Kingdom of Cambodia
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Ministry of Health

Strategic Plan
for Tuberculosis Laboratories
for TB Control in Cambodia
2007-2010

National Centre for Tuberculosis and Leprosy Control
(CENAT)

December 2007

Table of Contents

Acronyms and Abbreviations

AIDS	Acquired Immunodeficiency Syndrome
C-DOTS	Community DOTS
CENAT	National Centre for Tuberculosis and Leprosy Control
CIDA	Canadian International Development Agency
CMS	Central Medical Stores
CTC	Close to Client
DOTS	Directly Observed Treatment, Short course
DST	Drug Susceptibility Testing
EQA	External Quality Assurance
HIV	Human Immunodeficiency Virus
ICC	Inter-Agency Coordination Committee
IUATLD	International Union Against Tuberculosis and Lung Diseases
JICA	Japan International Cooperation Agency
JPR	Joint Program Review
Lab	Laboratory
MDG	Millennium Development Goal
MDR-TB	Multi-Drug Resistant Tuberculosis
MoH	Ministry of Health
MoU	Memorandum of Understanding
NIPH	National Institute of Public Health
NRL	National Reference Laboratory
NSP	National Strategic Plan
NTP	National Tuberculosis Program
PPM-DOTS	Public Private Mix DOTS
QA	Quality Assurance
RIT	Research Institute of Tuberculosis, Tokyo
SNRL	Supra-National Reference Laboratory
SOP	Standard Operating Procedure
TB	Tuberculosis
TOR	Terms of Reference
TWG	Technical Working Group
USD	United States Dollar
WHO	World Health Organization
WFP	World Food Program

Acknowledgements

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We wish also to extend our deep thanks to the members of Sub-Technical Working Group for TB Control, formerly called Inter-agency Coordination Committee (ICC) for TB control, who during the meetings have made invaluable contribution to the finalization of this strategic paper.

We wish to particularly thank Dr. Jim McLaughlin of US-CDC Cambodia for his tremendous effort in drafting this very essential paper in consultation with all NTP partners, especially WHO, JICA and USAID .

We would like to emphasize that without strong support, full and active participation of all partners, working group and committee members as well as other people involved, the finalization of this strategic plan document could not successfully take place.

Phnom Penh, 25 December, 2007

National Center for TB and Leprosy Control
Director

Mao Tan Eang, MD., MPH.

Strategic Plan for TB Laboratories for TB Control in Cambodia, 2007-2010

I. Introduction

A. Burden of tuberculosis in Cambodia

Cambodia is among the 22 countries in the world with a high burden of tuberculosis (TB). The WHO Report 2007 (Global Tuberculosis Control-Surveillance, Planning, Financing) provides the following estimates of TB in Cambodia: prevalence of all forms was 703/100,000 population; estimated incidence of smear positive cases was 226/100,000 population and the TB mortality rate was 87/100,000 population. These are among the highest in the world and Western Pacific Region.

It is estimated that incidence is declining at least at a rate of 1% per year. Accelerated DOTS expansion began at the end of 2001, reaching 100% coverage at the health center level in 2004. During the period of DOTS expansion, notifications of all forms and smear positive TB rose at a yearly rate of +14% per year and 8% per year respectively. An acceleration of case detection occurred in late 2005, as a partial result of active case finding activities. TB cases notified under NTP in 2005 of all forms was 36,123 and that of smear positive TB was 21,001 corresponding to the cases detection rates of 54% and 70%, respectively.

National surveys of HIV in TB patients were conducted in 2003 and 2005. The HIV prevalence rate of all TB patients in 2005 was 9.9%, a decline from 11.8% in 2003. The impact of HIV/AIDS on TB has been enormous during the last few years. All forms of TB seen in public health facilities under the NTP have nearly doubled over the five year period from 2000 to 2005. The number of new TB cases of all types notified was 34,660 in 2006, which included 19,985 cases of smear positive pulmonary TB, a small decline relative to 2005 figures (CENAT Annual Report 2006).

It was predicted that the annual rate of increase in notifications will likely slow down rapidly, with a peak in annual notifications around 2005-2007. Further progress in case detection might result in further increases in notification rates in the next few years. However, In the medium to long term (2008-2015), notifications will likely decline along with incidence.

As much of TB mortality in Cambodia is linked to TB-HIV co-infection, predictions on TB mortality depend on the speed of expansion of TB-HIV activities. It will be essential to compile and analyze case fatality rates in smear negative TB in order to better assess the magnitude of TB mortality. If rates of decline of prevalence and mortality do not slow down, the MDG targets will be met. It is anticipated that sustained TB control efforts will further accelerate the decline of the TB burden in Cambodia.

B. Structure for TB Control

The National Tuberculosis Control Program (NTP) was established in 1980. The NTP has been operating under the responsibility of the National Center for Tuberculosis and Leprosy Control (CENAT) of the Ministry of Health, within the overall national health system.

At the central level, within the CENAT, there are three structures: the NTP headquarters, the TB Referral Hospital (one of eight national hospitals in Cambodia), offering clinical and para-clinical TB services, and the National TB Reference Laboratory (NRL).

At the intermediate level, (provincial level), Provincial TB supervisors are responsible for program planning and management including training and supervision. At least two full time staff are working for the TB programme at this level. At the operational district (OD) level, an OD TB supervisor has a role similar to provincial TB supervisors.

At the service provision level, there are TB units and Health Centers (HC). A TB unit can be defined as a public health facility consisting of a TB ward with some beds and a microscopy center. There are 145 TB units that belong to referral hospitals or former district hospitals (now known as HC). In addition, in Phnom Penh, there are five central hospitals that have one TB unit each: CENAT clinical services, the Mittapheap Khmer-Soviet Hospital, the National Pediatric Hospital, the central police hospital and the Central Military Hospital, raising the total number of TB units in the country to 150.

At the lowest level of the health care system, the health facility providing TB services is the health center. Until 1998, DOTS was offered only at the hospital level, i.e. TB unit. In 1999, a pilot testing of the decentralization of TB control activities was started in nine health centers. In 2001, the national DOTS expansion plan was approved and due to the rapid DOTS expansion between 2001 and 2004, all health centers were able to provide DOTS and TB services by the end of October 2004.

In a broad sense, the TB laboratory network includes health centers where sputum specimens are collected, microscopy centers situated in some HCs, TB units, and some central hospitals, the National Reference Laboratory at CENAT in Phnom Penh and the supra-national TB laboratory in Tokyo, Japan(Annex1).

At present, the TB laboratory network consists of around 200 microscopy centers situated in 70 referral hospitals, 5 central hospitals, 75 former district hospitals and the remaining in health centers (Annex1).It should be noted that 75 microscopy centers are integral parts of general laboratories within all 70 referral hospitals and 5 central hospitals (3 national hospitals, 1 military hospital, and1 police hospital). Presently, there are three public laboratories in Cambodia with TB culture capabilities, one in CENAT, one in Kampong Cham referral Hospital and one in Battambang referral Hospital.

Sputum collection has been extended to all health centers and corresponding microscopy centers are located in former district hospitals and referral hospitals. In 2006, a total of 458,646 slides were examined for AFB from 138,516 suspects. The laboratory network included 328 technicians.

The quality assurance program is an essential component of the laboratory services of the NTP. Rapid feedback of QA results is the key to providing quality laboratory diagnosis of TB. The NTP has established the foundation for a quality assurance system of slide review according to WHO standards..

C. Major Challenges

Despite considerable progress made during the last five years in combating TB in Cambodia, a number of challenges still remain to be overcome if the NTP is to reach the MDG goals. These include the still very high disease prevalence and incidence; lack of resources to maintain the functioning of the extensive DOTS services nationwide; quality assurance issues; limited resources to expand innovative interventions such as community DOTS, TB/HIV, PPM-DOTS and other areas, such as laboratory strengthening, staff capacity and motivation, and the issue of ensuring free of charge services.

TB laboratory strengthening is essential for implementation of expansion-focused interventions to address TB/HIV and MDR-TB, including diagnosis and management and for supporting research activities. Additionally, the TB laboratory network can provide valuable operational information that can be used to measure the impact of the NTP, identify potential areas for improvement and establish treatment policy.

D. Joint Program Review of National Tuberculosis Control Program

The National TB Program invited the World Health Organization and major partners to conduct a Joint Program Review (JPR) in 2006. A team of international experts, assisted by staff from the NTP and partner agencies, conducted the JPR. One of the priority areas reviewed was the TB laboratory network. Members of the team reviewed the laboratory network from the health center level to the National Reference Laboratory (NRL) in Phnom Penh. The JPR report identified a number of laboratory achievements and issues and provided a series of recommendations.

Laboratory Achievements observed by the JPR

Impressive progress in the implementation and decentralization of laboratory services has been achieved. Decentralization of slide preparation to the health center level has contributed to increasing access to diagnostic services. There has also been great progress in the implementation of quality assurance programs. Primary culture for *Mycobacterium tuberculosis* is now available in three laboratories.

Issues identified by the JPR

The overall performance of the laboratory network remains insufficient. It was estimated from a compilation of the 2005 EQA results that over 15% of negative test results given back to care providers are false negatives. Readings of control slides (taken during follow-up of treatment to assess conversion rates at 2 months and cure rates at the end of treatment) are too often negative, an issue unlikely to be detected by the lot quality assurance sampling method used for EQA because samples contain mostly slides for diagnosis. Decentralization of EQA is not complete. There are occurrences of shortages of laboratory supplies (for example, stains, and alcohol and sputum cups) and inventories of materials remain incomplete.

Recommendations by the JPR

1. Performance should be improved though strengthened quality assurance implementation, development of comprehensive Standard Operating Procedures (SOP), and immediate follow-up to problems.

2. Fluorescence microscopy should be given consideration, to improve the sensitivity of diagnosis in the context of HIV.

3. Regular inventories should be conducted, and laboratory procurement and distribution should be strengthened and should include a buffer stock policy.

4. The quality of readings of control slides (month 2 and month 6) should be assessed separately from standard EQA.

E. The National Strategic Plan for Tuberculosis Laboratories of the National Tuberculosis Control Program in Cambodia

This National Strategic Plan for TB Laboratories in Cambodia 2007-2010 has been developed in response to a main objective in the National Health Strategic Plan for Tuberculosis Control in the Kingdom of Cambodia 2006-2010, specifically "to develop a 5-year strategic plan for strengthening the National TB Reference Laboratory (NRL) and all the other TB laboratories in the NTP network". Additionally, the plan states, "as quality improvement is one of the main components of the strategic activities in this five-year plan, TB laboratory strengthening will be on the agenda not only for quality enhancement but also, for some new specific activities such as diagnosis and management of MDR-TB and TB-HIV cases, as well as research work."

A core working group was jointly set up by CENAT and key partners on 14th September 2006 to assist in the development of the national strategic plan for TB laboratories (Annex-2). In addition, a consultative workshop was conducted in November 2006, to identify the essential components and provide the framework for developing the proposed plan (Annex-3).

Output 2: Capacity building & Human Resources Development

A. Main Strategies

- Enhance the institutional capacity by strengthening of the management structure at all TB laboratories.
- Build staff capacity according to identified needs through a continuing education program.
- Address human resources management and motivation of staff by exploring options of providing incentives through such scheme as performance-based incentive.

B. Main Activities

- To assess institutional capacity of TB laboratories in all TB units in order to obtain information for formulating actions for capacity building.
- To develop a database of laboratory technicians in order to assess the number of qualified staff for smear microscopy & culture
- To conduct training for new laboratory staff related to the staff turnover
- To conduct refreshment training for laboratory staff
- To conduct workshop for assessors and cross-checkers
- To organize "on-the-job" training (mentorship) for technicians at poor-performing TB laboratories involving CENAT and Provincial TB laboratory supervisors.
- To strengthen the quality of sputum smears at health center level through additional training on the technique of sputum collection and smear-making including transportation of smears.
- To expand culture capability to at least two additional TB labs through the training of selected TB laboratory staff in culture.
- To develop a performance evaluation system linked to a performance-based incentive scheme.
- To seek support for the provision of monetary and non-monetary incentives to lab staff.
- To organize study tours within the region and encourage participation at international meetings/TB conferences, e.g. IUATLD.
- To arrange overseas training in TB microscopy, culture and DST, and lab management.

Output 3: Infrastructure, logistics and laboratory supplies

A. Main Strategies

- Address the overall needs of the TB laboratories as an integral part of general laboratories within the MPA and CPA activity packages.
- Monitor the consumption of TB laboratory materials and consumables, quantify future requirement and provide information about anticipated requirements and estimated budget.
- Ensure timely and adequate supply of TB laboratory materials and consumables.
- Enforce quality assurance for laboratory equipment, supplies and reagents.
- Invest in physical infrastructure for the delivery of appropriate TB laboratory services, which include the construction or renovation of TB laboratories encompassing culture facilities.
- Improve the communication between the microscopy centers and the health facilities providing DOTS.

B. Main Activities

- To ensure that activities for strengthening the TB laboratory network will be in line with integrated approach for the development of general laboratories within the MPA and CPA activity packages.
- To closely monitor the situation of TB laboratory supply consumption at national, operational district and health facility levels.
- To develop an annual requirement plan and estimated budget for laboratory equipment (microscopes, centrifuges, safety cabinets, etc), staining reagents, other consumables (slides, sputum cups) and culture media.
- To coordinate with the Central MoH Department concerned and the CMS to ensure a timely provision of lab supplies and reagents and sufficient buffer stock, at least 9 months at CMS and 3 months at OD levels; and to closely monitor expiry dates of laboratory reagents.
- To conduct annual WS for lab technicians to provide guidance for maintenance of microscopes (based on the SOP for yearly inspection and cleaning of microscopes) and other equipment.

- To coordinate with the Central MoH department concerned and procurement agencies to ensure the quality of staining reagents (manufacturers to provide Certificate of Quality for each batch of reagents).
- To mobilize financial resources both local and external to ensure availability of laboratory supplies and reagents without interruption for the whole period of the plan and certain years beyond.
- To carry out an annual inventory of laboratory facilities and equipment.
- To seek support for strengthening infrastructure for the delivery of appropriate TB laboratory services, which include the construction or renovation of TB laboratories encompassing culture and DST facilities.
- To expand culture capabilities to at least two additional TB laboratories in two provinces with financial and technical support from partners.
- To mobilize resources to provide support for improving communication between health centers and microscopy centers, which include the provision of pre-paid phone cards to microscopy centers to expedite the feedback to health centers particularly for smear results.

Output 4: Service provision

A. Main Strategies

- Promote "free of charge" laboratory services for the diagnosis and follow up of TB at all government health facilities at all levels.
- Provide resources for the transportation of sputum samples and/or smear slides from health centers to microscopy centers.
- Maintain the functioning of the existing microscopy centers.
- Expand the laboratory network with other public and private laboratories in the health sector as part of Private Public Mix DOTS (PPM-DOTS) strategy.
- Address the priority issues such as the diagnosis and management of MDR-TB, TB/HIV, smear negative and extrapulmonary TB and TB in children.
- Introduce as appropriate new diagnostic tools for the diagnosis of TB recommended by WHO.

B. Main Activities

- To widely disseminate information on "free of charge" lab services for TB diagnosis, especially sputum examination, through NTP workshops, community meetings, issue of "*prakas**" by the MoH and subsidization of services.

- To provide financial support to ensure a smooth package of services between health centers and microscopy centers related to smear-making, transportation of slides.

- To ensure that existing microscopic centers receive sufficient resources for their functioning, which include basic logistics supplies, budgetary support and appropriate human resources.

- To implement the recommendations of the Joint Program Review related to the time taken to deliver specimens from health centers to microscopy centers and average time taken to report results.

- To train staff of TB laboratories at other government institutions such as the military and police hospitals and private health facilities (PPM-DOTS) and monitor the quality of services.

- To improve methods for diagnosis of smear negative TB and extrapulmonary TB, including those in TB/HIV setting, and TB in children, which includes of tuberculin test and other diagnosis means.

- To strengthen the referral mechanism to culture/DST centers for diagnosis of MDR-TB and other forms of TB.

- To seek support to introduce new diagnostic tools for the diagnosis of TB recommended by WHO through collaboration with partners.

Output 5: Monitoring, Evaluation, and EQA

A. Main Strategies

- Review and revise the monitoring and evaluation system of the TB lab network based on the recommendations of the Joint Program Review.
- Decentralize supervision and mobilize resources to strengthen periodic supervision to TB laboratories from central, provincial and district levels.
- Decentralize EQA (to provincial levels) and conduct on quarterly basis
- Promote partnership with Supra-National Laboratory (RIT, Tokyo) to assist in such areas as EQA and research .
- Promote the use of the WHO TB laboratory assessment tool

B. Main Activities

- To review and revise the monitoring and evaluation system of the TB lab network based on the recommendations of the Joint Program Review and in line with the revised M&E framework of NTP.
- To revise supervision checklist as necessary.
- To implement a cost-effective supervision plan that includes feedback to peripheral facilities, monitoring of follow up actions and linking of supervisory visits to results of slide rechecking.
- To decentralize EQA to provincial levels and conduct on quarterly basis.
- To perform QA on follow up smears separately from initial screening smears
- To provide rapid feedback to sputum collection sites and microscopy units on slide preparation and quality of smears
- To work with the supra-national laboratory to get assistance for EQA, DST and research activities etc.
- To translate, disseminate and implement the use of the WHO TB laboratory assessment tool
- To review laboratory safety conditions including infection control practices, ventilation, waste disposal, routine disinfection and condition of laboratory equipment

Output 6: Research

A. Main Strategies

- To support important NTP surveys and studies such as national TB prevalence and MDR surveys.
- Initiate, stimulate and participate in operational research related to TB diagnosis and case-management to contribute to the optimization of the NTP policies and guidelines.
- Study the feasibility of introducing modern technology, including those adapted to resource-constrained settings, to diagnose TB in selected facilities.
- Study the laboratory practices in the private sector for TB diagnosis and the quality of private practitioners.

B. Main Activities

- To serve as a core TB laboratory for important NTP surveys and studies such as national TB prevalence and MDR surveys.
- To conduct operational research to determine the reasons for low positive smears at two-month follow-up and to evaluate yield of two vs three sputum specimens in diagnosing TB
- To evaluate the use of fluorescence microscopy especially for the diagnosis of TB in high HIV settings.
- To evaluate the use of molecular diagnostic techniques for the diagnosis of TB and detection of drug sensitivity.
- To conduct a study on private laboratories and clinics to observe the practices in TB diagnosis and the quality of private practitioners.

Output 7: Partnership and Advocacy

A. Main Strategies

- Establish a TB laboratory technical working group (under the ICC or the Sub-TWG for TB) to include national and international partners.
- Explore possibility of developing MOU & TOR with institutions/partners (including SNRL-RIT).
- Collaborate with universities and research institutes abroad to share experiences and organize studies relevant to NTP goals
- Promote advocacy activities to keep TB laboratories as a high priority for NTP, especially for resource mobilization.

B. Main Activities

- To conduct monthly meetings of TB laboratory technical working group to review progress and tackle issues.
- To strengthen or establish ties with institutions such as the Sihanouk Hospital Center of Hope or academic institution to strengthen the capacity to diagnose extrapulmonary TB in tissue specimens.
- To establish a mechanism to work with private laboratories involved in the diagnosis of TB to improve capabilities and reliability of those labs.
- To establish ties with NIPH to utilize the unique strengths of each institution in supervision, training, QA or molecular diagnostics.
- To network with other laboratories performing culture and DST.
- To participate in joint research activities with other institutions
- Collaborate with universities and research institutes abroad to share experiences and organize studies relevant to NTP goals
- To design and carry out advocacy action plan, which includes campaign and other activities to mobilize resources for TB labs.

Output 8: Financing

A. Main Strategies

- Develop strategies to mobilize resources for strengthening the TB laboratory network.
- Develop a detailed annual workplan with estimated budget to secure funding.

B. Main Activities

- To enlist technical assistance from partners to develop proposals to mobilize resources for the TB laboratories.
- To promote activities related to resource mobilization for TB lab based on the identified strategies.
- To organize an annual workshop to develop an annual workplan for the TB laboratory network with clearly defined activities, indicators, budget and responsibilities.

IV. Resource Needs and Gaps

The National Strategic Plan of the NTP for the next five years (2006-2010) is focused on the continuing process of decentralization, through the expansion of community DOTS and also, through the scaling up of TB/HIV collaborative activities and PPM-DOTS, while making extensive efforts to enhance the quality of services, both clinical and diagnostic, at all health facilities. The accelerated DOTS expansion program launched during the first 5-year plan resulted in a four-fold increase in the number of TB suspects, from 29,000 in 2001 to 117,000 in 2005 while the number of smear positive TB cases increased from 14,000 to 21,000, an increase of 46% (Figure 1).

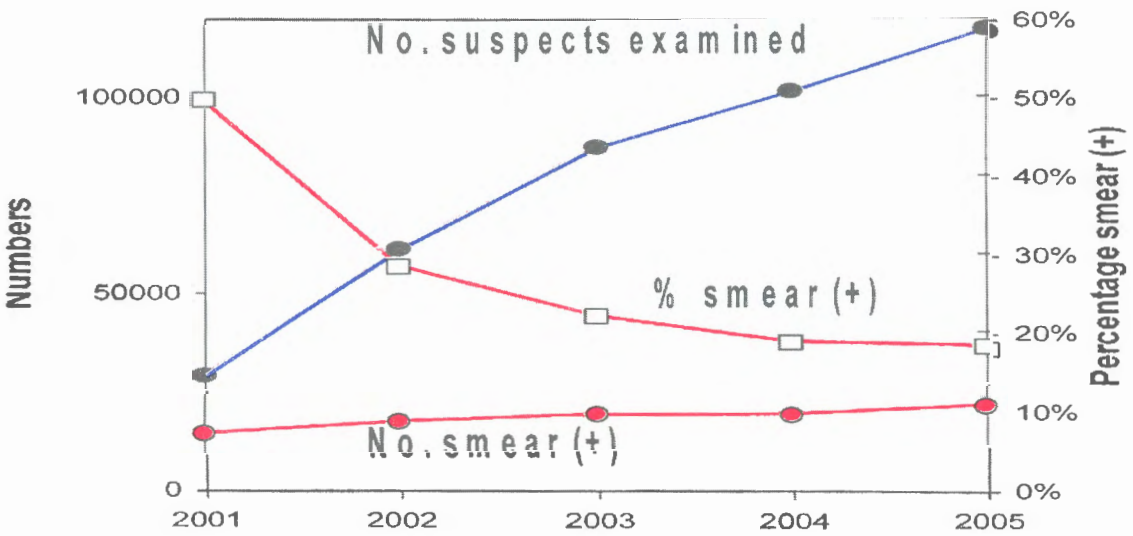


Figure 1: The no. of suspects and the no. and percent of smear positive cases

The Joint TB Program Review assessed the resource needs and the funding gap of the NTP for the next five years based on the financial data provided by the CENAT and taking into account the indirect costs related to the use of the existing MoH infrastructure and the contributions from donors.

The total amount of external funding to the NTP increased from USD 1.7 million in 2001 to USD 4.3 million in 2005. However, the proportion of funding from the MoH was stable during the same period. It is expected that from 2007, MoH funding for TB control will change substantially. The second five year National Strategic Plan for TB Control 2006-2010 estimates a total budget requirement of USD 36 million, showing a modest increase from USD 6.3 million in 2006 to USD 7.1 million in 2010, which is less than a 2% annual increase (Figure 2)

The Joint TB Program Review noted that there was an underestimation of the future financial requirements in the NTP budget for 2006-2010 and that the anticipated >2% increase per year might not be sufficient to handle the increase in TB cases projected in the coming years and the impact of scaling up TB/HIV collaborative activities and other emerging priority areas such as MDR-TB. Currently, the direct costs per case are USD 217 (excluding food support from WFP and indirect costs).

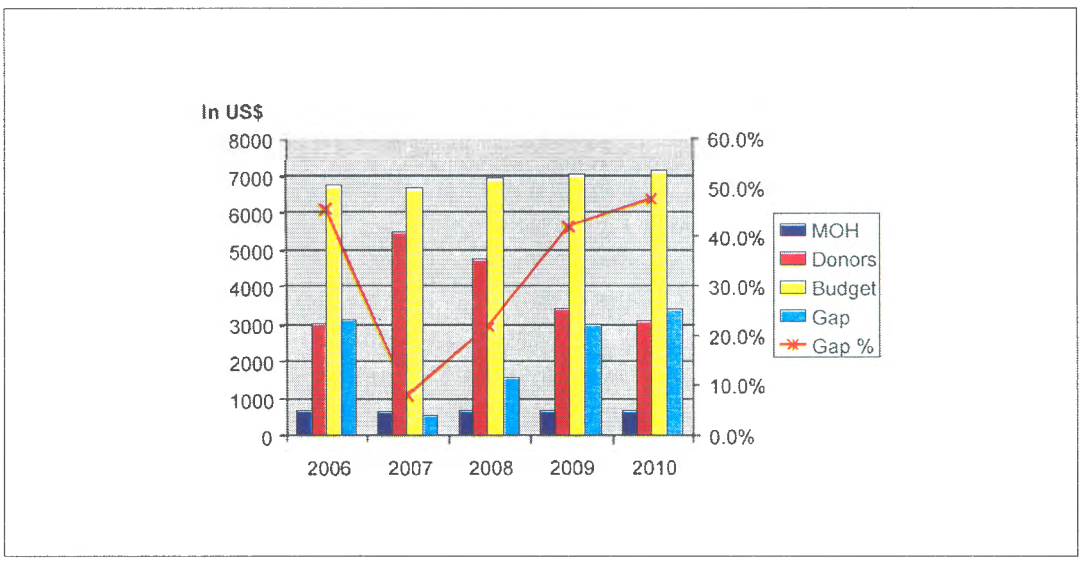


Figure 2: Budget and expected funding 2006-2010

In recent years, contributions to NTP from some of the previous donors have either reduced or ceased and the NTP is increasingly dependent on the Global Funds. It was recommended by the Joint TB Program Review that the NTP should broaden its funding base as there would be a substantial funding gap after 2007.

Additional resources are required to strengthen the National Reference Laboratory at CENAT and the laboratory network in the country to establish quality diagnostic services to address the emerging priorities such as the diagnosis of extrapulmonary and smear-negative TB, childhood tuberculosis and MDR-TB.

There has been an increase in the proportions of extrapulmonary and smear-negative TB (Figure 3). This could be related to progress in the capacity to diagnose smear-negative forms, including increased utilization of chest x-ray facilities. Training on TB-HIV is expanding, and could have a further impact on the capacity to diagnose smear-negative pulmonary TB. The proportion of smear-negative pulmonary TB cases seems to be higher in provinces with higher HIV prevalence in TB cases (Joint Program Review-NTP Cambodia, 2006).

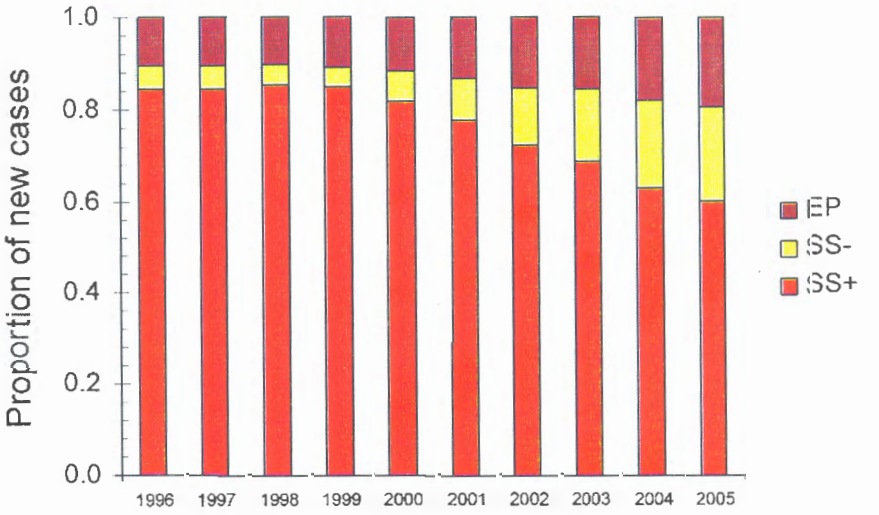


Figure 3: Increase in the proportion of extra-pulmonary and smear negative TB cases

CENAT would estimate the specific needs of the National TB Reference Laboratory and the TB microscopy network and develop a budget plan for the next five years, in line with the National Strategic Plan of the NTP (2006-2010). This would take into consideration the resources required for the implementation of the NSP for strengthening the TB laboratory network and enhancing the TB diagnostic services to improve the diagnosis and management of extra-pulmonary and smear negative TB as well as MDR-TB.

Strategies would be developed to mobilize resources and assess the absorptive capacity of the NTP, in general and the laboratory network, in particular. A detailed annual plan of action covering the first two years with budget estimation is essential for the purpose of proposal development and resource mobilization.

V. Risk Assessment

The Strategic Plan to Stop TB in the Western Pacific Region (2006-2010) has identified a number of risk factors that are most relevant to the high TB burden countries in the region.

1. Decentralization of TB control activities to lower levels.
2. Loss or decline in commitment to TB control.
3. Social and economic conditions.
4. Shifting TB control responsibilities outside the public sector.
5. Reduced funding levels.

Most of the above-mentioned factors are relevant at different levels in Cambodia though the magnitude may vary in comparison to other countries in the region. The NTP in Cambodia has already embarked on the concept of a "close to client" (CTC) system involving various strategies for delivering health interventions (e.g. DOTS) through health centers, health posts and community outreach services (Community DOTS and PPM-DOTS) which are generally not technically exacting.

However, they require sustainable national leadership, political commitment, increased organizational and supervisory capacity at all levels, greater transparency and accountability, all backed by more funding. This remains a daunting challenge for lower income countries that require massive additional funds to scale up health interventions to reach the poorest of the poor.

The National Strategic Plan for TB Control in Cambodia also highlights a number of concerns, one of which is the assistance and commitment from government and partners for supporting the implementation of the plan in which this laboratory strategic plan is an integral part.

VI. References

MoH/CENAT. *National Health Strategic Plan for Tuberculosis Control in the Kingdom of Cambodia, 2006-2010.* National Center for Tuberculosis and Leprosy (CENAT), May 2006.

WHO. *Improving the diagnosis and treatment of smear-negative pulmonary and extrapulmonary tuberculosis among adults and adolescents. Recommendations for HIV-prevalent and resource-constrained settings.* Geneva, World Health Organization, 2007.

WHO. *Strategic Approach for the strengthening of laboratory services for tuberculosis control.* Geneva, World Health Organization, 2006.

TBCTA. *International Standards for Tuberculosis Care.* Tuberculosis Coalition for Technical Assistance (TBCTA), 2006

WHO. *Strategic Plan to Stop TB in the Western Pacific 2006-2010.* World Health Organization, Western Pacific Region, 2006.

MoH/CENAT. *Joint Programme Review: National Tuberculosis Programme-Cambodia.* Ministry of Health, National Center for Tuberculosis and Leprosy (CENAT), 2006

HSS/URC. *Rapid Assessment of Private Laboratories in Four Provinces.* Report. USAID, Centre of Hope, CENAT and URC, December 2004

HSS/URC. *Review of Laws, Policies and Clinical Practices of the Private Medical and Pharmaceutical Sector for Tuberculosis Control.* USAID, Centre of Hope, CENAT and URC, November 2004

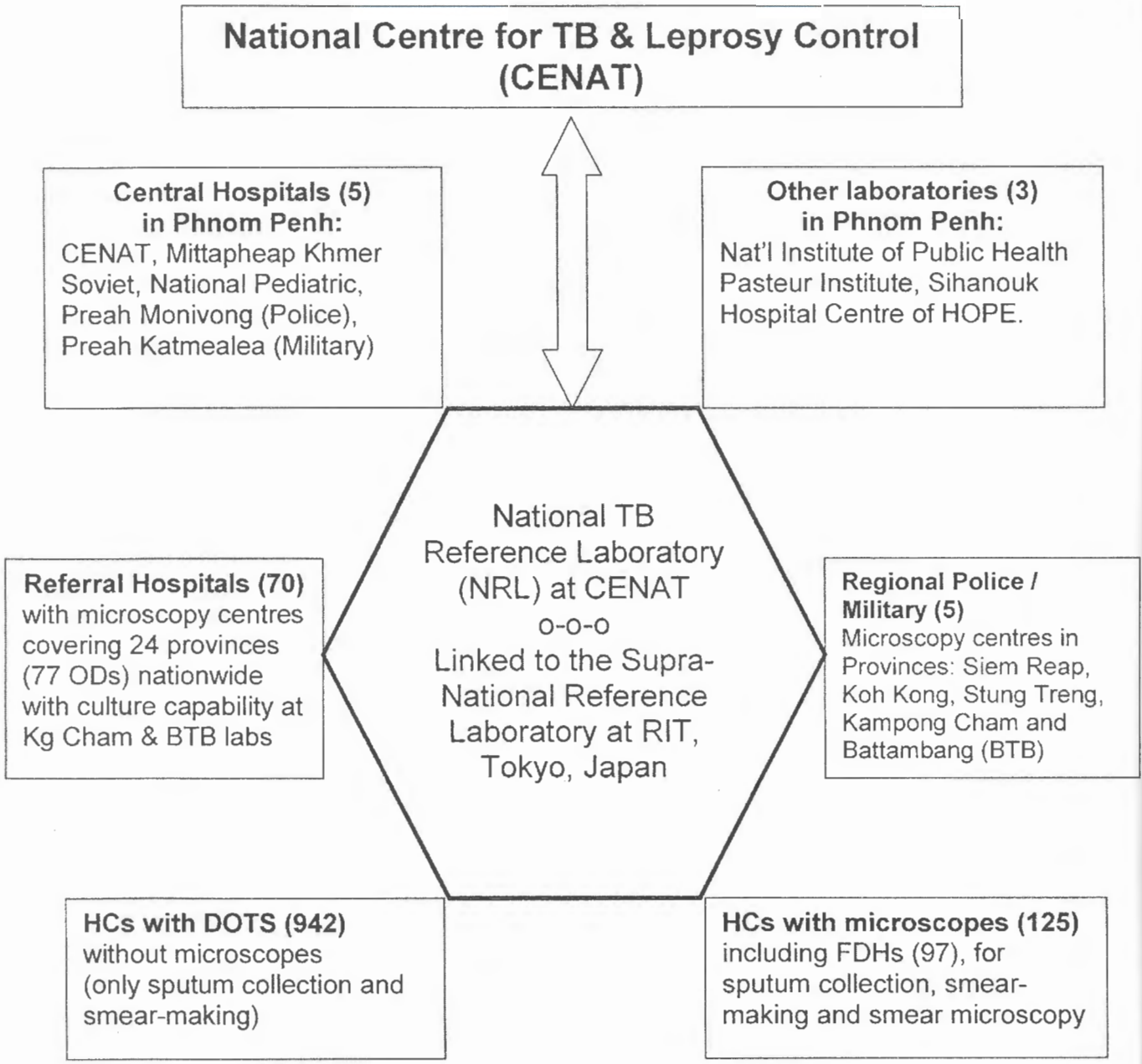
URC. An Assessment of the Private Sector Services for Tuberculosis: Cambodia. Technical Report. CENAT, URC/QAP, USAID, June 2004

WHO. *Macroeconomics and Health: Investing in Health for Economic Development. Report of the Commission on Macroeconomics and Health.* Geneva, World Health Organization, 2001

VII. Annexes

Annex-1

TB Microscopy Network in Cambodia



Total Number of TB Microscopy Centres in Cambodia = 200 (June 2007)

Annex-2

Members of the Working Group to develop the NSP for the TB Lab

#	Name	Organization	Position
1	Dr Mao Tan Eang	CENAT	Director
2	Dr Team Bak Khim	CENAT	Deputy Director
3	Dr Keo Sokonth	CENAT	Chief, Technical Bureau
4	Ph. Ton Chhavivan	CENAT	Chief, NRL, CENAT
5	Dr Kong Bun Navy	URC	TB Project Manager
6	Dr Delphine Sculier	Centre of Hope/ITM	Technical Advisor
7	Dr Chak Chantha	USAID	Team Leader (Inf.Diseases)
8	Dr Tatsuo Sugiyama	JICA	Senior Advisor
9	Dr Jim McLaughlin	US-CDC	Microbiology Lab Advisor
10	Dr Pratap Jayavanth	WHO	MO/Stop TB
11	Dr Borann Sar	Pasteur	Director, TB Laboratory
12	Ph Chuop Sokheng	NIPH	Deputy Director, NLPH
13	Dr Chawalit Natpratan	FHI	Country Director
14	Dr Bart Janssens	MSF-B	Medical Coordinator

Annex-3

Participants at the Consultative Workshop for TB Lab Strengthening

Dates: November 27-28, 2006 Venue: CENAT, Phnom Penh

Facilitator: Michael Calabria (M&E Advisor, US-CDC)

	Name of Participants	Organization / Institute	Position
1	Dr Mao Tan Eang	CENAT	Director
2	Dr Team Bak Khim	CENAT	Deputy Director
3	Dr Uong Mardy	CENAT	Deputy Director
4	Dr Keo Sokonth	CENAT	Chief, Technical Bureau
5	Dr Tieng Sivanna	CENAT	Deputy Chief, Technical Bureau
6	Dr Khun Kim Eam	CENAT	Chief, Statistics/Planning, etc
7	Ph. Ton Chhavivan	CENAT	Chief, NRL, CENAT
8	Dr Khloeung Phally	CENAT	Technical Officer, CENAT
9	Dr In Sokhanya	CENAT	Technical Officer, CENAT
10	Dr Pheng Sok Heng	CENAT	Technical Officer, NRL, CENAT
11	Mr Yang Sam Ol	CENAT	Technician, NRL, CENAT
12	Mr Ouch Vannorin	CENAT	Technician, NRL, CENAT
13	Mr Siem Sokh Aun	CENAT	Technician, NRL, CENAT
14	Ms Sam Sopheap	MoH	Chief, Laboratory Services
15	Ph. Chuop Sokheng	NIPH	Deputy Chief, NIPH Lab
16	Mr Chey Vichet Mony	PHD, Kg Cham	Provincial TB Lab Supervisor
17	Ms Ros Phoran	RH, Kg Cham	Technician, TB Laboratory
18	Ph. Huot Uong	PHD, Battambang	Provincial TB Lab Supervisor
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20	Mr Phan Vuth	PHD, Kandal	Provincial TB Lab Supervisor
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