OD Mukkampul, OD Lvea Aem, OD Stueng Trang, OD Kang Meas, OD Oraing Euv, and OD Suong. In quarter 4, the project has also expanded its coverage to four underserved ODs, including OD Praek Pnov, OD Koh Soutin, OD Srae Ambel and OD Bar Kaev. In total, COMMIT covers 14 ODs under the municipality and five provinces: Kandal, Kampong Cham, Thboung Khmum, Koh Kong and Ratanakiri, with a total population of 1.5 million.

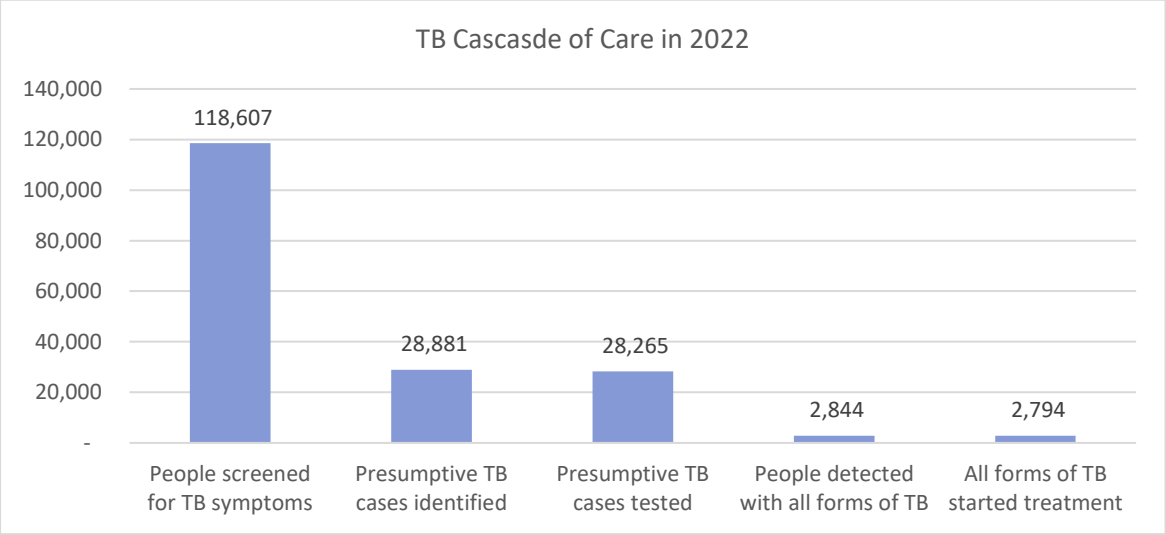

Figure 16: TB Cascade of Care under COMMIT Project in 2022

In 2022, 118,607 people (59.8% females) were screened for TB symptoms through all approaches, including the mobile ACF, Snowball using seeds and recruits, the Community TB Screening using village health support groups (VHSG), and Hospital Linkages. Within the total screened 118,607 people, 28,881 people (24.4%) were identified as presumptive TB, and 28,265 (97.9%) of cases were tested for TB. As a result, 2,844 people (10.1%) were detected with all forms of TB, and of those, 933 (32.8%) were bacteriologically confirmed cases. Of those confirmed cases, 2,794 (98.2%) were enrolled on the treatment. As part of the TB and DM bi-directional screening efforts, 130 cases (4.8%) were diagnosed with TB among 2,693 people with diabetes. Furthermore, COMMIT facilitated maintaining MDR-TB activities at all sites across the country.

COMMIT strengthened the implementation of CI by engaging health providers and local authorities to boost CI activities among the close contacts of bacteriologically pulmonary TB patients, and to improve TPT uptake and completion. As a result, the project supported CI activities on 628 index cases and achieved an over 80% rate in TPT uptake by those eligible for treatment, of which 3,110 were found to be eligible for TPT, and 2,549

enrolled on TPT (54.4% female and 7.0% children under 5). COMMIT managed to support 95% of the year 2021 cohort (1,428 out of 1,503 enrolled cases) to complete full courses of TPT treatment.

4.13.2 - Strengthen the meaningful engagement of community and civil societies for improving the health system and TB-focused programs.:

KHANA meaningfully engaged key stakeholders through various channels to increase support and resource mobilization: CENAT, development partners, NGO partners, relevant line ministries, journalists, celebrities as well as health and local authorities. In marking World TB Day, KHANA engaged over 500 participants to commemorate the event, including the members of the senate, the provincial governor, representatives from the national TB program, policymakers, journalists, and CSOs working on TB. The KHANA team also shared its achievements and best practices through the virtual 2022 World Conference on Lung Health, with three abstracts presented.

For a meaningful engagement of people living with and experiencing TB at a community, sub-national and national level, total of 103 peer support groups (PSG) and 4 TB networks at the district level have been established, located in 3 different provinces at Siem Reap, Kandal, and Tboung Khmum. Both platforms are playing critical roles to represent their constituency in various TB forums. KHANA, in collaboration with strategic partners, facilitated the establishment and launch of a national network of people affected and infected by TB, known as “TBPeople Cambodia”. In addition, KHANA has supported to implement of the community-led monitoring (CLM) – OneImpact Cambodia tool that empowers people with TB and communities to access information on TB, human rights, key messages from TB survivors and champions, and TB care and support services have been updated. It also allows people affected by TB to engage with their peers, TB support groups, in other chat forums, and to learn more about regional and global TB community networks. More than 600 users in six ODs have engaged the OneImpact app in 2022.

4.13.3 - Promote a country’s multi-sectoral response to end TB:

KHANA facilitated WHO and CENAT in the revision and finalization of the terms of reference, and a guide for the national consultative workshop on Multi-Sectoral Accountability Framework for TB (MAF-TB) Response amongst line ministries, UN agencies, development partners, private sector, Civil Societies, and TB affected community, which is planned to conduct in early 2023.

Through a joint work plan with the journalist association (CamboJA) to increase TB awareness-raising amongst the public and especially the key populations, a total of 16 articles on TB and TB-related issues have been written and disseminated by these journalists/journalist associations and three educational videos that focus on TB prevention/ TPT, policy and country commitment level and quality of sputum collection have been produced.

KHANA, in collaboration with NTP and Stop TB Cambodia organized the country dialogue to review the country's progress on UNHLM 2022 targets. The dialogue focused on reviewing the country's progressions and targets of the country's response to TB and then reaffirming the country's commitment and effort to reach those targets. The dialogue brought together 60 participants from the senate, line ministries, CCC/CCM, Provincial Health Departments, Labor Federation, CSO, community networks of people affected by TB, journalists, and celebrities. Besides, KHANA has engaged with the member of parliament and NTP to host a TV round table discussion on the country's progress toward the United Nations High-Level Meeting 2023, aiming to support NTP in disseminating the country's preparedness and recovery plan of the national TB program for the post COVID-19, make sure the messages on country targets and commitments on UNHLM-TB 2023 are reached to policymakers, program developers, donors, influencers, CSO, people affected TB, and key stakeholders.

In collaboration with the Ministry of Labor and Vocational Training and CENAT, the Secretariat of Stop TB Cambodia supported organizing a consultation meeting on TB and Workplace Policy to review the existing employment policies and procedures and then identify entry points of TB agenda to be well-incorporated, focused and read. This exercise aimed to enhance effective engagement of employment or textile sectors in TB programming through developing/implementing TB workplace policy/guideline/action plan, and then to develop a joint work plan between MoLVT and CENAT to revise and implement TB workplace policy/guideline/action plan.

4.14 - Collaborative DM-TB services

The prevalence of diabetes has an impact on changes in the incidence of tuberculosis and death from tuberculosis. Diabetes patients have two to three times greater chance of developing TB disease than people without diabetes do. They also have a two times greater chance of dying from TB while receiving treatment, a four times greater chance of developing TB relapse after completing treatment, and a two times greater chance of developing MDR-TB.

In 2022, the National TB Control Program and the Center for Health and Social Development of the COMMIT Project continued to collaborate in order to enhance the TB-diabetes services in five ODs, including five referral hospitals and 42 health centers. Key accomplishments of the TB-DM partnership in 2022 include:

- Establishment of the TB-DM technical working group, which was led by His Excellency, the Director General for Health. The vice-chairs were the director of the national center for tuberculosis and leprosy control and the director of the department of preventive medicine, and the relevant stakeholders are members. The technical working group held two meetings to go over roles and duties, standard operating procedures, documents for building capacity on TB-DM, budget mobilization from the GFATM, the WHO, etc.
- Strengthen the capacity of healthcare providers and collaboration activities to manage TB-DM comorbidity through trainings, supportive supervisions from

national, provincial, and district levels, conducting monthly, quarterly, and annual meetings and exchange visits to other projects, etc.

- Support materials to screen TB patients for diabetes, such as glucose meters.
- Screened a total of 1,712 TB patients for diabetes, of whom, 145 TB patients (8.46%) were diagnosed with diabetes.
- Screened a total of 2,429 diabetic patients for TB and 128 (5.3%) of them were diagnosed as TB, of whom 68 cases were bacteriologically conformed TB.
- TB-Diabetes Education: Distributed 10,000 booklets and 5,000 posters on TB education, as well as posters with pictures on health education messages on cough prevention tips, and 97 algorithms on TB-DM and coordinate World TB Day, etc.

In 2022, evaluation on TB-DM project was done by Infectious Disease Detection and Surveillance (IDDS) project, FHI 360, to identify successes and challenges and develop recommendations with the goal to enhance and expand implementation. Based on the evaluation, bidirectional screening of TB-DM patients is feasible and scalable in the setting of Cambodia.

4.15 - Advocacy, communication and social mobilization

Advocacy, Communication and Social Mobilization (ACSM) is an integral part of the TB control program. In 2022, the NTP always ensured that various ACSM approaches were included in the contents of refresher trainings, workshops and health education to the general population at Health Centre, Communities: Buddhist, School, Patient home etc.

In 2022, with support from the MoH, the NTP produced TB education video on order to increase TB awareness, TB care seeking behaviours and to increase TB service utilization among community. Furthermore, in collaboration with PSI, NTP is developing the National Strategy on Advocacy, Communication and Social Mobilization (ACSM). It is expected that this strategy will be finalised in 2023. This ACSM is part of the response to the National Strategic Plan to End TB 2021-2030.

Due to financial constraints, a very limited number of IEC materials were produced in 2022. However, the NTP has been working hard with relevant partners including PSI with financial support from USAID, to producing IEC materials such as posters, educational leaflets on general TB awareness and distributed to people in communities.

At the meantime, to strengthen the advocacy and for improving knowledge among general population, the NTP and partners organised the World TB Day in 2022 with participation from ministry of health, health staff from all levels, NGO partners, students and different stakeholders.

To overcome the budget limitations and to further strengthen the ACSM activities in the country, the NTP will intensify resource mobilisation in order to improve the ACSM implementation.

4.16 – Research, monitoring and evaluation

To be align with the WHO's global direction to end TB by 2035 to "*intensified research and innovation*", the National Strategic Plan to ENT TB in Cambodia 2021 – 2030 to strengthen "*surveillance, monitoring, evaluation and research*", and the recommendations by the Join Program Review (JPR) in 2019 to "*pursue innovation and research*", the NTP of Cambodia has been committed to strengthen TB research in the country through different mechanisms. In 2020, the Cambodia committee for TB research (CCTBR) was established. In 2022, several TB research and activities to strengthen TB research were held.

4.16.1- Progress update on TB research for 2022

In 2022, a number of TB research has been successfully completed, being implemented and will be conducted in the upcoming years. These TB research have been led by the NTP or by research partners in collaboration with the NTP.

No	RESEARCH TOPICS	LED BY	STATUS
Completed TB research in 2022:			
1	IMPAACT4TB (Evaluating the scale up of short course tb preventive therapy (3HP) among people living with HIV (PLHIV) and child household contacts of TB patients at sentinel sites in Cambodia)	CHAI	Completed
2	Mobile and migrant population's knowledge, attitude, practices on three Infectious diseases (HIV/AIDS, TB and COVID-19) and barriers to access Health services	IOM	Completed
3	Optimizing case finding and treatment for TB in Cambodia: a mixed method study to explore TB patient pathway and cascade of care (PPA study)	KHANA	Completed
4	Research on "All-oral shorter treatment regimens for multidrug- and rifampicin-resistant tuberculosis (MDR/RR-TB) (ShORRT_Cambodia)	NTP	Completed (Waiting for final report)
5	Third national drug resistance survey	NTP	Completed (Waiting for final report)
6	Systematic TB screening in private and public health care setting: The way forwards to eliminate TB in Cambodia.	SHCH	Completed (Waiting for final report)
7	TB Speed (A research project to strengthen paediatric tuberculosis services for enhanced early detection)	IPC	Completed

8	OPTICAM study (Optimizing Latent Tuberculosis Treatment Initiation in Cambodia Among People Living with HIV)	IPC	Completed
9	Applied epidemiological insights from a tuberculosis outbreak in a Cambodian captive bear population	IPC	Completed
Ongoing TB research in 2022:			
1	Effectiveness of community active case-finding strategies for detection of tuberculosis in Cambodia: a pragmatic cluster randomized controlled trial	KHANA	Ongoing
2	Tuberculosis disease and tuberculosis infection in ten operational health districts in Cambodia: a prospective cohort study	KHANA	Ongoing
3	OR on feasibility of Truenat TB test implementation for rapid molecular diagnostic test of TB in Cambodia	FHI 360 (IDDS)	Ongoing
4	Determination of Adequate Tuberculosis Regimen in Adults and adolescents hospitalized with HIV-associated severe immune suppression (CD4 ≤ 100 cells/µL) (DATURA clinical trial)	IPC	Ongoing
5	Documentation of implementation of community-based TB model with focused engagement of commune/Sangkat	LHSS	Ongoing
6	TB fund mapping and gap analysis	LHSS	Ongoing
TB research that will be implemented for upcoming years:			
1	3rd national TB prevalence survey	NTP	NECHR approved
2	Tuberculosis Knowledge, Attitude and Practice, Cambodia 2022	PSI	NECHR approved
3	National TB patient Costs Survey	LHSS	Protocol development
4	Households and close contact investigations of persons with tuberculosis in Cambodia	KHANA	Protocol development

Table 5: Status of TB research in 2022

4.16.2- Research situation analysis:

To understand the TB research environment in detail, the TB DIAH team conducted a TB situation analysis in 2022. Key findings included:

- Cambodia has completed three of the four 2020 WHO Milestones, excluding sporadic in-country research training.

- As of 2020, the GFATM was still the largest funding source (50%) in TB funding, followed by domestic funds (33%), USAID (7%), and other international donors (10%).
- Lack of appropriate and sustainable TB research funding.
- A number of academic programs in health research have been established, but there are no national competitive health research grants available to students and researchers, and procuring sustainable research funding sources from foreign donors or academic institutions is a major challenge

To explore the internal and external factors in the TB research circumstances, a desk review and key informant interview notes are summarized in the following SWOT analysis.

Table. SWOT (Strengths, Weaknesses, Opportunities, Threats) Analysis of TB Research in Cambodia

Strengths	Weaknesses
● CCTBR established by CENAT. WHO, USAID, NIPH, and other stakeholders can provide decision making support in TB research ● CCTBR has made some progress to identify the research priorities in research agenda ● CENAT develops the coordination and support network of several partners with research experiences, such as NIPH, KHANA, IPC	● Newly appointed research staff have insufficient research experiences in study design and data analysis ● Little motivation to participate in the whole research process ● Most TB research projects are not led by CENAT ● Research capacity and experiences may take a long time to build ● English writing skills for reports and research articles are crucially needed
Opportunities	**Threats**
● Research is listed as a strategic pillar in NSP, endorsed by MoH ● Technical support can be sought from stakeholders (NIPH, KHANA, IPC, CHAI) ● Collaborations with foreign research institutions and universities, with support by some stakeholders (NIPH, KHANA, IPC) ● Research capacity building support from other stakeholders, including NIPH, KHANA, and foreign universities ● Small research grants might be cut out from some existing TB projects	● Competitive tasks and other job responsibilities of CENAT research staff ● CENAT staff devoted most time to “investigation” (data collection), but not to research design and analysis ● Limited commitment in research: most are only interested in data collection and field visits, but not in study design and data analysis ● Limited external financial support in TB research ● Lack of sustainable funding in TB research ● Limited local academic research: very few Master thesis topics in TB research have been done at NIPH ● Provincial health staff work in all infectious diseases, so TB research is not their top priority ● TB data resources are managed by different stakeholders, but not all supervised by CENAT ● After completing TB projects, all donors do not request the NGOs to transfer TB data to CENAT ● Economic analysis, qualitative research, and genomic research are infrequently applied in TB research

4.16.3- Research Guidelines and Protocol:

Research guidelines focus on the research process more than other types of guidelines. Currently there is no TB research guideline in Cambodia; therefore, it is essential to develop the TB Research Guidelines and Protocol, supervised by the CENAT, for the scientific and ethical soundness of TB research activities in Cambodia. The objectives of the TB Research Guidelines and Protocol are to (1) Ensure the integrity of TB research; (2) Provide standard procedure and format for TB research activities; (3) Establish and update the TB research agenda; and (4) Improve the quality of TB research publications and dissemination.

This Research Guidelines and Protocol was developed by TBDIAH and has been reviewed by some CCTBR members in 2022, and it should be reviewed and endorsed by CENAT in 2023. Several research stakeholders will assist CENAT in the review and implementation of the TB research guidelines on a regular basis at the CCTRB Meetings.

4.16.4- Research Capacity Building for CENAT Staff:

To improve the research capacity of research staff at CENAT, TB DIAH is developing research capacity building activities in collaboration with the USAID STAR Advisor and the NIPH. The purpose of these TB research capacity building activities is to help CENAT research staff develop the practical skills to conduct operational research, analyze data, publish the findings, and promote changes in TB policy and practice. These research capacity building activities provide participants with practical expertise in carrying out the complete operational research process, from research conception to publishing and dissemination. Five operational research training modules are the main contexts applied in the capacity building activities for CENAT research staff. In December 2022, TB DIAH in close collaboration with the USAID STAR Advisor and instructors from NIPH developed module 1 of the training curriculum (Basic Epidemiology and Research Ethics) and remaining modules will be developed in 2023.

4.16.5- Research priority of the national TB program:

Under the leadership of the NTP, in October 2022, a CCTBR meeting was conducted to identify TB research priorities for the upcoming years for Cambodia. These TB research priorities will serve as a roadmap for the NTP for TB research. A number of the priorities for TB research under the following themes were proposed by the CCTBR's members:

- Research priority for TB case detection — 10 research topics
- Research priority for TB treatment — 7 research topics
- Research priority for TB prevention — 8 research topics
- Research priority for TB comorbidity and other priorities such TB-HIV, TB-DM, digital health — 4 research topics
- Research priority for TB financing and sustainability — 4 research topics

In collaboration with partners, some of these research topics have been implemented, or being implemented or at will be implemented in upcoming years. The NTP will further prioritise those research topics and discuss with partners to mobilise resources and share responsibility for the research implementation.

4.16.6– Monitoring and evaluation:

CENAT in collaboration with partners facilitates the development of the Monitoring and Evaluation Plan aligning with the NSP 2021-2030 to move towards the goal of ending TB in Cambodia. The goal of the M&E plan is to measure the performance of the TB program against the set vision, goals and targets in the NSP. The M&E plan provides a robust M&E framework that links the NSP objectives and interventions with relevant indicators and provides comprehensive insight on data collection systems, data analysis, use, and dissemination of quality data that are used for TB surveillance at the national level; monitor the progress towards the National TB targets; and inform the decisions on program planning, management, policy making and resource allocation required for NTP.

The development of the National TB M&E Plan is done through consultative process of all partners, including the TB Data, Impact Assessment and Communications Hub (TB DIAH) project, WHO's country office, STAR, the GFATM, USAID, and the NGO partners of the National TB programme. This multi-sectoral and partnership approach ensured that the M&E Plan represents the collective inclusion of a broad range of stakeholder participation for the development of the TB M&E plan in Cambodia.

In addition, to strengthen TB M&E capacity to the national and sub-national levels, the NTP, with technical support from TB DIAH, developed a TB M&E training curriculum for Cambodia, which will serve as a basis for national TB M&E training curriculum. The TB M&E curriculum was used in a Training of Trainers for approximately 50 provincial supervisors. This strengthened the Cambodia NTP's human resource capacity to conduct effective monitoring and evaluation. The curriculum provided competency-based training to TB program and M&E staff already engaged in TB M&E activities to hone the fundamentals of TB M&E and surveillance. This included how to develop, operate, manage, and maintain a well-functioning TB M&E system. The training also familiarized the attendees with the basics of developing M&E plans in the context of TB M&E in Cambodia.

The four modules of the TB M&E training curriculum focused on an overview of Cambodia's NTP and TB M&E system, data collection, verification, and analysis. The theory-based discussion with case studies allowed participants to gain hands-on experience analyzing, interpreting, and synthesizing TB data. How to develop TB M&E reports and visualizations and its use for decision-making at all levels of the NTP were also covered.

TB DIAH also provided mentoring and refining of M&E skills in on-the-job settings for CENAT staff and rolled out an e-Learning TB M&E course that provides an M&E training certificate. This course is available on the CENAT website.

4.17 - Electronic TB management information system

The TB Management Information System (TB-MIS) is a web-based tool that enables decision-makers to monitor the status of TB presumptive, test, and treatment by integrating data across key aspects of TB control. It was developed and managed by the CENAT with technical assistance from the USAID-funded COMMIT project, which KHANA is prime to provide technical support on the system since October 2020. TB-MIS was customized using the existing core application e-TB Manager [2] to fit the context of the case management flow of Cambodia's TB program by local programmers. TB-MIS has been customized its abilities to capture the treatment, follow-up, and outcome data of drug-susceptible TB (DS-TB), DR-TB, close contact to TB index case and Treatment Preventive Therapy (TPT) of all health facilities from the paper-based recording forms and registers. In addition to the TB-MIS is continuously customized the feature of capturing TB presumptive case and evaluate it to be a confirmed TB case for treatment.

Early of 2022, with technical and financial supports by COMMIT project, CENAT continuously provided a drill-down training on the utilization of TB-MIS to the remaining 43 health facilities (38 HCs and 5 RHs) of 5 ODs under the COMMIT project's coverage. These trainings enabled HFs' staff to directly enter data into TB-MIS and shift the responsibility of OD TB supervisors from entering data to just only monitor the entry uptake and data quality check. The drill-down training session includes recording and reporting the presumptive TB case, evaluation a tested presumptive TB case, immediately put a confirmed TB on treatment and tracking the treatment outcome. Since then, all 95 health facilities (85 HCs and 10 RHs) under COMMIT's coverage direct entered data into TB-MIS from their health facilities. For the DR-TB cases, entry is still performed by all 11 treatment sites throughout the country.

In September 2022, the CENAT and COMMIT project conducted a reflection meeting to evaluate the data entry into TB-MIS by health facilities as well as to evaluate the results from this direct data entry. The result of the meeting shown that direct data entry into TB-MIS by health facility staff is scalable for other ODs countrywide.

Furthermore, with the financial support of WHO and technical support of the COMMIT project, CENAT expanded training on TPT data entry into TB-MIS to all TB staffs from 14 ODs in 3 provinces (Banteay Meanchey, Svay Rieng, and Takeo) in September 2022 with a total of 17 participants.

To ensure smooth utilization and data entry into the system, CENAT and COMMIT project have maintained a helpdesk team for the day-to-day operation to provide technical supports remotely through different means, including directly communicating via phone call, and/or submitting their feedback in both the ten telegram groups by each OD and the

[2] e-TB Manager is a web-based tool for managing all the information needed by national TB control programs. It integrates data across all aspects of TB control, including information on presumptive cases, patients, medicines, laboratory testing, diagnosis, treatment, and outcome. It is developed by Management Science for Health (www.msh.org) with open-source tools to enable countries to customize the platform to fit particular country's needs without specific licensing.

Telegram Group 'Cambodia TB MIS'. All user feedbacks and issues were collected and considered for the system's improvement. Common feedbacks received from users included (1) the technical issue around case registration and report, (2) assistance around how to verify cases in the system against the paper-based form, (3) facilitate and resolve the outstanding cases of (a) confirmed, but not on treatment; (b) inconsistent age and regimen; (c) transfer-in; (d) re-open case; (e) case duplicate; and (f) treatment overdue without outcome, and (4) a common issue of forgetting password. Besides, CENAT and COMMIT project continue updating the meta-data including add/remove health facilities information, regimen list, and other field values in the system, and continuously customizing the TB-MIS platform according to the user's feedback which can be collected either from supervision visit, trainings, meetings, or telegram groups.

Under technical support from COMMIT project and another USIAD-funded IDDS project, CENAT had been setting up another trail on diagnostic connectivity between GeneXpert laboratories either to National TB Referral Laboratory (NTRL) for laboratory management purpose or to TB-MIS for pushing the GeneXpert test results automatically within 10 RHs under COMMIT's coverage. By the end of the year 2022, connection between GeneXpert laboratories to NTRL is available by using DataToCare platform, but the connection between DataToCare to TB-MIS is still on progress of developing and customizing both platforms to ensure they could talk to each other via Application Program Interface (API). Additionally, another technical assistance from USAID in collaborating with COMMIT and TB-DAIH project, assisted CENAT in developing TB-MIS roadmap to ensure either short-term or long-term approaches for transiting from completely customized the TB-MIS platform with comprehensive functionalities for users at central and peripheral levels, rolling-out the utilization to all health facilities level in countrywide, considering the reduction of paper-based forms and register books with directly electronic recording and reporting system by TB-MIS.

In the upcoming years, CENAT, with support from COMMIT project, will expand the drill-down training on the utilization of TB-MIS at health facility levels to all health facilities under 25 ODs of COMMIT's targeted provinces including Phnom Penh, Kandal, Kampong Cham, Tboung Khmum, one OD of Rattanakiri (Borkeo) and one OD of Koh Kong (Srae Ambel).

4.18 – Other key activities

4.18.1 - Supervision

Supervision is one of the important activities of the NTP. Supervisions were done by three major levels, from the central level, the provincial level and OD level. TB supervisors at each level monitored TB-related activities under its coverage areas including at provincial, OD, HF and community levels. This work is done regularly, based on the frequencies for each level. The key objective of the supervisions is to enhance the quality of the program's implementation through improving staff knowledge, improving technical skills, improving performance, motivating of service providers as well as providing

feedbacks to OD and provincial TB supervisors on the findings. Face-to-face communication between supervisors and staff working at the local level is very important, as it lets the supervisors know all aspects of the actual work, progress, and assists in motivating staff who have performed the tasks. It is not to blame or punish even if mistakes are found.

The funding that has supported supervision was from a variety of sources, including the national budget and funding from development partners.

In 2022, supervision was done smoothly. The NTP encouraged TB supervisors at provincial and OD levels to strengthen supervisory visits to health facilities under their jurisdiction in order to strengthen the TB program.

Handover X-Ray machines to OD TB supervisors

Handover motorbikes to Provincail TB supervisors

4.18.2 - Training

Trainings play an important role in strengthening the capacity of staff, as well as strengthening the TB program as a whole. In 2022, the NTP conducted several trainings for health officials after the situation of the COVID-19 epidemic has eased. Those training courses include:

- Trainings on monitoring and evaluation
- Trainings on basic TB management to newly appointed TB staff
- Trainings on TB clinical management for childhood TB
- Trainings on the use and maintenance GeneXpert machine
- Trainings on TB case detection management
- Trainings on TB-DM comorbidity management
- Trainings on TPT data entry into TB-MIS
- Trainings on TB infection control
- Trainings on DR-TB
- Training on chest Xray reading

4.18.3 - Workshops and meetings

In 2022, several face-to-face and virtual meetings and workshops have been conducted. Meetings and workshops held in 2022 included the quarterly progress review meetings, annual work plan development workshop, CCTBR meetings, and other several meetings. In addition, the NTP has held several meetings with relevant partners to prepare for the third national TB prevalence survey.

In addition, the management team of the CENAT also participated in various international meetings and workshops, such as participating in TB-SPEED international restitution symposium at Mozambique, a meeting on Regional Policy Dialogue-Commitment and Action to Improve TB Policy for Migrants and Mobile Populations in Thailand, etc.

4.18.4 - Procurement

To support activities to control TB at all levels, with supports from partners, the CENAT procured and distributed the following: 111 computers, 24 printers, 3 GeneXpert machines, 11 mobile and digital Xray machines, 36 motorbikes and 22 uninterruptible power supplies (UPS).

5 – FINANCING

The NTP has clearly identified a 7-year National Strategic Plan (2014-2020) by a thorough consultation with all concern partners, and a financial gap was clearly shown. The NTP is trying to negotiate with all potential partners for program financing.

From April 2009 to the end of 2014, CENAT was a principal recipient (PR) for the GFATM for TB grant round 7 and managed the financing of 11 sub-recipients (SRs). From 2015 to 2017, CENAT still continued as a PR for The GFATM under New Funding Model (NFM) with the total funding amount about US$ 15.6 million and managed the financing of 5 Sub-Recipients (SRs).

In late 2017, Ministry of Economy and Finance that became the new PR from GFATM has been signed for the three-year GFATM project cover from January 2018 to December 2020. In this project, the GFATM initially supported the TB program with an approximate total amount of US$ 13.7 million with an additional US$ 2.7 million was provided in September 2019. In total, the fund that was committed to support by GF was about US$ 16.4 million for the years of 2018-2020. This grant fund was implemented by CENAT itself and as the sub-implementer (SI) for TB program, CENAT also manages grant implementation of all Provincial Health Departments and five sub-sub-implementers (SSIs) namely: CHC, CRS, HPA, Op ASHA and RHAC.

In late 2020, GFATM agreed to support CENAT with a total amount of US$ 19.7 million for a three-year period 2021 – 2023. This new grant will be implemented by CENAT and as SI for TB program. CENAT also manages grant implementation of all Provincial Health Departments and three SSIs namely: CHC, CRS and Op ASHA.

In 2020, the NPT developed the National Strategic Plan (NSP) to End TB in Cambodia 2021-2030, outlining the key directions and interventions that the CENAT and partners should implement to achieve the goal of ending TB by the end of 2030 and 2035 in Cambodia. The 10 years' NSP (2021 to 2030) indicates a lack of funding and needs for additional funding supports. The average basic budget requirement for the NTP is about $ 30 million to $ 35 million per year. The NTP has been working hard to negotiate with potential donors to mobilize additional resources to fund the NTP.

In 2022, the $ 11.4 million grants approved from the GFATM were used for two projects, including the COVID-19 pandemic Response Mechanism (C19RM) project; Active Tuberculosis Elimination Among Migrants project and Increase Access to and Improve Quality of TB Diagnosis and Treatment at OD and Community levels, with linkages to TB-HIV in Cambodia (KHM-C-MEF / 1999) which is the largest project. These two grants are implemented by the NTP itself, all municipal and provincial health departments and four partner organizations, including CHC, CRS, Op ASHA, and KHANA.

Also, in 2022, beside grant supported by GFATM, five major donors including WHO, USAID, ADB, CHAI and US CDC also financially supported the NTP. The support

from USAID in 2022 was done through COMMIT project, jointly implemented by Khmer HIV/AIDS NGO Alliance **(**KHANA) and other three NGO partners including CHC, CATA and Center for Health and Social Development.

In addition to these grants from development partners, the Royal Government of Cambodia is increasing fund allocation from the National Budget to the TB program including a 100% contribution for purchasing adult TB drugs in 2022, salaries and incentive supports to all staff who manage and implement GFATM project at CENAT.

In summary, in 2022, the NTP received funding support from seven main sources: National Budget, the GFATM, WHO, USAID, ADB, CHAI, and US CDC.

However, the NTP could face budget shortage over the coming years to meet the new direction of aggressive TB control.

6 - TARGETS FOR 2023

NTP has recently set the targets in line with the End TB Strategy as well as SDG targets by 2030, in which we aim to reduce incidence of 80% and mortality rate of 90% in 2030, compared to 2015 figures.

For 2023, Cambodia NTP has the main targets as below:

- Maintain the treatment success rate of at least: 90 %
- Detect all forms of TB: 33,000 cases
- Detect bacteriologically confirmed TB: 13,500 cases
- Detect Childhood TB: 6,000 cases
- Detect MDR-TB cases: 280 cases

7 - ACKNOWLEDGEMENT

With the support from the government and Ministry of Health, the NTP has achieved tremendous results during the past years. The Royal Government of Cambodia and Ministry of Health of Cambodia has given high priority to TB Control. The above achievements are also contributed by active participation from all healthcare workers across the country with the support and collaboration from various partners. These partners include local authority, community, volunteer, technical and financial support from non-governmental and international organizations.

NTP would like to express our sincere thanks to:

- The government and Ministry of Health for their support.
- All healthcare workers, especially TB staff across the country for their active participation.
- NGO/IO partners especially WHO, GFATM, USAID, US CDC, ADB, Stop TB Partnership/GDF, JATA/RIT, KHANA, STAR, TB DIAH, IOs and NGOs for their both technical and financial supports to NTP.
- Local authority, community, and volunteer as well as other partners for their supports and collaboration.

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Annual Planning Workshop on TB Control 2023

World TB Day 24 March 2022

The TB-Speed National Restitution Days

Workshop on TB Management Information System Roadmap of Cambodia

National Consultative Workshop on Developing the National TB Public-Private Mix (PPM) Strategy and Standard Operating Procedure (SOP)

TB-MIS Training to TB staff at Health Center

TB supervisory visits from National to Sub-National levels