

PRESIDENT'S MALARIA INITIATIVE

Malaria Operational Plan — FY2011

Greater Mekong Sub-Region

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ABBREVIATIONS

3DF	Three Diseases Fund
ACT	artemisinin-based combination therapy
AL	artemether-lumefantrine
AMFm	Affordable Medicine Facility for malaria
ANC	antenatal clinic
API	annual parasite incidence
BCC	behavior change communication
BMGF	Bill and Melinda Gates Foundation
BVBD	Bureau of Vector-borne Diseases, Thailand
CDC	U.S. Centers for Disease Control and Prevention
China CDC	Chinese Centre for Disease Control and Prevention
CMPE	Centre for Malaria, Parasitology, and Entomology, Lao People's Democratic Republic
CNM	National Centre for Parasitology, Entomology, and Malaria, Cambodia
DfID	UK Department for International Development
DHA-Pip	dihydroartemisinin and piperazine
Global Fund	Global Fund to Fight AIDS, Tuberculosis, and Malaria
GMS	Greater Mekong Sub-Region
GMS-RID	Greater Mekong Sub-Region Responses to Infectious Diseases Project
HPLC	High performance liquid chromatography
IEC	information, education, communication
IMCI	integrated management of childhood illnesses
INGO	International non-governmental organization
IPTp	intermittent preventive treatment for pregnant women
IRS	indoor residual spraying
ITN	insecticide-treated net
JICA	Japan International Cooperation Agency
LLIN	long-lasting insecticide-treated net
MC	Malaria Consortium
M&E	Monitoring and evaluation
MICS	Multiple Indicator Cluster Survey
MIS	Malaria Indicator Survey
MOH	Ministry of Health
MOPH	Ministry of Public Health (of Thailand)
MMP	Mekong Malaria Programme
MRA	Medicine regulatory agency
MSH	Management Sciences for Health
NGO	non-governmental organization
NIMPE	National Institute for Malariology, Parasitology, and Entomology, Vietnam
NIPD	National Institute of Parasitic Diseases of the Chinese CDC
NMCP	National Malaria Control Program
OR	Operations research
PMI	President's Malaria Initiative
PPM	Public private mix
PSI	Population Services International
RBM	Roll Back Malaria

RDMA	Regional Development Mission Asia
RDS	Respondent-driven sampling
RDT	rapid diagnostic test
RFA	request for application
SEARO	Southeast Asia Regional Office
THD	Township Health Department (Burma)
UNICEF	United Nations Children's Fund
URC	University Research Corporation
USAID	United States Agency for International Development
USG	United States Government
USP	United States Pharmacopeia
VBDC	Vector-borne Disease Control Program, Burma
VMW	Village Malaria Worker
WPRO	Western Pacific Regional Office
WHO	World Health Organization

EXECUTIVE SUMMARY

Malaria prevention and control is a major foreign assistance objective of the U.S. Government (USG). In May 2009, President Barack Obama announced the Global Health Initiative (GHI), a six-year, comprehensive effort to reduce the burden of disease and promote healthy communities and families around the world. Through the GHI, the United States will invest \$63 billion over six years to help partner countries improve health outcomes, with a particular focus on improving the health of women, newborns, and children.

The President's Malaria Initiative (PMI) is a core component of the GHI, along with HIV/AIDS, and tuberculosis. The PMI was launched in June 2005 as a 5-year, \$1.2 billion initiative to rapidly scale up malaria prevention and treatment interventions and reduce malaria-related mortality by 50% in 15 high-burden countries in sub-Saharan Africa. With passage of the 2008 Lantos-Hyde Act, funding for PMI has now been extended through FY2014. Programming of PMI activities follow the core principles of GHI: encouraging country ownership and investing in country-led plans and health systems; increasing impact and efficiency through strategic coordination and programmatic integration; strengthening and leveraging key partnerships, multilateral organizations, and private contributions; implementing a woman- and girl-centered approach; improving monitoring and evaluation; and promoting research and innovation.

In line with the 2009 Lantos-Hyde Malaria Strategy, PMI support has now been extended to the Greater Mekong Sub-Region (GMS), which is made up of six countries: Burma, Cambodia, China (Yunnan Province), Lao People's Democratic Republic, Thailand, and Vietnam. Although considerable progress has been made in malaria control in the GMS during the past 10 years, malaria remains a major concern for the international community and ministries of health in the region. This is due primarily to the development and possible spread of resistance to artemisinin drugs, the principal component of the combination therapies for malaria that now are the first-line treatment for malaria throughout the GMS and the world. *Plasmodium falciparum* resistance to artemisinin drugs has now been confirmed in western Cambodia; failures in artemisinin combination therapy (ACT) have been reported from multiple sites on the Thai-Cambodian border; and an early warning sign of artemisinin resistance - prolongation of parasite clearance times - has been reported from the Thailand-Burma border and in southern Vietnam.

The USG has supported malaria control efforts in the GMS since 2000. These regional efforts have focused on antimalarial drug resistance and drug quality surveillance. Burma and Cambodia received Round 9 Global Fund malaria grants and Thailand recently learned that its Round 10 malaria grant was approved. The other major source of funding for malaria control in Cambodia and Thailand is a Bill and Melinda Gates Foundation artemisinin resistance containment project.

The FY2011 PMI Malaria Operational Plan for the GMS was based on progress and experiences during the last five years and was developed during a planning visit carried out in December 2010 by representatives from USAID, the Centers for Disease Control and Prevention (CDC), and the national malaria control programs of the region, with the participation of other major partners working on malaria in the area. Because this is the first "regional" program under PMI, the FY2011 Malaria Operational Plan includes support to both regional/cross-cutting activities, such as surveillance for antimalarial drug resistance and antimalarial drug quality monitoring, and community intervention activities with a country-specific focus. Given the threat of

artemisinin resistance and the burden of malaria in countries making up the GMS, the focus of the community intervention activities is on the border areas of Burma-Thailand and Thailand-Cambodia. These cross-border focus areas will be centered on the Kawthoung-Ranong border areas of Burma and Thailand and the Trat-Pailin border areas of Thailand and Cambodia. The proposed FY2011 PMI activities are in line with the National Malaria Control Strategies of the six countries and are intended to complement ongoing Global Fund malaria grants and contributions from other donors.

Vector control: Malaria transmission in the GMS is closely associated with two malaria vectors that inhabit the forest and forest fringe, *Anopheles dirus* and *An. minimus*. Insecticide resistance is not a major problem for these two vectors, and most studies suggest that insecticide-treated nets (ITNs) can provide at least some protection. Bed net ownership appears to be quite high, especially in Burma and Cambodia when compared to Thailand, but most of those nets are untreated. Considerable numbers of long-lasting ITNs targeted for townships along the borders between Burma and Thailand and Thailand and Cambodia are included in the Global Fund Round 9 and Round 10 grants.

With FY2011 funding, PMI will procure about 150,000 LLINs to fill gaps in Global Fund grants in the cross-border focus areas of Kawthoung-Ranong and Trat-Pailin, as well as provide technical assistance for ITN strategy development and monitoring and evaluation of net coverage in the public and private sectors. PMI will also provide support to entomological services in the region, in response to the changing vector ecology and the challenge of outdoor transmission. Indoor residual spraying (IRS) is mostly limited to outbreak response and is not a key activity in national malaria control strategies for any of the GMS countries. Therefore, no PMI funds will be targeted for IRS in the sub-region.

Intermittent preventive treatment of malaria in pregnancy (IPTp): Because of the low levels of malaria transmission in the GMS, IPTp is not national policy for any country in the sub-region. PMI will encourage a review of country malaria in pregnancy policies and approaches to better understand issues and explore options in the future.

Case management: In all countries making up the GMS, diagnosis of malaria is based on laboratory tests with microscopy (which is preferred), or rapid diagnostic tests (RDTs). Although all countries in the sub-region recommend artemisinin-based combination therapy as the first-line treatment of *P. falciparum* infections, artemisinin resistance has been confirmed on the Thai-Cambodian border and early evidence of developing resistance has been reported from several other sites in the sub-region. Case management of malaria in the GMS is further complicated by the fact that *P. vivax* and *P. falciparum* are both relatively common. Chloroquine is the drug of choice for the treatment of *P. vivax* infections, although reports of resistance are emerging from the sub-region. Another problem in the sub-region is the widespread availability of counterfeit and substandard antimalarial drugs, especially artemisinin drugs. With USG support, considerable progress has been made in recent years in establishing effective drug quality monitoring in the sub-region, but engagement with Burma and China have been limited to date.

Most of the RDT needs and essentially all needs for ACTs in Burma, Cambodia, and Thailand are being met by those countries' Global Fund grants. With FY2011 funding, PMI will procure RDTs, microscopes, and microscopy supplies to fill gaps and strengthen laboratory capacity in

the cross-border focus areas of Kawthoung-Ranong and Trat-Pailin. Because of concerns about the quality of microscopic diagnosis of malaria in these border areas, PMI will support in-service training for microscopists and quality assurance of the parasitological diagnosis of malaria with a focus on those areas. In addition, PMI will continue support to national pharmaceutical reference laboratories to ensure they have the capacity to carry out pre- and post-marketing surveillance of drug quality.

Strategic Information: Monitoring and evaluation (M&E), Surveillance and Operational Research: The quality of malaria case detection and reporting systems vary widely within the GMS. If countries making up the GMS are to further reduce malaria transmission, contain the spread of artemisinin resistance, and move towards elimination, their malaria surveillance systems must be strengthened. USG funding for M&E during the past several years has focused on building a regional malaria M&E framework.

With FY2011 funding, PMI will help countries develop national malaria M&E plans and build M&E capacity within their national malaria control programs. PMI will support collection of baseline survey data and strengthening collection of routine surveillance data in the cross-border focus areas of Kawthoung-Ranong and Trat-Pailin. PMI will also continue USG support to antimalarial drug resistance monitoring in all six countries making up the GMS as well as capacity building of national malaria control programs for monitoring the molecular markers of antimalarial drug resistance. Operational research activities to be supported with FY2011 funding will include an assessment of a field-ready glucose-6-phosphate dehydrogenase deficiency test prior to primaquine administration for both *P. vivax* and *P. falciparum* infections.

The proposed FY2011 PMI budget for the GMS is \$12 million.

INTRODUCTION

Global Health Initiative

Malaria prevention and control is a major foreign assistance objective of the U.S. Government (USG). In May 2009, President Barack Obama announced the Global Health Initiative (GHI), a six-year, comprehensive effort to reduce the burden of disease and promote healthy communities and families around the world. Through the GHI, the United States will invest \$63 billion over six years to help partner countries improve health outcomes, with a particular focus on improving the health of women, newborns and children. The GHI is a global commitment to invest in healthy and productive lives, building upon and expanding the USG's successes in addressing specific diseases and issues.

The GHI aims to maximize the impact the United States achieves for every health dollar it invests, in a sustainable way. The GHI's business model is based on: implementing a woman- and girl-centered approach; increasing impact and efficiency through strategic coordination and programmatic integration; strengthening and leveraging key partnerships, multilateral organizations, and private contributions; encouraging country ownership and investing in country-led plans and health systems; improving metrics, monitoring and evaluation; and promoting research and innovation. The GHI will build on the USG's' accomplishments in global health, accelerating progress in health delivery and investing in a more lasting and shared approach through the strengthening of health systems.

President's Malaria Initiative

The President's Malaria Initiative (PMI) is a core component of the GHI, along with HIV/AIDS, and tuberculosis. The PMI was launched in June 2005 as a 5-year, \$1.2 billion initiative to rapidly scale up malaria prevention and treatment interventions and reduce malaria-related mortality by 50% in 15 high-burden countries in sub-Saharan Africa. With passage of the 2009 Lantos-Hyde Act, funding for PMI has now been extended through FY2014 and an updated USG Lantos-Hyde Malaria Strategy has been developed for the period 2009-2014. As part of the GHI, the goal of the PMI in sub-Saharan Africa has been adjusted to halve the burden in 70% of the at-risk population in the original 15 countries by the end of 2015. This will be achieved by continuing to scale up coverage of the most vulnerable groups — children under five years of age and pregnant women — with proven preventive and therapeutic interventions, including artemisinin-based combination therapies (ACTs), insecticide-treated nets (ITNs), intermittent preventive treatment of pregnant women (IPTp), and indoor residual spraying (IRS). In addition, PMI will work to limit the spread of antimalarial drug resistance in two USAID-supported regional programs, the Mekong Regional Initiative in six Southeast Asian countries and the Amazon Malaria Initiative in seven South American countries.

This FY2011 Malaria Operational Plan presents a detailed implementation plan for the Greater Mekong Sub-Region (GMS), comprising six countries: Burma, Cambodia, China (Yunnan Province), Lao People's Democratic Republic (PDR), Thailand, and Vietnam. It was developed in consultation with the Thailand and Cambodian National Malaria Control Programs and with the input of multiple national and international partners involved with malaria prevention and control in the sub-region. The activities that PMI is proposing to support with FY2011 funding contribute to the countries' national malaria control strategies and plans and build on malaria

investments made by the USG in the sub-region since 2000. FY2011 planning also took into account the successful Round 9 Global Fund to Fight AIDS, Tuberculosis, and Malaria (Global Fund) malaria grants to Burma and Cambodia and the recently approved Round 10 Thailand malaria proposal.

Because this is the first “regional” program within PMI, this FY2011 Malaria Operational Plan for the GMS includes support to both regional/cross-cutting activities, such as surveillance for antimalarial drug resistance, antimalarial drug quality monitoring, and regional capacity building as well as malaria control activities with a country-specific focus. The regional, cross-cutting activities will attempt to cover all six countries making up the GMS, depending on access and other sources of funding. In contrast, given the burden of malaria and the threat of artemisinin resistance in the GMS, the focus of the country-specific, community intervention activities will be centered on the Kawthoung-Ranong border areas of Burma and Thailand and the Trat-Pailin border areas of Thailand and Cambodia. These selected cross-border focus areas are the geographic areas in the GMS most concerning for artemisinin resistance. PMI will concentrate its commodity investments as well as additional M&E resources in the cross-border focus areas to ensure access to quality malaria prevention and curative services. Commodity support will aim to fill gaps in all cross-border focus areas, but the need is likely to be greatest in Burma. This document briefly reviews the current status of malaria control policies and interventions in the GMS, describes progress to date, identifies challenges and unmet needs if the targets of the National Malaria Control Programs (NMCP) and PMI are to be achieved, and provides a description of planned FY2011 activities.

NATIONAL HEALTH SYSTEMS IN THE GMS

The six countries in the GMS vary greatly in their economic, political and health service structures and investments. The six countries are comprised of both low and lower-middle income levels with gross national income (GNI) per capita ranging from 467 USD in Burma to 3,670 USD in Thailand. Their investment in health also ranges from seven USD per capita in Burma to 136 USD per capita in Thailand. The proportion of total health expenditures derived from private sources ranges from a low of 36% in Thailand to a high of 87% in Burma. Although, this proportion is likely to be lower for malaria-specific private expenditures as malaria treatments are provided free of charge in the public sector, the private sector plays a large role in providing malaria treatment, especially in Burma, Cambodia, and Lao PDR. The mortality rates for children under five years of age range from 14 deaths per 1,000 live births in Vietnam to a high of 98 deaths per 1,000 deaths in Burma.

Table 1. Government structure and key national statistics

	Burma	Cambodia	China	Lao PDR	Thailand	Vietnam
Population (in 1000s)	50,496	15,053	1,354,146; 40,091 (Yunnan)	6,436	68,139	89,029
GNI/capita	467*	640	2940	760	3,670	890
Income Level	Low	Low	Lower-middle	Low	Lower-middle	Lower-middle

Total health expenditure per capita (USD)	7	36	108	27	136	58
Private expenditure as a percentage of the total health expenditure† (%)	87	74	59	81	36	68
Mortality rate for children under five (deaths per 1,000 live births)	98	90	21	61	18	14

Source: www.theglobalfund.org; *GDP/capita from IMF 2010; †WHO, 2006 National Health Accounts Data: <http://www.who.int/nha/country/en/index.html>

NATIONAL MALARIA CONTROL PROGRAMS¹ AND THE MALARIA SITUATION

GMS

Malaria control in the GMS faces many challenges different from those in the African context. The sub-region is the epicenter of the world's most severe drug resistance with chloroquine resistance developing in the late 1950s, followed by resistance to sulfadoxine-pyrimethamine (SP), mefloquine, and decreased sensitivity to quinine. The emergence of artemisinin resistance on the Thai-Cambodia border, the same area where chloroquine resistance emerged 50 years ago is of great concern as artemisinin is the last remaining efficacious antimalarial drug for the GMS. Beyond drug resistance, the NMCPs face several challenges including an active private sector selling both effective and sub-standard or counterfeit medicines, migrant and mobile populations, vulnerable remote ethnic minorities, poor public health infrastructure, weak surveillance, monitoring and evaluation systems, civil strife, and occasional cross border conflicts.

While it is imperative that countries in the GMS work together on cross border issues and sharing of information, bringing the countries of the GMS together through the traditional mode of a World Health Organization (WHO) regional office is problematic because the sub-region is split into two separate WHO regions [Southeast Asia Regional Office (SEARO) and Western Pacific Regional Office (WPRO)]. Through the development of first Roll Back Malaria (RBM)-Mekong and later, Mekong Malaria Programme (MMP), United States Agency for International Development (USAID) has supported an innovative bi-regional approach to the sub-region. The MMP is coordinated by WHO staff based in Bangkok but reporting to both regional offices in New Delhi, India and Manila, Philippines. The MMP “aims to facilitate the implementation and monitoring of a comprehensive *MMP Malaria Strategy* endorsed by national authorities and stakeholders to address common Mekong challenges in order to further impact malaria morbidity and mortality.”²

The key malaria control strategies and policies of the countries comprising the GMS are listed in Table 2.³ All countries in the GMS now recommend ACTs for first-line treatment of *P. falciparum*.

¹ This section of the MOP heavily borrows from: Malaria in the Greater Mekong Subregion: Regional and Country Profiles. WHO 2010

² Strategic Plan to Strengthen Malaria Control and Elimination in the Greater Mekong Subregion: 2010–2014. A Mekong Malaria Programme Partnership Initiative Working Document, Dec 2009. WHO

³ Malaria in the Greater Mekong Subregion: Regional and Country Profiles. WHO 2010

Table 2. Key national strategies and policies in malaria control

	Burma	Cambodia	China	Lao PDR	Thailand	Vietnam
Treatment and Diagnosis Guideline	✓	✓		✓	✓	✓
First-line treatments for <i>P. falciparum</i>	AL; AS+M; DHA-Pip	AS+M being updated to DHA-Pip + PQ	DHA-Pip; AS+PYR; AS- AQ; ART+ Napthoquinone	AL	AS+M+PQ; Atv-Pro (Zone 1)	DHA-Pip
First-line treatments for <i>P. vivax</i>	CQ+PQ	CQ being updated to DHA-Pip + PQ	CQ+PQ	CQ	CQ+PQ	CQ+PQ
Published/updated in:	2008	2010		2005	2007	2003
Monitoring antimalarial drug resistance	✓	✓	✓	✓	✓	✓
Number of sites:	4	8	4	3	8	5
Community-based approaches	✓	✓	✓	✓	✓	✓
Vector control using limited IRS in targeted areas/settings	✓	✓	✓	✓	✓	✓
Vector control using ITN/LLIN	✓	✓	✓	✓	✓	✓
Monitoring insecticide resistance	✓	✓		✓	✓	✓
Number of sites:	1	4		10	2	>10
Epidemic preparedness	✓	✓	✓	✓	✓	✓
AL- artemether-lumefantrine; AS- artesunate; M- mefloquine; DHA- dihydroartemisinin; Pip- piperazine; CQ- chloroquine; PQ- primaquine; PYR- pyronaridine; AQ- amodiaquine; ART-artemisinin; Atv- Atovaquone; Pro- proguanil						

The malaria epidemiology and situation across the GMS is very complex and ranges from countries on track to elimination and countries that have yet to scale-up malaria control activities. Unlike most sub-Saharan African countries, the GMS must contend with multiple species with *Plasmodium vivax* more prevalent than *falciparum* in some countries, numerous vector species that are not typically endophilic, and most importantly, multi-drug resistance with confirmed artemisinin resistance at the Thai-Cambodian border.

Much of the malaria burden in the sub-region is concentrated along border areas and in forest or forest-fringe areas where the region's most efficient vector, *Anopheles dirus*, exists. Approximately three-quarters of the reported cases in the GMS occur in Burma. In 2009, the incidence of malaria ranged from 0.01 cases per 1,000 in China to 11.8 cases per 1,000 in Burma. Malaria mortality also ranged from <0.001 deaths per 100,000 in China to 1.9 deaths per 100,000 in Burma. These figures reported for 2009 in the 2010 World Malaria Report⁴ (WMR) for the sub-region likely under-estimate the true burden of malaria as it captures data only from the public sector.

Table 3. Malaria burden in the GMS

⁴ World Malaria Report 2010. World Health Organization

	Burma	Cambodia	China	Lao PDR	Thailand	Vietnam
Probable and confirmed malaria cases	591,492	83,777	14,491	22,800	31,771	49,186
Confirmed malaria cases	436,068	64,595	9,287	14,674	31,771	16,130
Deaths attributed to malaria	972	279	12	5	70	26
Of the confirmed cases, % due to Pf	75.2	73.3	10.3	96.8	41.1	79.9
Annual Parasite Incidence (per 1000)	11.8	5.7	0.01	3.6	0.5	0.6
Source: WMR 2010						

Over the past decade as a whole, the GMS countries have made tremendous progress in reducing the number of malaria cases and deaths. Between 1998 and 2007, the six countries have collectively noted a 60% reduction in the annual number of deaths attributed to malaria, and a 25% reduction in the number of confirmed cases, from 418,859 cases in 1998 to 316,078 cases in 2007.⁵ Multiple factors have contributed to the region's achievements in reducing the burden of malaria. Governments and partners made national malaria control a priority by increasing investments in malaria control, successfully garnering international funds, strengthening political will, integrating malaria control programs into national health systems, and intensifying cross-border collaboration. Environmental changes such as deforestation, economic development, demographic stabilization, greater political stability, and improved coverage of basic health services have also likely impacted malaria morbidity and mortality in the GMS.⁵

Burma

The national malaria control program is implemented by the Vector-Borne Disease Control (VBDC) Program within the Department of Health located in the Ministry of Health. The VBDC is charged with the responsibility at the central level to formulate plans and national policies, develop standards, provide training, conduct operational research (OR), and provide guidance to implementing partners. The VBDC is aided in this process by a Malaria Technical Advisory Group which has evolved into the Malaria Technical and Strategy Group. The Core Group of the Technical and Strategy Group comprises of VBDC, WHO, UNICEF and Japan International Cooperation Agency (JICA).

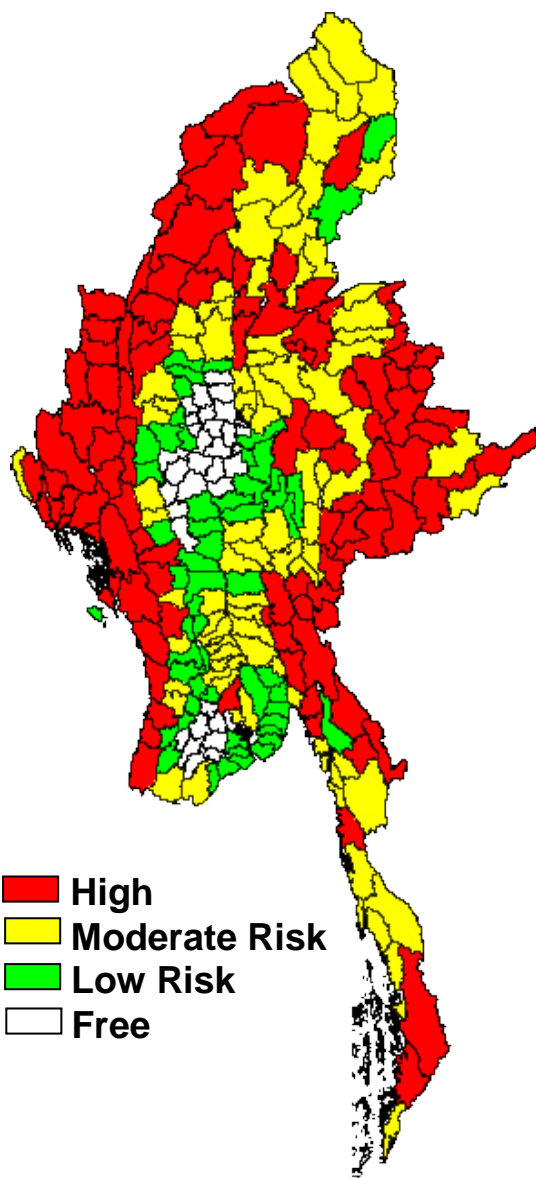
A key challenge faced by the malaria control program in Burma has been a lack of resources. Burma ranks among the lowest in the world in per capita health expenditures, thus while the program develops sound, comprehensive approaches to malaria control, it lacks adequate resources to implement those plans. Following the termination of the Global Fund Round 3 support, the Three Disease Fund (3DF) — a Multi-Donor Trust Fund consisting of European Commission, Department for International Development (DfID), Australia's Aid Programme, Norway, Netherlands, and Sweden — was established in August 2006. Its purpose was to support activities to reduce transmission and enhance provision of treatment and care for HIV & AIDS, TB and malaria for the most in need populations. The 3DF has contributed approximately \$4 million per year to malaria control over the past several years, allowing the program to successfully implement case management and prevention programs in limited areas. With the recent signing of the Global Fund Round 9 grant, VBDC will be able to expand access to parasitological diagnosis and treatment with an ACT.

⁵ Delacollette, C., et al., *Malaria trends and challenges in the Greater Mekong Subregion*. Southeast Asian J Trop Med Public Health, 2009. 40(4): p. 674-691

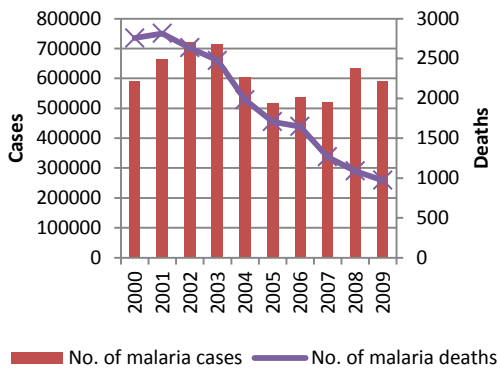
The additional resources will allow the program to continue to implement its policy of protecting at risk populations with ITN/LLINs. Their objective is to ensure that 80% of the population living in moderate to high risk areas is protected. The use of IRS was halted in the early 1990s; however, the program continues to advocate for its selected use in situations such as outbreaks or new development projects.

Among the six Mekong countries, the malaria burden is highest in Burma and remains a leading cause of morbidity and mortality. Burma has recently finalized their National Strategic Plan⁶ for 2010 – 2015 setting malaria control targets to achieve the Millennium Development Goals. Approximately 68% of the population is thought to be at risk for malaria with the high risk areas concentrated near international borders. Malaria occurs mostly in and near forested areas and disproportionately affects men age 15–54 years. Other major risk groups consist of migrant workers involved in seeking jungle products, logging, mining in the mountains and forests, as well as agriculture, plantations and construction in the forest-fringe areas. While the number of malaria deaths has decreased in the past decade, the total number of reported cases has remained steady. These numbers need to be interpreted with caution, however, as the number of cases confirmed with microscopy and especially rapid diagnostic tests (RDTs) has increased tremendously. Furthermore, these reports reflect only the public sector cases, estimated to be only 25 to 40% of the total burden. In 2009, with 591,492 reported outpatient and inpatient cases, the true burden was estimated to be over two million cases as only ~25% of cases seek care in the public sector. Areas of concern for artemisinin resistance have been identified within Burma through ongoing drug resistance monitoring. Kawthoung, which is located in Tanintharyi Division neighboring Ranong Province in Thailand, has noted both increased failure rates to ACTs and an increased proportion of patients with delayed parasite clearance (increased day 3 positive blood smears).

⁶ National Strategic Plan for Malaria Prevention and Control, Union of Myanmar, 2010-2015



**Burma Malaria Cases and Deaths
2000–2009**



Cambodia

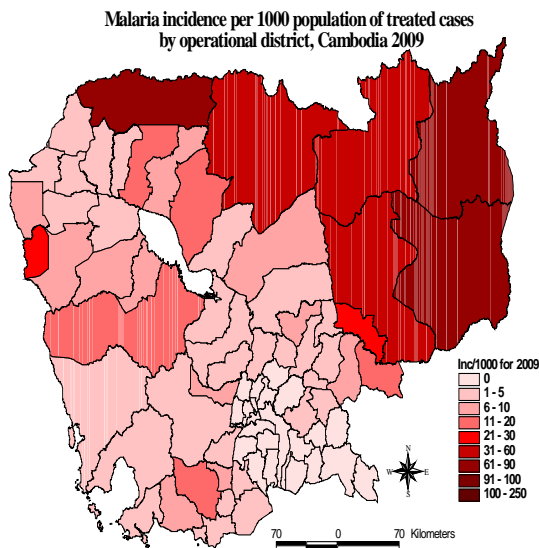
The National Centre for Parasitology, Entomology, and Malaria formally referred to by its French acronym CNM or the National Malaria Centre) sits within the Ministry of Health of the Royal Government of Cambodia. The leadership of malaria control activities within Cambodia rests at the central level; however, with decentralization, the Provincial Health Department and Operational District Malaria Supervisors are responsible for planning and implementing activities.

The national treatment policy in Cambodia is currently being updated. Dihydroartemisinin-piperaquine (DHA-Pip) combination will be the first-line therapy for both uncomplicated falciparum and vivax malaria. With the increases in resources associated with successful Global Fund grants, Cambodia has aggressively distributed ITNs and LLINs to at-risk populations. Overall, ITN ownership is still insufficient with 2007 coverage levels only reaching 43% in high risk areas,⁷ although the coverage in the areas of artemisinin resistance is much higher. In the areas of artemisinin resistance around Pailin, the Bill and Melinda Gates Foundation (BMGF) has supported a containment response that has allowed Cambodia to intensify malaria control and surveillance. A national malaria survey was conducted at the end of 2010, which will provide updated data for the country as a whole as well as for the containment areas shortly. Cambodia is currently in the process of drafting a new strategic plan targeting malaria elimination by 2025.

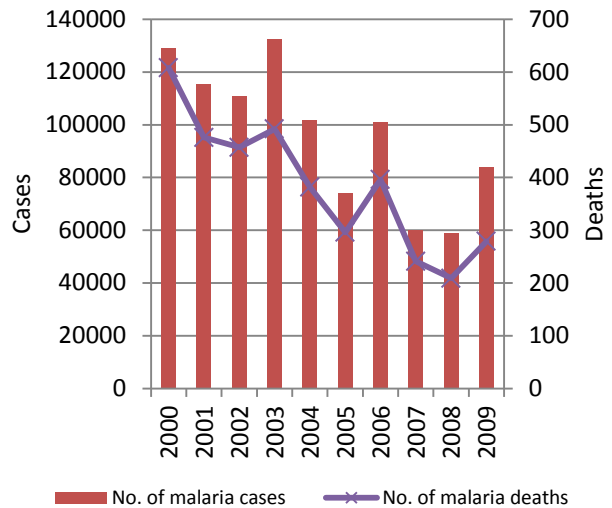
Malaria remains a major public health and economic burden in Cambodia with an incidence of 6.2 per 1,000 in 2009. The majority (80%) of the population lives in urban or rural areas without malaria transmission, but around 20% (approximately 2.89 million people) either live permanently in the forested endemic areas or are “forest dependent” for additional income. The 2007 national survey estimated a malaria prevalence of 2.9% in the high-risk areas (<2km from the forest). High-risk groups include traditional forest inhabitants (e.g. ethnic minority groups), forest fringe inhabitants, temporary migrants, and organized groups (e.g. the military and plantation workers). Transmission is high and seasonal in the forest and forest-fringe areas of the north, west and northeast, and also in the rubber plantations of the east and northeast. In the rice growing areas of the south and central regions, transmission is low or non-existent. There is no transmission in urban areas. According to the health information system (HIS) (from public health facilities), 51% of confirmed malaria cases occur in males aged 15–49 years.

Both malaria morbidity and mortality rates have declined over the last decade. This occurred in a setting of increased government commitment together with substantial additional financial and technical support from the international community. However, the public health system suffers from poor quality services and inaccessibility, leading to a large private sector delivery of care. Various surveys have reported 67–80% of patients seek treatment in the private sector. CNM estimates that at least 300,000 to 400,000 new cases of falciparum malaria were treated in the private and informal sector in Cambodia in 2009.

⁷ Cambodia Malaria Survey Report 2007



Cambodia Malaria Cases and Deaths 2000–2009



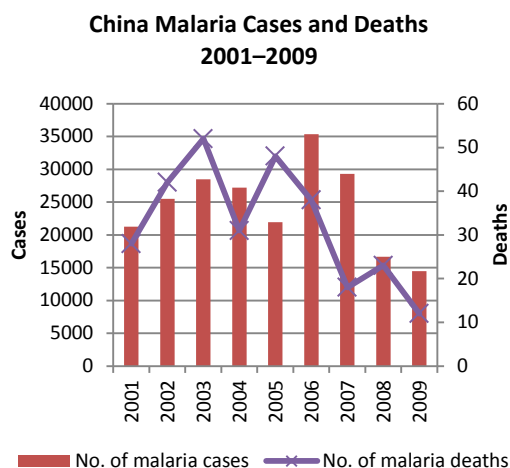
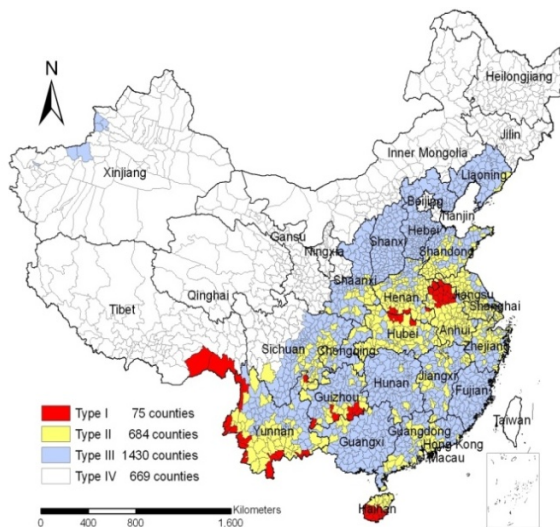
China

Yunnan Province shares borders with Burma, Laos, and Vietnam and is thus generally considered to be part of the GMS. Malaria control activities are managed through the Bureau of Disease Control located within the Ministry of Health. Malaria control activities at the provincial and county levels are orchestrated by the Provincial Health Bureau and County Health Bureau respectively. Additional technical support comes from the National Institute of Parasitic Diseases (NIPD) of the Chinese Centre for Disease Control and Prevention (China CDC). The reach of the NIPD/China CDC goes from the national level through the provinces all the way to Township Healthcare Centers and Village Doctors. Patients with suspected malaria in China are generally seen by either a doctor at the township hospital or by a part-time doctor located at the village level. One problem with the Village Doctors is that many have little basic education and medical training, often leading to a significant under-diagnosing of malaria.⁸ The national treatment policy in China is with ACTs, primarily DHA-Pip. The strategy for vector control in China is based on epidemiologic stratification. In the high risk areas with a “responsive vector,” the program aims to achieve 100% coverage of LLINs and use IRS in focal areas of transmission. Additionally, the program designs specific interventions for special populations such as forest workers and migrant populations.

China is mainly affected by *P. vivax*. Endemic *P. falciparum* is limited to only two provinces, Yunnan and Hainan. *P. falciparum* cases accounted for only 4% of all confirmed malaria cases in China in 2008, but it accounted for 17% of all confirmed cases in Yunnan. The new National Malaria Strategy 2010–2020 aims to eliminate malaria from all provinces in China by 2020 with an intermediate goal of universal elimination from all areas except the border areas of Yunnan

⁸ From Malaria Control to Elimination: A Revised National Malaria Strategy 2010-2015. The People’s Republic of China

Province by 2015.⁹ Although the health system in China has the advantage of having a strong network of public health facilities, which is the basis for the delivery of malaria services such as diagnosis and treatment, some patients (especially in Yunnan) seek care from other privately operated health care providers and pharmacies. In Yunnan, malaria is particularly problematic among border crossers and ethnic minority groups at the Yunnan/Burma border areas. Type I counties with incidence > 1/10,000 cases are concentrated at the border areas. Type II counties have incidence < 1/10,000, Type III counties have had no local cases for three years, and Type IV counties are malaria-free. Forty-three percent of the counties in Yunnan are either Type III or Type IV. Although China has demonstrated a decline in malaria morbidity and mortality, malaria control efforts are hampered by the continuous influx of migrants from Burma.



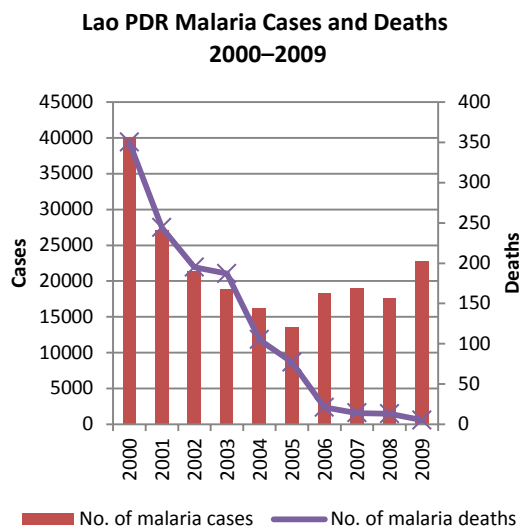
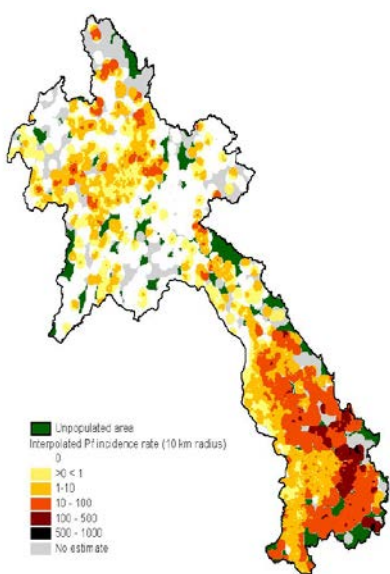
Lao PDR

The national health system in Lao PDR aims to provide full health care service coverage and equity. Although the public health system is predominant, a private alternative is growing, especially in the peripheral areas. Lao PDR has recently drafted a new National Strategic Plan for malaria control and pre-elimination 2011-2015¹⁰ with the goal of intensifying malaria control efforts, targeting remaining endemic communities and key risk groups, and progressively rolling out malaria elimination in selected provinces. The malaria control activities in Laos are managed by the Ministry of Health’s Centre for Malaria, Parasitology, and Entomology (CMPE). The Government of Laos has been successful in securing four Global Fund grants which now supports more than 90% of the national program’s activities. Much of the support has focused on distribution of ITNs/LLINs, reaching vulnerable ethnic minority groups, implementing diagnosis and treatment with AL. Recent data show that 89% of patients with malaria received a parasitological diagnosis and were treated with an ACT. The CMPE is now in the process of scaling up LLINs with a target of reaching 3.6 million persons at risk for malaria.

⁹ From Malaria Control to Elimination: A Revised National Malaria Strategy 2010-2015. The People’s Republic of China

¹⁰ National Strategy for Malaria Control and Pre-elimination 2011-2015. Lao People’s Democratic Republic, Ministry of Health.

Although malaria has long been a leading cause of mortality and morbidity in Lao PDR, especially in rural areas, the intensity of malaria transmission varies between different ecological zones: from very low transmission in the plains along the Mekong River and in areas of high altitude, to intense transmission in remote, hilly and forested areas. *P. falciparum* is the predominant species, accounting for 95% of all recorded malaria cases, although recent surveys suggest a *P. vivax* prevalence rate of around 25% and *P. vivax* becoming the dominant species in some areas in the north. Transmission is perennial but with large seasonal and regional variations. Groups at greatest risk include ethnic minorities, forest and agricultural workers, miners, and children below the age of five years. Significant reductions have been reported since the large-scale introduction of ACTs and ITNs, in conjunction with socioeconomic and environmental changes. The annual number of uncomplicated malaria cases (probable and confirmed) fell from 40,106 in 2000 to 22,800 cases in 2009 and the number of malaria deaths in hospitals dropped from 350 in 2000 to 5 in 2009. The burden has declined significantly in most districts in the Northern provinces.



Thailand

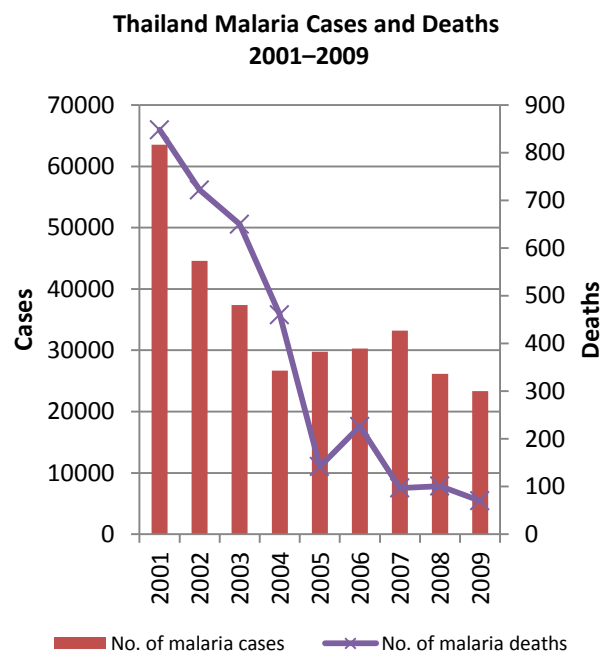
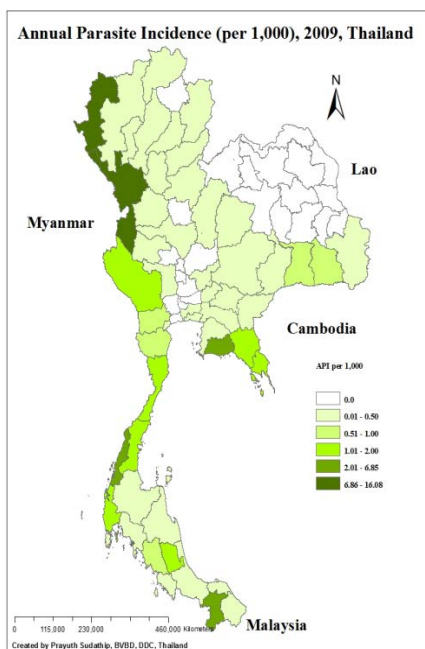
The goal of the national malaria program is to reduce malaria morbidity and mortality, and contain and eliminate artemisinin-resistant parasites. The NMCP is located within the Bureau of Vector-Borne Diseases (BVBD), Department of Disease Control within the Ministry of Public Health (MOPH). The program operates vertically in areas where malaria transmission still occurs. In areas where indigenous transmission has been eliminated, programmatic responsibilities have been transferred to the Provincial Public Health Offices, and BVBD provides only technical assistance. BVBD is in the process of drafting the National Strategic Plan for Malaria Control and Elimination 2011–2020 with the goal of 80 percent of the country free from malaria transmission by the year 2020.

Malaria has been a national public health problem, but significant progress has been made due to years of intensive malaria control, especially for Thai nationals. The country has done an excellent job of getting diagnostic services to the endemic areas through the establishment of malaria clinics and malaria posts using either microscopy or RDTs -based diagnosis. Patients

testing positive for falciparum malaria are treated with mefloquine and artesunate per national policy and with atovaquone-proguanil in select zones of the artemisinin resistance containment project. In both these settings, a single dose of primaquine is provided for gametocytocidal effect without prior glucose-6-phosphate dehydrogenase (G6PD) testing. The BMGF support for the artemisinin resistance containment project has allowed Thailand to intensify malaria control efforts, surveillance, and long-term follow-up of all patients in zone 1 areas (areas of suspected artemisinin resistance) of Chantaburi and Trat provinces. With the successful Global Fund Round 10 application, the NMCP will continue containment activities initiated with the BMGF funds and expand its focus beyond the Thai-Cambodian border to include the Thai-Burma border. Round 10 support will increase the coverage of LLINs to 100% (<2 persons per LLIN) amongst Thai citizens and long-term non-Thai residents. In addition, LLINs for short-term non-Thai residents will be provided when the person presents with fever. Insecticide treated hammocks and repellents will also be provided to special at-risk populations. In the event of a documented local focus of infection, the NMCP plans to conduct limited IRS in the areas near the cases.

In-vivo efficacy studies have identified additional sites in Thailand with increased proportion of day 3 positive blood smears and increased ACT failure rates on day 28. These sites include Ranong, Kanchanaburi, Tak, and Mae Hong Son, all located at the border with Burma.

Malaria cases mainly occur in the border provinces, especially the Burmese border. Political unrest in the south has also hampered malaria control activities. The groups at risk for malaria in Thailand consist of migrants, mobile populations, refugees in camps, and those spending nights in the forest, which include ethnic minority groups. In 2009, they reported a higher number of cases amongst foreigners than Thai nationals. Over the past decade, Thailand has noted a drop in the burden, with the number of cases falling from 63,528 in 2001 to 23,327 in 2009, and the number of deaths falling from 848 to 70.

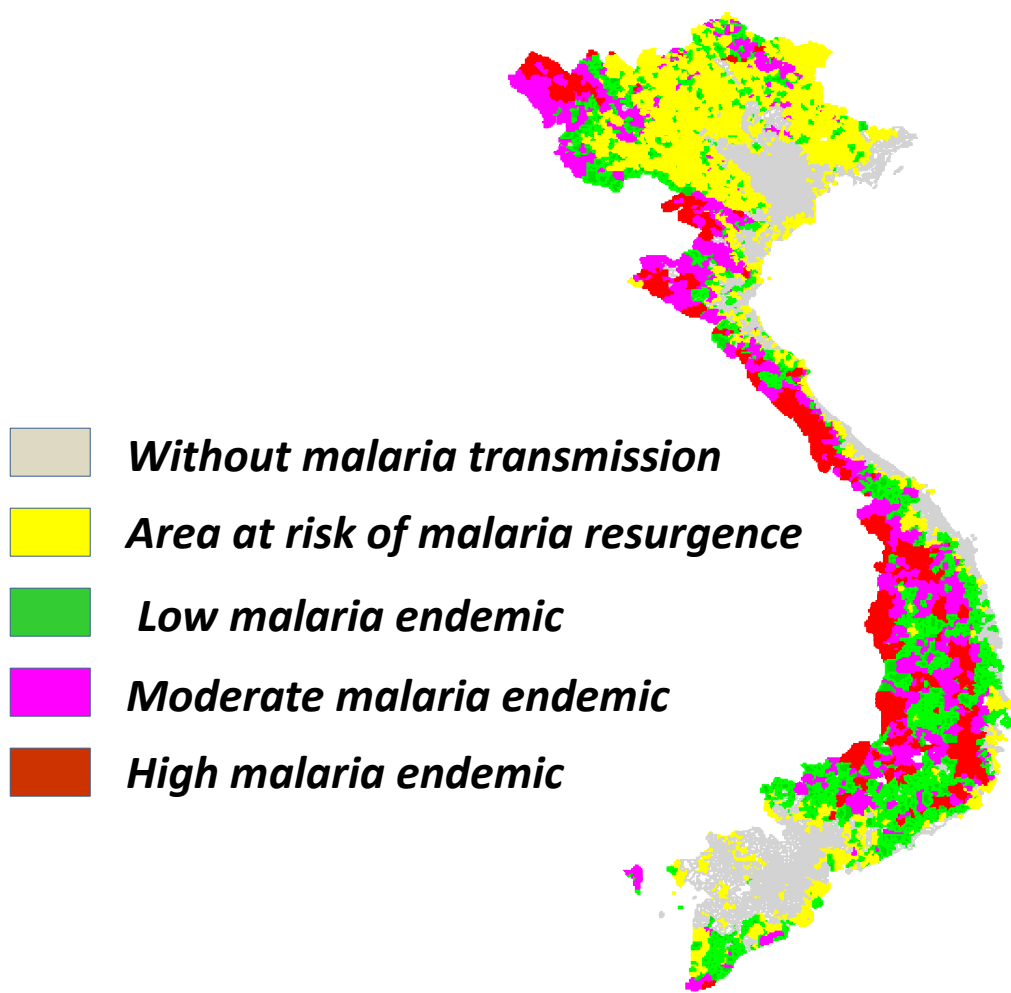


Vietnam

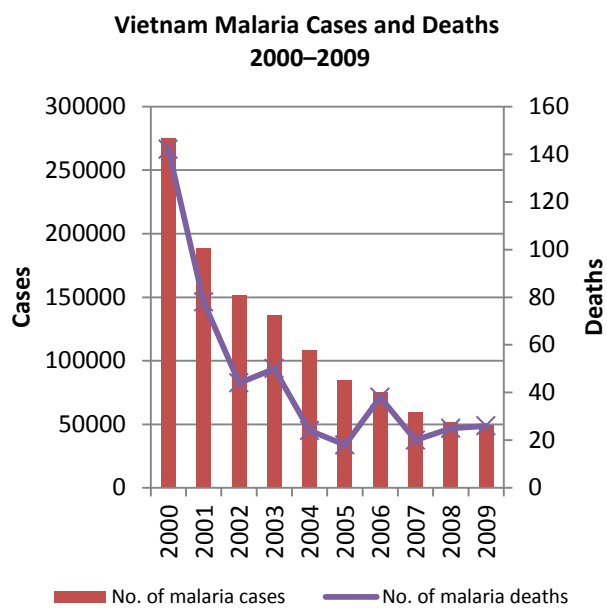
The NMCP rests within the National Institute for Malariology, Parasitology, and Entomology (NIMPE) within the Ministry of Health. It is a vertical program with offices at the provincial, district, and communal level. There are parallel curative services (primary and tertiary) at the same administrative levels. The NIMPE recently drafted the National Strategy for Malaria Control, Prevention and Elimination in Vietnam through 2020 with the goals of continuing to roll back malaria in meso- and hyper-endemic areas and implementing step by step malaria elimination strategy in the low endemic areas.

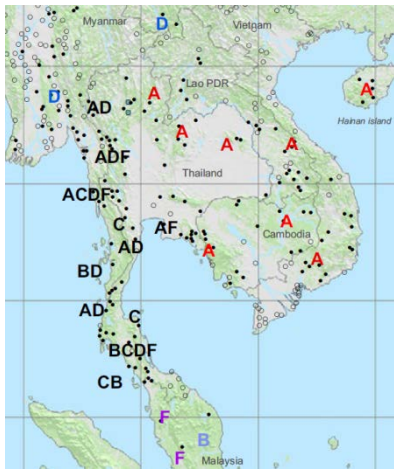
The vast majority of the malaria diagnosis occurs at the commune and village levels. The government has provided more than 3,000 microscopic testing points to enhance diagnosis; however, some village workers continue to diagnose malaria clinically. DHA-Pip is used to treat *falciparum* malaria cases and chloroquine for confirmed *vivax* cases. The national program uses data to stratify malaria risk in the country. These maps are utilized to determine where malaria prevention services will be targeted. ITNs have been distributed in all endemic villages with a coverage estimated at 70% by the national program. The program retreats approximately 4–5 million bednets each year. In addition, the control program uses IRS to cover an additional two million people residing in hyper-endemic areas, where the culture of using ITNs is poor.

Although the burden of malaria in Vietnam has declined steadily in recent years, in remote forested areas many highly endemic foci still remain. Malaria occurs in remote forest and forest fringe communities, which are often inhabited by marginalized groups including ethnic minorities and migrant settlers. The burden is concentrated at the border areas of Cambodia and Lao PDR. Vietnam has reduced malaria cases and deaths from 2000 to 2009 from 274,910 to 49,186 and from 142 to 26, respectively.



2009





ENTOMOLOGIC SITUATION IN THE GMS

Malaria transmission ecology

Traditionally malaria transmission in the GMS has been closely associated with two forest and forest fringe mosquito vectors, *Anopheles dirus*, and *An minimus*. The two most important species are *An dirus* s.s., also known as Species A, which is found between the Northern Thai-Burma border and the Vietnam border and *An baimai*, or Species D, found along the lower half of the Thai-Burma border. There are important ecological differences among the members of the *An dirus* complex. *An dirus* ss (Species A) and *An baimaii* (Species D) are extremely anthropophilic. *An crascens* (species B) appears to be less anthropophilic than these and also less anthropophilic than *An scanloni* (Species C). *An nemophilous* (Species F) feeds primarily on monkeys and is not considered a vector of human malaria. The two most anthropophilic species in the complex, Species A and Species D, are also thought to feed later in the night than Species B and Species C.

An minimus is the second most important malaria vector in the Mekong region. This has also been shown to be a complex of sibling species.¹¹ *Anopheles minimus s.l.* bites throughout the night, but exhibits geographical and seasonal variation in peak biting activity. A large peak from 22.00 hours to 03.00 hours was recorded in Lao, Burma and Vietnam. Peak activity was earlier in Thailand from 21.00 hours to 22.00 hours.

Other “secondary vectors in the Mekong region include, *An sundaicus* and the closely related *An epiroticus*, *An maculatus*, and possibly in some areas, *An aconiotus* and *An campestris*. Burma has an especially rich mosquito fauna. According to the National Strategic Plan, of 37 species of *Anopheles*, eight are considered malaria vectors with *An dirus* and *An minimus* found with sporozoite rates between 2-4%; secondary vectors *An. annularis*, *An. sundaicus*, *An. culicifacies* with sporozoite rates 1-2%; and suspected vectors, *An. maculatus*, and *An. vagus* with sporozoite rates less than 1%.

Impact of Insecticide Treated Nets in the GMS

Because of these variations in biting times among many of the Mekong malaria vectors, there are sometimes questions on the value and the impact of ITNs. The number of published studies across the region are relatively limited, but have recently been summarized in an unpublished draft document from the Malaria Consortium (MC).¹² The one published study showing ITNs were not effective was conducted in Rakine State in Western Burma, where the vectors did not include *An dirus* and *An minimus* but the secondary suspected vectors where 50% of the biting occurred before 20.00 hr. All major species showed a strong preference for outdoor biting.¹³ A number of studies were conducted in Burmese refugee camps along the Thai-Burma border,

¹¹ Garros C, et al Review of the *Minimus* Complex of Anopheles, main malaria vector in Southeast Asia: from taxonomic issues to vector control strategies *Trop Med Int Health* 2006;11(1):102-114

¹² Meek, SR and M Kaviratne (2010) Efficacy of Insecticide Treated Nets in South East Asia, Annotated Bibliography. Malaria Consortium, unpublished document.

¹³ Smithuis F, et al. The effect of insecticide-treated bed nets on the incidence and prevalence of malaria in an area of unstable transmission in western Myanmar. 2006 Unpublished thesis.

showing an impact in school children with a 38% reduction in parasite prevalence and a 42% reduction in clinical episodes.¹⁴ Likewise a study among pregnant women showed a two-fold decrease in women requiring treatment for anemia compared to those with no net and a 1.6 fold decrease among women using untreated nets.¹⁵

Insecticide Resistance

Insecticide resistance among the major vectors does not appear to be a critical challenge in the Mekong region at the present time. A survey of Thailand, Cambodia, Lao PDR and Vietnam published in 2008¹⁶ concluded that *An. dirus s.s.*, *An. epiroticus* and *An. minimus s.l.* were susceptible to DDT and pyrethroids except in Vietnam. In central Vietnam, *An. dirus s.s.* showed possible resistance to type II pyrethroids (e.g. deltamethrin) and in the Mekong delta, *An. epiroticus* (part of the *An. sundaicus* complex) was highly resistant to all pyrethroid insecticides tested; it was susceptible to DDT, except near Ho Chi Minh City where it showed possible DDT resistance. In Vietnam, *An. minimus s.l.* showed DDT tolerance (mortality between 97% and 80%) at one site in the north along the Lao border; pyrethroid resistance (mortality < 80%) was seen at a number of sites in the far north of Vietnam, along the China border. The authors concluded that in Vietnam, as insecticide resistance was mainly observed in low or transmission-free areas, there is no need to actually change the malaria control strategy. In Burma, the data is quite old, the latest only available from 1997. However, in that study vectors were sensitive to DDT, pyrethroids and organophosphates except for a report of *An. annularis* resistance to DDT from Rakine State in the west. The Global Fund Round 9 calls for four sentinel sites, with a budget of just USD 7,500 per year (from a total annual budget of USD19 million). The Asian Collaborative Training Network for Malaria (ACTMalaria) has established a page on their website to update the vector resistance in each of the countries, but the information presented needs standardization and updating (<http://www.actmalaria.net/home/IRW.php#base>).

FUNDING OF MALARIA CONTROL ACTIVITIES

The tremendous progress made to date has paralleled the unprecedented increase in malaria funding from external sources. As a whole, the region has been very successful in obtaining funds from the Global Fund to carry out their malaria activities. All six countries have had at least one successful Global Fund grant totaling a sum close to USD 400 million for the GMS. The table below details the various Global Fund grants from the six countries. It also includes domestic funding where the data was available and additional major funding sources in the sub-region, e.g. 3DF and BMGF. Cambodia is the only country in the GMS to have bid successfully for Phase I of the Affordable Medicine Facility for Malaria (AMFm) grant, a funding mechanism aiming to enhance access to ACTs through price subsidies both in the private and public sectors.

¹⁴ Luxemburger C et al. Permethrin-impregnated bed nets for prevention of malaria in schoolchildren on the Thai-Burmese border *Trans R Soc Trop Med Hyg* Mar-Apr 1994;88(2):155-159

¹⁵ Dolan G et al Bed nets for the prevention of malaria and anemia in pregnancy *T Roy Soc Trop Med* Nov-Dec 1993;87(6):620-626

¹⁶ Van Bortel et al the insecticide resistance status of malaria vectors in the Mekong region *Malaria Journal* 2008, 7:102

This table does not include funding from JICA, a bilateral source of funding for malaria activities in the GMS. In addition, both Thailand and China submitted proposals to the most recent round of Global Fund proposals (R10), which have been approved.

Table 4. Key funding sources in the GMS

Country	Funding	Approved Amount (USD)	Activities
Burma	GF R3	2,169,079	Provision of LLINs and drugs; training voluntary health workers
	3DF*	3,790,000	2009 contribution to malaria control in 137 out of 284 endemic townships
	GF R9	29,816,415	LLINs and early diagnosis and treatment in 14 out of 17 states/ divisions.
Cambodia	Domestic*	1,480,254	
	GF R2	9,730,345	Procurement of prevention and treatment needs
	GF R4	9,857,891	Social marketing of LLINs; Replacement of ITNs with LLINs
	RCC	10,916,537	Full coverage with LLINs; Village malaria workers
	GF R6	22,908,144	Procurement of LLINs, RDTs and drugs; Coordination at the periphery
	BMGF	9,500,000	2 year support for the artemisinin resistance containment project in Thai-Cambodian border for Cambodia
	GF R9	56,137,912	Move toward pre-elimination of malaria across Cambodia, with special efforts to contain artemisinin-resistant <i>P. falciparum</i> malaria
	AMFm	9,600,000	Subsidized distribution of DHA-pip. Implementation to be delayed by 6 months due to challenges with procurement.
China	Domestic*		None reported for 2009
	GF R1	6,406,659	Distribution of bednets, establishing microscopy stations; malaria surveillance
	GF R5	38,522,396	Social marketing of LLINs; Strengthening microscopy; provision of ACTs in Hainan and Yunnan; RDTs in remote areas; training of public and private providers; monitoring drug quality and resistance.
	GF R6	12,312,206	Focus on Chinese migrant workers and local residents on the Burma border and cross-border collaboration
	NSA	79,476,904	Focus on elimination
Lao PDR	GF R1	12,709,087	Procurement of ACTs/RDTs; Social marketing of nets
	GF R4	14,502,222	Scaling up prevention and treatment; Engaging village workers and private sector
	GF R6	3,633,039	Antimalarial quality assurance, especially with private sector
	GF R7	7,877,742	Scaling up prevention and treatment; Information, Education, Communication (IEC) for ethnic minority communities
Thailand	Domestic*	2,356,992	Treatment services for Thai citizens (2009 Funding)
	GF R2	5,282,000	ITN distribution; Establishment of malaria posts; Training of CHW
	GF R7	17,515,927	Focus on migrants and communities in conflict zones
	BMGF	4,030,005	2 year support for the artemisinin resistance containment project in Thai-Cambodian border

Vietnam	Domestic*	4,582,210	
	GF R3	21,177,956	Distribution of bednets; IEC activities; training of VHW
	GF R7	13,536,282	Community-based interventions targeting endemic areas and mobile populations
Source: WMR 2010 and www.theglobalfund.org; Highlighted funding streams in grey are closed; *Annual funding for 2009			
GF R- Global Fund Round; 3 DF- Three Diseases Fund; RCC- Rolling Continuation Channel; AMFm- Affordable Medicines Facility malaria; NSA- National Strategy Application			

CURRENT STATUS OF MALARIA INDICATORS

Although some of the standard indicators adopted in the GMS differ from those in sub-Saharan Africa, several indicators are applicable to this sub-region, including net ownership and use. The following table shows the baseline figures for the standard indicators being used by PMI, where survey data is available:

Table 5. National and sub-national data for the GMS countries

Indicator	Burma (Chin, Kachin, Sagaing 2008)	Cambodia (CMS 2007)	Cambodia (Containment zones 1&2 2009)	Lao PDR (Bednet 2009)	Vietnam (MICS 2006)	Thailand (R7 household 2009)
Malaria prevalence (%)		2.6	0.9	-	-	
Households with at least one net (%)	91	95	94	-	99	
Households with at least one ITN (%)		36	67	90	19	
Persons who slept under an ITN the previous night (%)		25	41*			36
Children under five years old who slept under an ITN the previous night (%)		28	46*	81	5	
Pregnant women who slept under an ITN the previous night (%)		28	55*	-	-	
CMS: Cambodia Malaria Survey; ITN: insecticide treated net; LLIN: long lasting insecticidal treated net; MICS: Multi Indicator Cluster Survey; R7: Global Fund Round 7						

*Limited to LLIN use

Most of the GMS countries have relied primarily on routine health management information system data for planning and monitoring their malaria activities and less so on national survey data. The exception has been Cambodia, which has conducted national malaria surveys in 2004, 2007, and 2010. The 2010 survey results are not yet available. Other countries with national intervention coverage, but not prevalence data include Lao PDR which conducted a national bednet survey in 2009 and Vietnam with a Multiple Indicator Cluster Survey (MICS) in 2006. Sub-national level data is also available from Cambodia as large evaluation surveys have been conducted as part of the artemisinin resistance containment project, limited bednet ownership data from three states/divisions in Burma, and household surveys in Thailand in Round 7 supported areas. Overall, these surveys from the sub-region show high levels of bednet ownership with lower levels of ITN ownership and use with the notable exception of Lao PDR.

This sharp drop-off in bednet to ITN ownership is notable in Burma with sub-national bednet ownership at >90% and projected ITN use in endemic populations at only 6%. None of the surveys reported the percentage of children under five years old with fever in the last two weeks who received treatment with an ACT within 24 hours of onset of fever as this has not been a standard indicator in the GMS. Furthermore, no countries have conducted the RBM standard Malaria Indicator Survey. No national level malaria prevalence or intervention coverage estimates are currently available from Burma, Thailand, and China.

Similarly, for the cross-border focus areas, Pailin, Cambodia is the only site with malaria prevalence and coverage data. However, Burma is planning to conduct a malariometric survey with Global Fund Round 9 funds and Thailand has requested funding from Global Fund Round 10.

Table 6. Cross-border Focus Areas

Indicator	Kawthoung, Tanintharyi Burma	Ranong, Thailand	Trat, Thailand	Pailin, Cambodia
Population*	1,655,592	179,873	216,955	70,482
Malaria cases*	31,947	460	289	1474
<i>P. falciparum</i> cases*	4,383	185	97	867
Malaria prevalence† (%)				0.3%
Households with at least one ITN† (%)				38%

*As reported by the NMCPs for the 2010 World Malaria Report.

†Cambodia National Malaria Survey 2007.

GOAL AND TARGETS OF THE PRESIDENT’S MALARIA INITIATIVE

In line with the Lantos-Hyde Malaria Strategy¹⁷, PMI will work with NMCPs and partners to strengthen efforts to limit the spread of multidrug resistant *Plasmodium falciparum* malaria in the GMS. The USG strategy states that this will be accomplished by:

- o Supporting well-functioning antimalarial drug resistance surveillance networks in each country in the region;
- o Establishing national systems to monitor the quality of antimalarial drugs as a means of preventing the introduction and dissemination of sub-standard or counterfeit drugs, which contribute to increased drug resistance; and
- o Contributing to a further reduction in the level of transmission of *P. falciparum* malaria and the number of reported cases in the Greater Mekong Region and the Amazon Basin, with a goal of elimination of malaria in these areas by 2020.

For PMI GMS, the goal of limiting the spread of multidrug resistant malaria will be accomplished through three programmatic sub-objectives which will guide MOP activities and planning. The three sub-objectives are:

1. To strengthen malaria control in areas with existing or threatened artemisinin resistant malaria

¹⁷ Lantos-Hyde USG Malaria Strategy 2009–2014

2. To ensure effective surveillance for artemisinin resistant malaria throughout the GMS
3. To support regional cooperation and NCMP capacity-building.

Areas currently targeted for intensified malaria control include two cross-border areas with suspected artemisinin resistance but very different epidemiology: (1) on the Thai-Burmese border, especially Kawthoung-Ranong area; and (2) on the Thai-Cambodian border, especially Trat-Pailin area (see map below¹⁸). Traditional PMI intervention targets will apply but with increased emphasis on intensified case management, collaboration with the private sector, and effective cross-border collaboration. PMI will focus on elimination of falciparum malaria in administrative districts with very low transmission.

The effort to reinforce artemisinin resistant malaria surveillance will cover the entire region but with particular intensity in areas where there is evidence of real or possible emergence of artemisinin resistance (diffused or de novo). PMI will continue to lead this effort and ensure technical capacity and timely reporting with engagement of national governments to take ownership of these efforts and supported by other donors. PMI will continue and eventually broaden support to artemisinin resistant malaria prevention through drug quality assurance, increased surveillance activities to include follow-up of cases, and efforts to track the flow of potential human carriers (migrant and mobile population). While target setting at the impact level is difficult, PMI will closely monitor efforts to build national and regional capacity.

PMI efforts to reinforce regional cooperation and build capacity will generally focus on the two sub-objectives mentioned above, but also include support for WHO's bi-regional Mekong Malaria Program as well as ACTMalaria.

¹⁸ Cui et. al., Malaria in the Greater Mekong Subregion: Heterogeneity and complexity. [Acta Trop.](#) 2011 Mar 5.

**Malaria incidence in the Greater Mekong
2008 (Subregion 2011)**

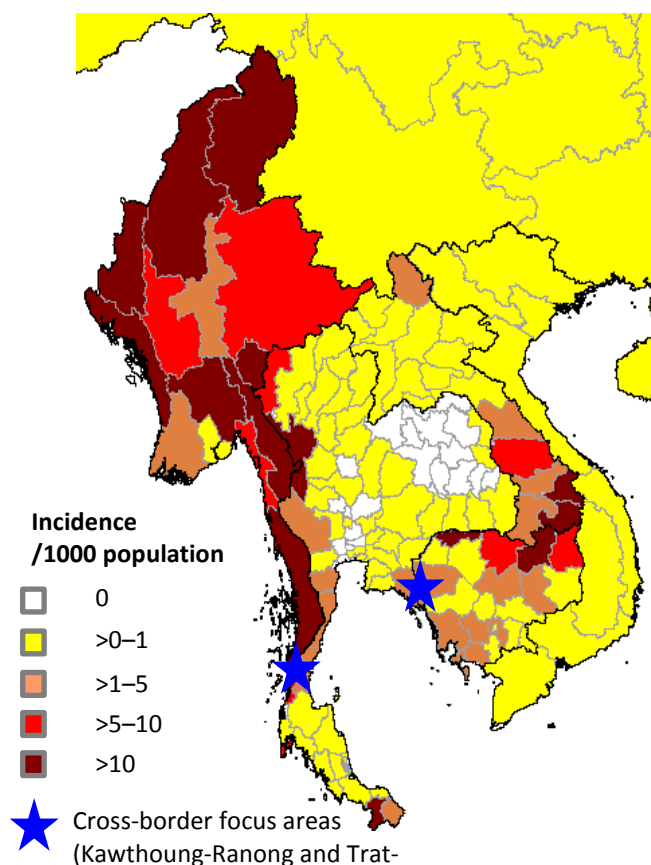


Table 7. Country Level Engagement in the Three Sub-objectives

	Objective #1: Strengthen malaria control	Objective #2: Surveillance of artemisinin resistant malaria (situation as of 2010*)	Objective #3: Regional cooperation and capacity-building
Burma	Kawthoung, Tanintharyi	Suspected in many areas along Thai and Chinese borders	Yes
Cambodia	Pailin	Confirmed in Pailin and suspected along the Thai border	Yes
China	None	Suspected along Burmese border	Yes
Laos	None	Not identified	Yes
Thailand	Trat; Ranong	Suspected in Trat and along the Burmese border	Yes
Vietnam	None	Confirmed in Binh Phouc	Yes

*Suspected=an increase in parasite clearance time, as evidenced by 10% of cases with parasites detectable on day 3 after treatment with an ACT; Confirmed= treatment failure after treatment with an oral artemisinin-based monotherapy with adequate antimalarial blood concentration, as evidenced by the persistence of parasites for 7 days, or the presence of parasites at day 3 and recrudescence within 28/42 days

As the malaria situation differs from the African context, USAID has supported the development of a new Bi-Regional Malaria Indicator Framework for Monitoring and Evaluation of Malaria Control and Elimination (BMIF) to generate GMS appropriate M&E framework and indicators.

As these indicators have been endorsed by all the countries in the GMS, PMI will adopt these indicators to measure its regional and community-level progress, whenever possible. The targets will be set at higher than previous PMI targets as we will be supporting areas of documented artemisinin resistance that require intensive scale-up. Most of the targets adopted by the containment projects in the sub-region have set targets of 100% ITN ownership and case confirmation and 90% use of ITNs.

For objective 1 of strengthening malaria control in the cross-border focus areas of Kawthoung-Ranong and Trat-Pailin, PMI will contribute to achieving the sub-regional targets set by WHO-MMP and WHO-WPRO of reducing malaria morbidity and mortality by 50% by 2015 compared to 2010 and increasing the number of administrative areas that are malaria-free. In addition to the impact indicators, several outcome indicators will be measured at baseline and tracked. The malaria control strategies in the GMS will include scale-up of household ownership of ITNs, use of ITNs by high-risk populations, and prompt treatment with ACTs. Other strategies often deployed in Africa, such as indoor residual spraying of insecticide and intermittent preventive treatment of malaria for pregnant women, are less applicable in the GMS. Furthermore, the focus on pregnant women and children under five as the vulnerable groups has shifted to all age groups and other high-risk groups, e.g. ethnic minority groups and migrants.

For objective 2 of ensuring effective surveillance for artemisinin resistant malaria throughout the GMS, the following indicators will be monitored across the six countries: 1) cases with parasites detected on day 3 after treatment with an ACT, 2) substandard/ counterfeit drugs identified during post-market surveillance and 3) number of sites conducting drug efficacy and drug quality studies.

For objective 3, to support regional cooperation and NCMP capacity-building, PMI will continue to support the WHO MMP office which serves to coordinate malaria control activities across two WHO regions. WHO provides technical assistance to the six countries in the GMS in a variety of areas and supports the evidence-based updating of their national policies and plans.

Although Year 1 of PMI in the GMS will focus on the specific cross-border focus areas of Kawthoung (Tanintharyi Division)-Ranong and Trat-Pailin, PMI will maintain geographic flexibility and remain responsive to the dynamic situation of antimalarial drug resistance during the duration of GHI.

Table 8. M&E Indicators for the Three Sub-Objectives

Objective	Geographic Focus	Indicators	Targets	Data Source
1.To strengthen malaria control in areas with existing or threatened	Cross-border focus areas of Kawthoung-Ranong and Trat-Pailin	Confirmed malaria cases (number and rate)*	50% decrease by 2015 from 2010	Routine surveillance

artemisinin resistant malaria		Deaths due to malaria (number and rate)*	50% decrease by 2015 from 2010	Routine surveillance
		Interruption of malaria transmission in targeted administrative units*	20% interrupted by 2015	Routine surveillance
		Percentage of households at risk of malaria own at least one ITN	100%	Household and migrant surveys
		Percentage of individuals in areas at risk of malaria who slept under long-lasting insecticidal net/insecticide-treated net the previous night*	90%	Household and migrant surveys
		Percentage of uncomplicated malaria cases with (a) confirmed <i>P. falciparum</i> malaria that received artemisinin-based combination therapy, and (b) confirmed <i>P. vivax</i> that receive appropriate antimalarial treatment including radical treatment, according to national guidelines*	100%	Routine surveillance
2. To ensure effective surveillance for artemisinin resistant malaria	GMS (6 countries)	Percentage of cases with parasites detected on day 3 after treatment with an ACT	<10% in areas without suspected resistance	Routine monitoring and sentinel sites
		Percentage of substandard/ counterfeit drugs identified during post-market surveillance	<5%	Sentinel sites
		Number of sites completing drug efficacy studies	>30	NMCP/ Partner records
		Number of sites completing drug quality testing	>30	Partner records
3. To support regional cooperation and capacity-building	GMS (6 countries)	National malaria policies and plans are updated and independently or jointly reviewed at least every five years*		NMCP documents

*Indicators from the Bi-regional Malaria Indicators Framework

EXPECTED RESULTS — YEAR ONE

By the end of Year 1 of PMI in the GMS, the following targets under the three programmatic objectives will have been met:

1. To strengthen malaria control in areas with existing or threatened artemisinin resistant malaria (**Cross-border focus areas**)

Prevention:

- In Year 1, 150,000 LLINs will be procured and distributed free of charge in the PMI cross-border focus areas through various distribution mechanisms as a gap filling measure to the existing distribution plans.
- In Year 1, the distribution mechanisms for both public and private sector will be evaluated.

Treatment:

- PMI will support a limited procurement of RDTs and microscopy equipment to fill any gaps in the cross-border focus areas.

Strategic Information:

- Baseline household and migrant survey data will be conducted in the cross-border focus areas.
- Key OR projects addressing bottlenecks to understanding how to safely use primaquine will be conducted.

2. To ensure effective surveillance for artemisinin resistant malaria (**Regional— GMS 6 countries**)

Surveillance:

- Over 30 sentinel sites across six countries in the regional network will conduct therapeutic efficacy studies.
- GMS-wide network of drug quality surveillance at over 30 sentinel sites will be maintained.

3. To support regional cooperation and capacity-building (**Regional— GMS 6 countries**)

- WHO will convene MMP partnership coordination meetings.
- ACTMalaria will continue to provide a capacity building platform that has been endorsed by the NMCP directors in the sub-region.
- With the finalization of the BMIF, MMP partners will provide technical assistance to NMCPs to effectively adopt the new indicators and develop new national M&E plans, where needed.

PREVENTION ACTIVITIES

Insecticide Treated Mosquito Nets and Indoor Residual Spraying

National malaria control programs in GMS all support the mass free distribution of LLINs to targeted areas, especially where there is suspected artemisinin resistance. In addition to LLINs there is provision – sometimes free and sometimes through social marketing – of nets specially designed for use with hammocks, which are often used by individuals entering the forest for economic activities. Traditionally there has been a very large and active private sector sale of untreated nets of varying quality, e.g. the Cambodia private sector net market. Household ownership of untreated nets is nearly universal, especially in rural Burma and Cambodia, thus both national programs include net retreatment as part of their strategy. Overall, while there is a large investment in free LLIN distribution as well as investments in hammock nets and retreatment activities, there is a need to review strategies and develop policies, refine delivery

mechanisms and improve monitoring and evaluation schemes to optimize and ensure sustained universal usage of treated nets in these targeted areas.

While indoor residual spraying appears in the strategy documents for the GMS countries, it is now rarely used, being difficult to efficiently target and implement. Larval Source Management is generally not appropriate for malaria vectors in the GMS. Finally, there is a small amount of research on personal protection with repellents and treated materials in Burma, Thailand, Cambodia and Vietnam, but these technologies have not yet been deployed on an operational scale.

The FY2011 GMS MOP allocates overall USD 1 million for ITN procurement and technical assistance activities. No funds will be specifically targeted for support to IRS operations.

Background:

Burma

Traditional untreated net ownership

Like other countries in the region, there is a traditionally high rate of mosquito net use among much of the population. According to the 2010–2015 National Strategic Plan for Malaria Control, many families in Burma already use mosquito nets, but rates are highly variable and many are untreated. In 2002, a situation analysis in 15 eastern Townships revealed that 81 to 97 percent of families owned mosquito nets of various sizes and materials, with an average of two nets per family. However in other parts of the country, net ownership was stated to be only 20%. A study in Mandalay Division and Northern Shan State showed that 88% of households owned at least one net, 68% - 85% slept under a mosquito net the night before the survey, and 86% (range: 81% – 93%) of the nets were purchased privately. A 2008 survey by the Myanmar Council of Churches conducted in 160 malaria endemic and hard-to-reach villages in Chin State, Kachin State and Sagaing Division showed that 91% of households own mosquito nets with an average of two nets per household.

Although mosquito net ownership is high, there are three large gaps:

1. There is very low coverage of insecticide treated nets (either ITNs or LLINs). According to the Global Fund Round 9 application, in 2008 only 5.65% of the total population in malaria risk areas were protected with ITNs/LLINs.
2. There are concerns regarding whether existing nets are being used properly and in a consistent manner to achieve effective malaria prevention, especially when men go to the forest for work.
3. Untreated nets are more readily available than treated ones.

Procurement and distribution plans within Global Fund Round 9 Grant

Within the Global Fund Round 9 Grant, a total of 170 townships are targeted. In 55 priority townships, 1.8 million LLINs will be distributed free of charge and the existing ordinary mosquito nets will be treated with long-lasting insecticide to ensure coverage of 94% and above from year 2 onwards. Two LLINs per household will be distributed in the 55 priority townships where 17% of the population live and where 22% of malaria cases and 32% of malaria deaths were reported in 2003–2007 (5-year average). Most of the target townships are in the eastern and southern part of the country where treatment failures to and prolonged parasite clearance

time to ACT were reported. In addition, mass treatment of existing ordinary mosquito nets with long lasting insecticides will be done in 115 other priority townships. Overall, the coverage of LLINs/ITNs will increase from 2.33 million people in 2008 to 4.25 million people in 2011, 7.68 million people in 2012, and sustained at over 8.6 million people thereafter.

Indoor Residual Spraying

Indoor Residual Spraying in Burma has been on the decline since the early 1990's. In the most recent data available (from the National Strategic Plan) the number of houses/dwelling units sprayed has declined from 7,932 in 2003 to 1,484 in 2007. While IRS is still listed as a potential intervention, it does not appear to be budgeted for in the Global Fund Round 9 Grant.

Thailand

Traditional untreated net ownership

Good estimates of untreated net coverage in Thailand are not available. Usage is thought to be lower than in neighboring areas of Burma and Cambodia – but this may also be due to higher standard of housing in Thailand, i.e. less open with solid walls and window screens. According to the WHO-MMP Profiles, in 2007, 884 913 ITNs were distributed in Thailand. The WHO Profiles report also states that approximately 8 million people in Thailand were covered by mosquito nets in 2007, including low-risk populations. Of the population at moderate and high risk of malaria, it is estimated that approximately 40% were covered by mosquito nets, but the proportion of these that are treated are not clear. Higher coverage levels with ITNs are reported from the artemisinin resistance containment project areas.

Plans for ITN distribution within Global Fund Round 10 grant

Global Fund grants from Round 2 and Round 7 were already contributing to increase the LLIN coverage in villages with on-going transmission in 22 target provinces to also include migrants. In all, 1,925,000 LLINs will be required over the project period with replacement of LLINs every three years. In addition, hammocks and long-lasting insecticidal hammock nets (LLIHN) will be distributed in areas of on-going transmission in target provinces in order to provide protection from malaria where traditional LLINs cannot. In total, 83,500 hammock nets will be provided over the project period for local residents, migrants and soldiers spending nights in the forest particularly on the Thai-Cambodia border.

Indoor Residual Spraying

Implementation of IRS in Thailand, like Burma and Cambodia, is limited. All three countries state that they will implement IRS in “outbreak” areas or where there is active transmission. For example, the Thai Global Fund Round 10 documents state: “Indoor residual spraying (IRS) will be supported and strengthened in documented active transmission foci (2 or more confirmed secondary cases per investigation site) detected through active case investigation.”

Cambodia

Traditional untreated net ownership

Cambodia has a strong “net culture”. The national malaria survey from 2007 indicated that all households owned at least one mosquito net (100%), and most respondents reported sleeping under a net the previous night (80%). However, only 43% of households had an ITN, and 25% of all respondents reported sleeping under an ITN the previous night. The majority of pregnant women and children under five in the surveyed households reported any net use the previous

night (88% and 84%, respectively), while the proportion who slept under ITNs the previous night was 28% for pregnant women and children under five.

Plans for procurement and distribution

The CNM has been distributing free ITNs since the mid-1990s. The Global Fund Round 9 grant continued LLIN distribution started through R4 and R6 grants targeting all affected villages located less than 2km from the forest; however, the current stratification of malaria risk (distance from forest less than 2km) is based on outdated maps of forest cover. Furthermore, there is an increasing number of new settlements that have not been mapped. In 2011, CNM will work with Provincial Health Departments to update the list of high risk communities using village level malaria data compiled in the malaria data base, field visits, GPS technology and up-to-date satellite images. The target population for LLIN distribution, i.e. those persons living less than 2 km from the forest edge, is 2.85 million. In addition to the traditional LLINs, 537,000 insecticidal hammock nets will also be distributed to this population.

The CNM will procure 2,047,000 family sized LLINs (with funding from Global Fund Round 6 and Round 9 grants) for distribution during the period 2011 to 2012. In addition, 1,075,000 family size LLINs will be procured and distributed during 2011-12 to cover the mobile/migrant population who report visiting transmission areas; 397,000 LLINs will also be procured and distributed. Cambodia has a large number of privately purchased untreated nets (PSI estimates 900,000 untreated nets are imported every year). Unlike programs in Africa, where the guidance has been to supply only LLINs and not retreatment kits for the limited number of untreated nets, there is a significant treatment scheme for untreated nets in Cambodia. According to the Strategic Plan, 600,000 new conventional bednets will be treated free of charge, in addition to the 470,000 pre-existing conventional nets that will be re-treated free of charge for those living in “high-risk areas” less than 2 km from the forest. The target is to saturate these communities with one ITN/LLIN per person. However, the CNM reported that they underestimated the migrant population by as much as 25% in their projected needs.

Bundled untreated nets in the private sector

PSI is implementing a ‘bundling strategy’ to ensure that a long-lasting insecticide treatment kit (LLITK) is attached to 70% of all commercially available family-size and hammock nets *before* the nets are released onto the market. Most of the estimated 900,000 untreated nets imported and sold in Cambodia each year are untreated. The nets are moderately priced, affordable, and attractive (coming in an array of colors and styles), which make these nets extremely attractive to the Cambodian consumer. During the first year in 2010 PSI procured 800,000 LLITKs and branded them as *Super Malatab*. One *Super Malatab* kit was then attached, or ‘bundled’ to each incoming net before the net was released onto the market. PSI provided the kits, packing materials (branded bags and stickers) and point-of-sale materials and launched a mass communications campaign to create demand. In a July 2010 PSI report, 72% of net outlets in surveyed communes of malarial endemic areas had bundled nets in stock. Nets bundled with an LLITK were seen to be widely available and accessible, with no associated increases in price. Findings indicate the distribution strategy for ‘bundled’ nets has been successful in ensuring bundled nets are available across wide areas of Cambodia. This data is encouraging, particularly considering that the program had been operating for less than seven months when the survey was done. Despite a limited communication campaign, correct use of the kits was good, but needs to be improved. A PSI- conducted rapid assessment survey noted that of those that purchased and slept under a net, 60% were dipped according to instructions on the kit. There were two key

reasons to why people reported not dipping: 1) 29% of respondents reporting concerns about the insecticide safety that kept them from using the kits and 2) reported lag between purchasing the net and actually using it. Many individuals interviewed indicated they would often buy a net to have it on hand, but did not use it immediately.

Indoor Residual Spraying

Cambodia also has only brief mention of IRS in their strategic plans. The CNM sprayed a few villages in 2010 with alphacypermethrin, but the spray report or the evaluations are not yet available. Like the other countries in the GMS, IRS is not at this time a priority activity.

PMI support to ITNs and IRS in the GMS

PMI will allocate a total of USD 1 million FY2011 funds for ITN-related activities in the three countries, Burma, Thailand and Cambodia. No funding is envisioned to directly support the IRS operations.

Proposed activities for FY 2011 (\$1,000,000)

- 1. Procurement and distribution of LLINs and treated hammock/hammock nets.** Burma, Thailand and Cambodia have large amounts of funding available for the procurement and free distribution of LLINs and treated hammocks and hammock nets. This fund of \$800,000 is to fill gaps that may appear in the cross-border focus areas of Kawthoung-Ranong and Trat-Pailin where there will be more intensive community-based operations. Accompanying this distribution will be communications on appropriate and sustained use as outlined below in the Community Intervention section under “Malaria Prevention.” The exact distribution strategy and plans will be determined during the first six months of program implementation. (\$800,000)
- 2. Support strategy development, monitoring and evaluation of GMS LLIN programs in both the public and private sectors.** While there are large numbers of LLINs being procured and distributed, support is required to optimize the investments for the public-sector distributions and to leverage complementary actions in the private sector. For the public-sector strategies there are at least three fundamental questions: First, what is the optimal strategy, including monitoring and evaluation, for attaining and continuously sustaining universal coverage in the target areas? For example, Thailand and Cambodia both target one LLIN per person in their priority areas and it is not clear if this is over-saturating some areas at the expense of others. Second, regarding net preference and use, there were reports from Cambodia of stark differences in net preferences between polyester and polyethylene. How can we deliver the most appropriate product? Third, evaluation and strategy development is needed to optimize how free LLIN distribution from the public sector can complement nets and treatment kits available in the commercial sector. While net retreatment is not policy in most of the African programs, it is a core element in Burma and Cambodia through public-sector retreatment campaigns and through social marketing.

There is a complementary set of questions, strategies and activities related to the private sector and how this fits into the broader public sector strategies i.e. “workplace programs” and commercial institutional sales. (Note, at this time there does not appear to be enough demand for individual retail sales of LLINs – this is aimed at bulk sales to employers). Both Burma and Cambodia, and to a lesser extent Thailand encourage institutional sales to farmers, plantations, construction camps and NGOs. This will be addressed through an initial analysis and development of a private-sector strategic marketing plan and

implementation in the cross-border focus areas in the GMS. Access barriers also need to be addressed, particularly registration, tax and tariff barriers and other policies that may hinder local retail sale of LLINs. (\$200,000)

Malaria in Pregnancy

Intermittent Preventive Treatment in pregnancy (IPTp) is not part of any of the national strategies in the GMS and will not be supported by MOP11. However, PMI will support promoting universal LLIN coverage and prompt diagnosis and treatment of clinical cases in pregnant women as they remain a vulnerable group in the region. PMI recognizes that malaria in pregnancy is a concern and will explore options in the future to understand the issues better. While IPTp is not felt to be an appropriate strategy in the GMS, Cambodia has undertaken a malaria in pregnancy study in Ratanakiri Province in order to assess the burden of malaria in pregnancy and evaluate additional measures needed to protect pregnant women and their babies. With USAID support, WHO has worked with Ratanakiri Province to implement a malaria screening strategy for pregnant women using RDTs (and treatment, if the RDT is positive) as part of antenatal care in three selected health centers. This involves village malaria workers obtaining malaria information from pregnant women in high risk villages located far from ANC services. They conduct monthly RDTs among pregnant women, refer those in their first trimester to ANC and provide treatment for women in their second or third trimester as per national guidelines. Although IPTp is not deployed in the region, this study will inform future development of regionally appropriate strategies to improve management of malaria in pregnancy in higher transmission areas.

CASE MANAGEMENT

Malaria Diagnosis

Background:

The principal approach to diagnosis and treatment of malaria in the GMS is to provide prompt and highly effective ACTs for confirmed uncomplicated malaria episodes. All NMCPs subscribe to the use of early diagnosis using quality microscopy and RDTs. While microscopy is preferred, RDTs are increasingly used in areas where there are limited microscopic services. *P. vivax* is present in all endemic areas of the GMS, thus if microscopy is not available, national programs are increasingly using pan-specific RDTs.

Burma

The Government of Burma strives to develop services for a biological diagnosis of malaria either through microscopy or RDTs. Diagnosis, where available, is provided free in the public sector. The NMCP prefers diagnosis by microscopy. There are a reported 700 malaria microscopy centers throughout the country including 325 Township hospitals; however, only about 60% are considered to be functioning adequately. A quality assurance system was initiated in 2005 and recently underwent strengthening with USAID-supported WHO and ACTMalaria activities.

Although microscopy is preferred, given the limited resources in the country, especially in rural, malaria endemic areas, confirmatory diagnosis is not always readily available, and thus patients are treated for presumptive malaria based on clinical suspicions and epidemiological

stratification. Even in health facilities that have biological diagnosis, there are still some health providers that treat patients based on clinical signs and symptoms alone.

The National Program promotes the use of RDTs at various levels of the health care system, including by providers in hospitals during the period when microscopists are not available, peripheral health facilities without microscopy, and by trained village health volunteers. Private medical practitioners are also encouraged to use RDTs.

Cambodia

A key objective of the CNM is to “improve access to early malaria diagnosis and treatment services with an emphasis on detection of all malaria cases (including among mobile/migrant populations) and ensure effective treatment.”¹⁹ The program has been striving towards that goal; however, given that a large proportion of patients with febrile illness seek care outside of the formal health sector, malaria is still largely diagnosed clinically in Cambodia.

The program is attempting to increase diagnostic coverage through Global Fund support. Through this support, CNM is working towards ensuring early diagnosis at all public health facilities; however, diagnostic capabilities are either weak or unavailable in many health centers in remote villages. In facilities where both microscopy and RDTs are available, many staff prefer using RDTs because of the ease of use. In order to further the reach of diagnosis in Cambodia, CNM has been working to scale up Village Malaria Workers and Migrant Malaria Workers, both of whom work in remote areas providing testing and treatment services to rural and mobile populations.

Thailand

A key objective of the malaria control program in Thailand is to ensure that malaria patients have access to quality-assured diagnosis. Those diagnostic services are managed by the malaria control program in areas where malaria transmission occurs and in areas still considered to be receptive to transmission with potential for reintroduction. In other areas, malaria diagnosis is integrated into routine health care services.

The vertical malaria control program has established an extensive network of malaria clinics and posts throughout endemic areas of the country. There are 315 malaria clinics, each of which has the ability to perform microscopy. An additional 460 malaria posts have been established in endemic villages. The malaria post is staffed by one malaria post worker who provides diagnostic services with the use of a combination RDT. The national program provides diagnostic quality assurance for microscopy.

As a part of the program’s aggressive malaria surveillance and response, there is active case detection occurring in villages and towns. These activities further the use of both microscopy and RDTs in the field to detect malaria cases. The program, in conjunction with Provincial Health Offices, is establishing mechanisms to reach special high-risk populations in high-risk border areas through the development of special service facilities with RDTs. Furthermore, there are INGOs providing primary health care services to 140,000 refugees along the Thai-Burma border. Malaria diagnostic services in these camps are provided by the INGOs.

¹⁹Dr. Siv Sovannaroeth, Chief of M&E, CNM. MMP Partners’ Meeting presentation

Proposed FY2011 USG activities (\$360,000):

PMI will support the improvement of diagnostic services in Cambodia, Thailand and Burma through the provision of commodities, technical training of current and incoming microscopists including support for training on appropriate use of RDTs, and the strengthening of quality assurance of both microscopy and RDTs. With 2011 funding PMI will support the following activities:

1. **Procure RDTs and microscopy supplies for the cross-border focus areas.** The PMI will procure additional microscopes and microscopy kits (reagents, slides, lancets, etc.) to further improve laboratory capacity in cross-border focus areas along the Thai-Burma and Thai-Cambodia borders. Coordinating support from other donors, notably the Global Fund, PMI will procure equipment to fill gaps in the cross-border focus areas of Burma, Thailand, and Cambodia. Given the recent award to the Thai Government of Global Fund Round 10 grant, it is likely that these commodity gaps will be largest in Burma; however, the exact distribution has yet to be determined. (\$310,000)
2. **Strengthen appropriate use of microscopy including QA/QC systems.** The PMI will provide support to improve the use of diagnostics by developing and strengthening strategies to assist programs with ensuring high quality microscopy. For the cross-border focus areas, additional support coordinated with the community intervention program will include in-service training and supervisory visits for malaria microscopists, as part of a comprehensive program for laboratory diagnostics. Engagement of the private sector should be explored as appropriate in the cross-border focus areas. (\$50,000)

Malaria treatment

Background:

All of the malaria control programs in the GMS subscribe to early diagnosis and prompt effective treatment with ACTs. While this region was the first to pioneer the use of artemisinin combination therapy, not every country in the GMS was using ACTs in line with international standards. That has now changed and all six countries in the GMS promote the use of ACTs in their national treatment policy as the first choice for the treatment of uncomplicated falciparum malaria. Countries that have *P. vivax* transmission continue to use chloroquine as the antimalarial of choice to treat that species.

The immediate problem that is facing the sub-region is the development of parasites resistant to artemisinins. The BMGF-funded containment project is aimed at containing and potentially eliminating the resistant strain from the project areas along the Thai-Cambodian border. Unfortunately, through the routine therapeutic efficacy surveillance supported through USAID, other areas in the GMS are showing early warning signs of tolerance: the prolongation of the time necessary to clear the falciparum parasites from the patients' blood. These areas include the Thai-Burma border, the Burma-China border, and areas in southern Vietnam.

Proposed FY2011 USG activities (\$0):

Large quantities of ACTs have been programmed by other donors for 2011 and thus PMI will not invest in the procurement of antimalarial drugs with FY2011 funds.

Pharmaceutical management

Background:

Effective malaria case management requires that efficacious, high quality antimalarials are available and used appropriately by both provider and patient according to national guidelines. Incomplete or inappropriate treatment can lead to drug failures requiring additional treatment. In addition, sub-therapeutic drug levels can select for resistant parasite strains potentially rendering the first-line antimalarial regimen ineffective.

Burma

There are two ways that supplies are procured and distributed in Burma. One is through the VBDC and the other is through the Central Medical Store Depot (CMSD). The VBDC program distributes laboratory supplies and antimalarial drugs to Township Hospital and Township Health Departments (THD) in all townships in Burma. Additionally, they supply sub-national VBDC Teams located in the States and Divisions. The THDs then are responsible for the distribution to the Station Hospitals, Rural Health Centers, and sub-Rural Health Centers. The second system managed by the CMSD is within the Medical Care Services of the Department of Health. The CMSD purchases antimalarial drugs using government budget in consultation with VBDC program. CMSD distributes to all Township Hospital and Township Health Department. Since 2002, UNICEF has supported Supply System Management Officers whose duty it is to strengthen the supply and logistics systems within the Ministry of Health.

Per capita expenditures on health in Burma are among the lowest in the world.²⁰ Until recently, the national budget for all antimalarial drugs was estimated to be USD 7,000. With this budgetary level, few antimalarial drugs could be procured and thus stock-outs were frequent in the public sector. With increased donor support, the estimated budget for ACTs alone in 2010 increased to \$1,809,678²¹ although this has yet to be realized as the Global Fund grant was only signed in late 2010. It is envisioned that both the VBDC and CMSD will be challenged with the sudden influx of commodities made available through Global Fund support. UNICEF is reportedly continuing their work with the MOH to support improvements in procurement and distribution.

The PMI MOP team could not ascertain if there had been a recent evaluation of the Pharmaceutical and Supply Management system in Burma.

Cambodia

In Cambodia, like much of the developing world, the large majority of patients with febrile illness seek care in the private or informal sectors. This is due, in part, to the fact that the public health system is weak in Cambodia and commodity stock-outs have been a major problem for the program. There have been several hypotheses regarding the root of this problem, ranging from changes in the approval status of manufacturers to long procurement timelines associated with donor delays, and overcoming GMP hurdles associated with the post-marketing co-packaging of mefloquine and artesunate. In addition, the rural nature of the country and undeveloped infrastructure made distribution of malaria commodities difficult.

²⁰ <http://www.globalhealthfacts.org/topic?i=66>

²¹ National Strategic Plan for Malaria Prevention and Control, Union of Myanmar, 2010-2015

The Government of Cambodia, working with the NGO community developed a logistics system for essential drugs and supported the capacity building of staff within the Essential Drug Bureau at the central, provincial, and district level. A database for monitoring pharmaceutical commodities was developed in an integrated fashion combining essential medications with birth spacing commodities. The introduction of performance improvement plans resulted in improved supervision, and overall reduction in stock-out levels at health centers.

Outside of the public sector, patients suffering from febrile illnesses will purchase medications in either a recognized pharmacy staffed by a trained pharmacist, a Depot A staffed by an assistant pharmacist, a Depot B staffed by a retired midwife or nurse, or an illegal outlet. In an effort to improve the quality of antimalarials accessed in the private sector, PSI/Cambodia embarked upon a pilot project in 2002 exploring the possibilities of a socially-marketed ACT named Malarine (mefloquine plus artesunate). The pilot was successful and PSI scaled up the program which distributes Malarine through private clinics, pharmacies, and shops throughout rural Cambodia. By 2009, it was estimated that this program provided up to 75% of all ACT malaria treatments distributed in the country. PSI manages all aspects of the in-country supply chain and thus no stock-outs were reported resulting from breakdowns in the actual supply chain. Stock-outs that have occurred have done so because of delays in the procurement of Malarine into Cambodia.²² Other hurdles have included the high price of ACTs in the private sector leading to the use of artemisinin monotherapies, and poor overall coverage of ACTs in the private sector (~40% of private shops stock co-packaged ACTs).²³

The Government of Cambodia successfully bid on Phase I of the AMFm which is a funding mechanism aiming to enhance access to ACTs in the private and public sector. With support from AMFm, Cambodia aims to increase coverage of affordable, co-formulated ACTs to more than 60% of malaria patients and possibly delay the spread of drug resistance by eliminating the use of artemisinin monotherapies. This will be done through the development of a program involving a massive BCC campaign designed to increase demand, training of those involved with treating malaria patients on the provision of ACTs, strengthening regulatory frameworks, and developing approaches to reach the most at-risk populations.

Lao PDR

Laos has been awarded several Global Fund grants for malaria during the past decade under which much of their malaria commodities have been procured. Generally, the Procurement Unit of the Global Fund Principal Recipient procures the commodities, according to a forecast provided by the Lao NMCP. The pharmaceuticals are stored with the Medical Products Supply Center (MPSC) at the Ministry of Health. Once these are delivered to a warehouse in the capital, the medications and other supplies are then distributed to the provinces per the program's recommendations. The provinces subsequently supply the districts that supply the health centers that then ultimately provide commodities to the village health workers.

A USAID-funded assessment of the procurement and supply management system was conducted that highlighted several areas that needed to be addressed including developing a Standard Operating Procedure defining the procurement and supply management (PSM) responsibilities at each level, the improvement of storage conditions at the district and health center levels,

²² Large-Scale Malaria Treatment in the Private Sector: A Case Study of the Cambodian Experience

²³ AMFm application for Cambodia

implementation of an appropriate pharmaceutical management information system, improved quantification, and improved monitoring and supervision.

Thailand

In order to achieve the goal of early diagnosis and prompt treatment of malaria cases in Thailand, the national program must ensure that malaria commodities, generally delivered at the community level through malaria centers or posts, are properly managed.

A recent USAID-supported assessment of the PSM system in Thailand revealed that only 53% of the facilities visited had all the essential antimalarials and RDTs available.²⁴ The process of borrowing was a common way for malaria clinics to fill gaps and ensure availability of essential commodities. The assessment reveals a number of other issues including differences in prices the government was paying for malaria medications, no formal plans leading to uneven distribution, lack of temperature control for storage at the facility level, incomplete inventory management procedures, and a lack of a supervisory checklist specific for pharmaceutical management. The Thai national program acknowledges these weaknesses and is working on improving the current systems. The annual process currently utilized in procuring commodities supported by Global Fund Round 7 will be used for the newly acquired Round 10 grant as well.

Proposed FY2011 USG activities (\$120,000):

While there are still significant problems related to pharmaceutical procurement and supply chain management throughout much of the GMS, the USG-funded partners continued to have challenges finding an entry point. With the advent of PMI and commodities procurement in the GMS, both commodities procurement and strengthening pharmaceutical management will be supported by the same partner. Although PSM in the cross-border focus areas will be a priority, additional regional capacity building activities will be explored. With 2011 funding PMI will support the following activities:

1. **Pharmaceutical management strengthening:** Support PSM operations in the cross-border focus areas and address potential bottlenecks in procurement and distribution of malaria commodities (including Global Fund financed commodities) to ensure the availability of key commodities in the focus areas through monitoring, trainings, and support to distribution when needed. Support will be provided, as needed, for all GMS countries in the areas of forecasting, central level stock monitoring, supply planning and management and distribution of pharmaceuticals and RDTs. (\$120,000)
2. **Pharmaceutical management capacity building:** Provide technical assistance to ACTMalaria regional training courses on procurement and supply management which occurs every 2–3 years. (\$0)

Drug Quality

Background:

As stated above in this MOP, a key component to case management is ensuring that the antimalarial drug provided to the patient with malaria is of high quality. The USG has a strong commitment in the GMS to improve the quality of antimalarial drugs. Over the past decade,

²⁴ MSH/SPS: Assessment of the Supply Systems for Malaria in Thailand, July 2008: Final Report

USAID has supported the establishment of a regional approach to monitoring drug quality by training key staff within national programs and medicine regulatory agencies to travel into the field and periodically test randomly collected antimalarials for quality. The presence of counterfeit drugs with no active ingredient can result in the patient going untreated possibly leading to death. Substandard drugs, those with less than an appropriate amount of active ingredient leads to sub-therapeutic blood levels and may contribute to the development of drug resistance. Other key challenges faced by the GMS include inadequate QA/QC of medicines, weak regulatory enforcement, non-GMP-compliant manufacturers, and multiple brands on the market which make it hard to regulate.

The United States Pharmacopeia (USP), with support from USAID, has established a regional program of >30 sentinel sites that periodically monitor antimalarial drugs in the GMS countries. Over the past five years, in close collaboration with NMCPs, medicine regulatory agencies (MRA), and other local and national authorities, the program has been able to reduce the number of sub-standard and counterfeits located. This has been accomplished through a comprehensive approach including not only field monitoring, but also training of national quality control laboratory personnel and manufacturers in good manufacturing processes (GMP) with assistance from regional centers of excellence developed to enhance capacity building within the Asia region. Public education campaigns have occurred including the use of public service announcements, newspaper and radio campaigns, posters, etc.

Burma

Given the large amount of antimalarials available in the private sector, the high number of malaria cases in the country, and the relative poverty of the populace, Burma is vulnerable to the introduction and sale of counterfeit antimalarial drugs. There have been some reports of counterfeits in Burma resulting in patient deaths.²⁵

The work of the USAID-supported antimalarial drug quality program is only beginning in Burma. WHO conducted an assessment in 2009 and found that most of the staff trained to use the three minilabs in the country were no longer present nor were there sufficient supplies. In addition, the national reference laboratory at the Food and Drug Administration (FDA) only has one HPLC machine, one refurbished dissolution machine, and no standards for registration of malaria medicines. The assessment found that there was a severe need for investing in equipment, supplies, and training of the national reference laboratory.

Cambodia, Lao PDR, Thailand, Vietnam

Cambodia, Laos, Thailand, and Vietnam have had very active programs aimed at addressing the problems of sub-standard and counterfeit medications. Through the support of USAID and other donors, these countries have developed extensive networks of sentinel sites utilizing the portable minilab to do field testing of drug quality. In addition, USP has worked with FDAs, MRAs, and other authorities to develop appropriate enforcement approaches to regulate the drug industry. The countries also benefit from training obtained through the Asian Network of Excellence in Quality Assurance of Medicines (ANEQAM). ANEQAM is a network of university pharmaceutical programs providing technical assistance within the region to develop national capacities for QA/QC, GMP, and bioavailability testing.

²⁵ Newton PN, McGready R, Fernandez F, Green MD, Sunjio M, et al. (2006) Manslaughter by fake artesunate in Asia--Will Africa be next? PLoS Med 3(6): e197

China

Drug quality issues within China have been coordinated between the Government of China officials and the WHO. It has been determined that some of the counterfeit antimalarials coming into the GMS have originated from China; and WHO working with INTERPOL and national enforcement authorities has been successful in cracking down on some of the producers. The MMP is interested in having China join the other GMS countries in FY2011 in accessing the sub-regional antimalarial drug quality program resources so that the data collected by sub-regional programs can be better shared among the national authorities.

Proposed FY2011 USG activities (\$750,000):

The MMP has made tremendous strides towards establishing a drug quality network, periodically collecting field specimens for monitoring of drug quality, and working with national and international authorities to enforce drug manufacturing policies. In the areas where the programs are sampling, there has been a notable decrease in the presence of counterfeit or sub-standard malaria medications. To-date in China and Burma, there has been limited engagement with the sub-regional antimalarial drug quality program. The goal of PMI is to make these resources available to all the countries in the GMS and work in a concerted regional fashion to address the problem of poor drug quality. With 2011 funding, PMI will support the following activities:

1. **Drug quality surveillance network:** Maintain the sub-regional network of drug quality surveillance with increasing resources made available to Burma and China. This could involve the procurement of additional minilabs for the network. Continue to work with the GMS Food and Drug Administrations, MRAs, and other pertinent partners to ensure that national pharmaceutical reference laboratories are qualified to conduct the necessary analyses for pre and post- marketing surveillance of drug quality. This will be done, in part, through support to ANEQAM. Procure 1 HPLC, 1 dissolution test, and 1 UV spectrophotometer for the national reference laboratory in Burma. This support will include the necessary supplies and reagents as well as appropriate training in the use of the new equipment. This will also include collaboration with Interpol and other activities on enforcement as needed. (\$750,000)

COMMUNITY INTERVENTION and BEHAVIOR CHANGE COMMUNICATIONS

Background

Community intervention

In response to the documented failures of ACTs on the Cambodian-Thailand border, USAID began support specifically in western Cambodia in 2007 to increase focus on multi-drug resistance hotspots and to accelerate intervention activities at peripheral settings. USAID support supplemented the larger funding source that Cambodia had received from the Global Fund for malaria control for the whole country. Due to delays in implementation and challenges in reaching the peripheral health system, especially rural settings with Global Fund resources, this USAID-supported smaller, community intervention project in western Cambodia turned out to be instrumental in reaching remote, rural villages, gathering information from and reaching out to migrants, strengthening staff capacities in malaria diagnosis and treatment and in

promoting malaria prevention. The project may serve as a model for other remote populations in the GMS, where multi-drug resistant malaria is an emerging threat, to ensure quality diagnosis, prompt treatment and use of preventive measures.

There has been an apparent decline in malaria morbidity and mortality in the GMS for the past decade.²⁶ However, there remain certain areas where malaria continues to be a public health problem for the GMS countries, especially in Burma, Cambodia and Thailand. These areas are typically along their international borders (e.g. Burma-Thailand, Cambodia-Thailand), usually in the hard-to-reach parts of the country, and often associated with cross-border conflicts [Srisaket (Thailand)-Preah Vihear (Cambodia) border], or civil unrests (e.g. southern Thailand). Thus a program that targets malaria control management at a central level may not capture the on-the-ground situation in a timely fashion. As a result, FY11 MOP for the GMS will also focus on specific cross-border focus areas where malaria incidence remains higher than elsewhere, or areas recognized for high-level multi-drug resistance, especially those known or suspected for bearing artemisinin-resistant strains of *P. falciparum*.

Behavior Change Communications

IEC/BCC to educate and raise awareness in order to improve utilization of preventive and curative services is a key component of the malaria strategy in all the GMS countries. Although the appropriate medium and target populations vary across the countries, some form of interpersonal communication through the use of community-level workers and mass media to reach a wider audience is utilized.

In Burma, WHO, UNICEF, and JICA have supported VBDC in producing various IEC materials e.g. posters, pamphlets and television spots in multiple languages, including Shan and Karen. In 2007, WHO in collaboration with VBDC and other agencies working in malaria control developed a “*Communication and Social Mobilization for Malaria Prevention and Control in Myanmar*,” which has served as the framework for BCC activities in Burma since then. In Thailand and Cambodia, extensive efforts to develop bilingual Thai and Khmer language IEC/BCC materials have been supported through the containment project. Thailand has been developing materials for migrants and mobile populations as well as for schools. They have implemented mass health promotion and community mobilization activities in their transmission areas as well as more focused personal counseling and education through village health volunteers, migrant health volunteers, and migrant health workers. They are also exploring non-traditional collaborations with hard-to-access workplaces such as factories and plantations and faith-based organizations. In Cambodia, they deliver various IEC messages to improve utilization of prevention measures via radio and TV spots. Their targeted messages reach specific groups such as forest workers and pregnant women and cover topics such as ITN use in mobile populations, the importance of treating conventional bednets with insecticide and seeking early diagnosis and treatment, and rational drug use for malaria. Cambodia is also exploring school-based activities and input from different sectors e.g. education, women welfare, defense, and interior. Similarly in Lao PDR, they aim to maximize utilization of malaria services through IEC/BCC which include various methodologies e.g. targeted BCC through inter-personal communication between healthcare providers and their patients, health volunteers and peer group

²⁶ Delacollette, C., et al., *Malaria trends and challenges in the Greater Mekong Subregion*. Southeast Asian J Trop Med Public Health, 2009. 40(4): p. 674-691

educators to reach mobile populations, roadside bill-boards targeting border crossers and migrant workers, posters targeting patients attending public and private sector health facilities, radio and television news articles, and shows and advertisements targeting the overall population. CMPE will also support a vigorous IEC campaign in all provinces reorienting from control to elimination. Vietnam promotes IEC activities through both mass media and direct communication suited to each region and ethnic group. They aim to mobilize all sectors and communities especially in their malaria elimination areas. In China, IEC/BCC activities and target populations vary depending on the malaria burden of the county. For example in Type I counties with API>1/10,000, they focus on community outreach to improve health seeking behavior, whereas in Type IV counties that are malaria-free they target Chinese nationals traveling to malaria endemic areas with IEC/BCC pre-departure and screening of febrile travelers upon return.

In western Cambodia, URC has been visiting health facilities and communities to identify IEC/BCC needs for patients, community members, health care providers, managers, and mobile and migrant population. They have conducted a baseline survey in four provinces to better understand current practices and information provided to both the target populations and providers with regards to malaria prevention and control. They have drafted an IEC/BCC strategy which focuses on advocacy, community mobilization, public education using local media and mass media, and mobile migrant population. They have produced job aids for providers, pharmacists, and laboratories and posters, educational pamphlets, and billboards to be located at the entrance of highly endemic areas. URC is involved in Malaria Week, a large-scale IEC/BCC dissemination campaign in Cambodia, which occurs once per year to raise awareness about bednet distribution, treatment, and diagnosis through community and school-based activities. Another USAID partner, Kenan, has also worked extensively with schools to develop curricula and age-appropriate IEC/BCC materials through a previous project, Borderless Action Against Microbes.

Target Areas and Populations

The FY11 PMI MOP for the GMS will target remote, often rural, border areas, where there are insufficient resources and/or support through other mechanisms have been limited. Certain cross-border areas along the Thai-Burmese border (Maesot-Myawaddy, Sangkhlaburi-Payathonsu, Ranong-Kawthoung) and Thai-Cambodian border (Chanthaburi-Pailin, Trat-Koh Kong, Trat-Pailin) are of particular concern because of migrants and the threat of spreading artemisinin resistance. Furthermore, migrants entering Thailand contribute to 2/3 of malaria cases in Thailand.

Like several other malaria endemic areas in the world, mobile and migrant populations are often among the high-risk groups for malaria due to their increased risks of mosquito exposure, sub-standard living conditions, poor health education and limited access to existing health care services. In the GMS, the needs of these populations are underscored because of their potential to spread multi-drug resistant malaria from one area to another.

Economic migrants from Burma travel daily across the western Thai border and to all parts of Thailand seeking jobs and better living conditions. With minimal use of preventive measures, they are often sick upon arrival on Thai soil. While in Thailand, their access to treatment also varies, depending on their employers and their immigration status. In general, they have minimal health care access. INGOs provide general health care for Burmese refugees, but

services are limited to the nine refugee camps along the Thai-Burmese border, which are home to 140,000²⁷ refugees of predominantly Karen and Karenni ethnic origins.

New foci of artemisinin resistance are suspected in Kawthoung area of Tanintharyi Division in the southernmost part of Burma. The PMI support for community intervention intends to initially complement the Global Fund operations for malaria control in this area. Depending on logistic and political factors as well as the availability of funds, PMI support could possibly extend northward to include other states along the Thai border.

The public health system in Burma suffers several constraints and is unable to address the malaria burden in the country effectively. In addition, the termination of the Global Fund Round 3 in 2005 resulted in malaria control in Burma lagging behind their neighboring countries, with multiple Global Fund grants. In the last 5 years, support from the 3DF helped contribute to the recent drop in malaria incidence in areas of Burma where investments were placed. Global Fund Round 9, which has just started implementation, is expected to further reduce the malaria burden in Burma. However, more difficult to access villages, where malaria control support is most needed, have yet to be reached. In Burma, a way to more effectively engage the private sector is needed and the application of the ‘village health workers’ model for malaria diagnosis and treatment needs to be improved and expanded. Mobile malaria clinics have proven to be useful in some remote areas of Burma. Both of these mechanisms need to be further explored and appropriately modified for specific endemic, high-risk areas especially along the border with Thailand. All approaches should be in line with the National Malaria Strategic Plan (2010–2015) and be made in consultation with the National Malaria Control Program and other organizations/malaria stakeholders that have already had relationship and experience working with local communities. Logistical and political issues will need to be considered. Overall, an innovative community-based model to reach remote populations and to strengthen capacity of the public health facilities in the periphery of the health care system as was piloted in western Cambodia is needed.

In Cambodia, the health care infrastructure remains poor. Over the last five years, increased support to fight malaria in western Cambodia from the Global Fund, the BMGF, USAID, as well as other donors and stakeholders has contributed to a significant decline in the overall malaria morbidity and mortality to the level that malaria elimination is being considered nationally. While the public health system slowly improves in peripheral areas, the success of malaria control in those areas has to depend on alternative means such as by setting up a community-based, informal public system, through the use of trained Village Malaria Workers (VMWs) to provide malaria diagnosis and treatment at their homes or through Public Private Mix (PPM) by involving local pharmacies or drug sellers, who are usually more accessible to patients than the nearest health centers and rural hospitals. Cambodia’s new Global Fund Round 9 is expected to continue support to this part of the country to ensure that malaria incidence will further decline and malaria will eventually be eliminated. PMI support will help to fill any gaps that may exist or arise (due to the changing ecology and population mobility) in all aspects of control, namely, prevention, diagnosis, treatment and a close monitoring for therapeutic-failure cases as well as malaria cases in mobile and migrant populations.

Proposed FY2011 USG Activities (\$4,550,000)

²⁷ <http://www.tbcc.org/camps/2010-12-dec-map-tbcc-unhcr.pdf>

The PMI will focus on strengthening malaria prevention and control at the community level in selected cross-border focus areas of the GMS. Support should include malaria prevention, accurate diagnosis, prompt and effective treatment as well as a robust system of monitoring and evaluation (M&E). Depending on capacity of the existing public health system, the suitable approach for each area may be different and may vary from increased participation of village health workers, PPM, to an innovative community-based system. The PMI will also support rapid start up activities in Burma to establish linkages with the community and engage community representatives in malaria prevention and control efforts.

Planned activities with FY 2011 funding are as follows:

- 1. Strengthening Malaria Prevention and Control at the Community Level in Cross-border Focus Areas:** The PMI will help strengthen prevention measures in FY 11, with a particular focus on scaling up ITN coverage through LLIN distribution and re-impregnation of existing nets in all cross-border focus areas, but the need is projected to be greatest in southeastern Burma. This will include a possible gap analysis that takes into account other donor contributions. The PMI will also support community network activities through civil societies or PPM to encourage an increased use of nets. Additionally, PMI will also aim to support malaria health education through mass media, IEC/BCC materials, school health programs, etc. especially in eastern Burma. To strengthen, malaria diagnosis and treatment, the PMI will support the provision of technical assistance for clinical management at the district and village levels to improve quality of care among uncomplicated cases within the community and facilitate a prompt and effective referral to public facilities for complicated cases. This PMI support may include the development and training for the use of algorithms for community health workers on how to proceed with further clinical/laboratory investigations in order to reach the overall goal of reducing morbidity from febrile illnesses in malaria-endemic communities. The PMI will continue to strengthen QA/QC for both microscopy and RDT through training, refresher training, cross-checking of slides, RDT temperature control and development of job-aids for performing RDT testing in the field, etc. Local staff will be trained to support and maintain the national QA/QC scheme adopted by the NMCPs. The PMI also plans to assist community mobilization efforts to promote rational drug use (e.g. the ban of oral artemisinin monotherapy in drug outlets) and to raise community awareness about the dangers of counterfeit and substandard drugs working with other USAID-funded partners. (\$3,550,000)
- 2. Rapid Start Up and Bridge Activity for Community Engagement in Burma:** The PMI will initiate community activities and engage communities through a launch of initial start-up activities in Burma. These efforts will include establishing community level activities, identifying networks of community partners as well as engaging community representatives and traditional leaders in malaria prevention and control efforts. As part of the launch of activities, PMI will support mass media messages to promote general awareness and knowledge about malaria prevention as well as information about malaria treatment to strengthening treatment-seeking behaviors at the community level. PMI will support groundwork in the target areas, identify community based organizations and NGOs that will work in partnership, conduct some community formative research for the target districts, and gather programmatic data on net coverage, diagnostic/treatment coverage, etc. This should be with the view to collaborate and transition activities to the RFA awardee. The PMI will identify a jump/kick start rapid activity in Burma such as an LLIN distribution campaign to raise awareness about malaria prevention and control efforts. (\$1,000,000)

EPIDEMIC SURVEILLANCE AND RESPONSE

Background:

With the progress made in the sub-region, larger geographic areas are now considered malaria-free or low-risk for malaria resulting in waning immune status of the population. This biologic vulnerability combined with large population movements of people harboring parasites to low-risk/ malaria-free areas and non-immune populations into high-risk areas put the region at risk for epidemics. Although no large outbreaks have been reported in the region recently, a disastrous epidemic occurred in Burma in 2001 with an estimated 1,000 deaths, and large *P. vivax* outbreaks have occurred in central China. Through Global Fund support, most countries in the region have been strengthening their surveillance systems to be able to identify outbreaks in a timely fashion and to mount a rapid and decisive response to any future outbreaks. For example, Vietnam is expected to have 95% of commune level health centers participating in their outbreak early detection system by 2012. China has moved to real-time, web-based monitoring of malaria cases and Thailand has piloted a web-based, GIS-based electronic surveillance system in the BMGF-funded containment project provinces on the Thai-Cambodian border.

WHO has been the main USAID-funded partner in the GMS addressing the issues of epidemic surveillance and response. They provide technical assistance to NMCPs in utilizing the WHO-developed outbreak detection database system and developing SOPs for outbreak detection and response. They have also been involved with developing and testing epidemic prediction systems and early warning systems. With varying epidemic potential and surveillance capabilities across the six GMS countries, no efforts to standardize outbreak detection and response have been proposed for the sub-region.

In the elimination setting, even one local case is considered an outbreak and a response must be launched. Under GMS-RID, Kenan continues to work on developing a malaria elimination surveillance and response model for Phuket Province, and Thailand with plans to expand activities to the southeastern border of Thailand and Cambodia (Trat province in Thailand and Koh Kong province in Cambodia). These efforts to prevent reintroduction will become increasingly important in the GMS as countries move toward plans for sub-national and national elimination. In Phuket province, Kenan has worked with the provincial health department in order to set-up a small vertical staff to conduct case investigation, and subsequent response activities of mass blood surveys and vector control measures. They have held meetings on applying effective practices and lessons learned for developing a strategy for malaria elimination in Thailand and engaged the private sector to mobilize public-private partnerships for healthy tourism and elimination of malaria.

Planned activities with FY 2011 funding are as follows: (\$320,000)

1. Maintaining surveillance and response in low transmission and elimination

settings: Develop replicable approaches for maintaining MOPH surveillance and response capabilities in elimination provinces of Thailand, e.g. Phuket; the lessons learned from trying to maintain a state of zero local malaria transmission in Phuket will be shared with and replicated in other provinces that are approaching this state; continuation of surveillance activities in previously BMGF-funded containment project areas (Trat). (\$320,000)

STRATEGIC INFORMATION

Monitoring and Evaluation: Regional

USAID funded development of the Bi-regional Malaria Indicator Framework (BMIF) in order to create an updated, GMS-specific M&E framework. The BMIF was developed through the joint efforts of the NMCPs of the six GMS countries, WHO, USAID, CDC, and the Malaria Consortium, with leadership from MEASURE Evaluation. The framework has been harmonized with the WPRO Regional Action Plan to Control and Eliminate Malaria as endorsed by the Regional Committee Meeting in 2009 and was presented to the 16th RBM Monitoring and Evaluation Reference Group Meeting (RBM-MERG) in Cambodia in February 2011. With the finalization of the BMIF, technical partners in the region (WHO, CDC, MC) have been and will continue to assist the NMCPs in adopting this framework and streamlining their various reporting requirements. The updated M&E framework is expected to guide the multiple existing-donor driven M&E needs and assist countries in developing national M&E plans. Cambodia hosted the first country-level Workshop to *Develop and Strengthen Malaria Monitoring, Evaluation and Surveillance* with support from USAID-funded technical partners. The workshop reviewed the current national malaria strategic plan and reviewed and harmonized the performance framework for Global Fund Round 2, RCC, Round 9 consolidated grant with the indicators from the national malaria program and the BMIF. Technical assistance has also been provided to Vietnam to adopt the BMIF into their new national M&E plan.

The BMIF includes indicators that require data generated through both the routine HIS and from surveys. Malaria has been integrated into the HIS in all the countries and is a reportable disease. The HIS and its capacity in the GMS vary widely from paper to web-based surveillance and from passive case detection unable to parasitologically confirm all the cases to conducting active case detection activities. Whether a web-based surveillance system based on confirmed cases only is in place, e.g. in China and the containment zones of Thailand, or a paper-based system reporting large number of probable cases e.g. in Burma, certain challenges and limitations common to most surveillance systems exist throughout the countries in the GMS. These challenges include delays in reporting, completeness and the collection of data limited to the public sector. Most programs struggle with collecting data from the periphery such as from Village Health Volunteers (VHV) and from the private sector, military, and migrants. The collection of data from the private sector poses a major challenge in Cambodia and Burma. With high utilization of the private sector in both these countries, estimating the true burden of malaria and delivering quality services remains problematic. PSI, a provider of private sector malaria care both in Cambodia and Burma, has started a pilot incentive program in Cambodia to provide free RDTs to providers in exchange for collecting information for a set of key malaria indicators. Other common limitations are providing feedback and supervision, poor information technology structures limiting the use of computers and timely reporting of data, and weak capacity for data management and analysis, especially at the periphery. Often the data is not disaggregated by the factors of interest e.g. age, gender, ethnicity, migrant status, or occupation that are epidemiologically pertinent. The process of adopting and actually collecting the data for the BMIF indicators will likely highlight weaknesses and limitation of the existing systems.

To assist NMCPs to effectively adopt the BMIF and to build M&E capacity, a regional M&E curriculum is being developed. The curriculum will be developed by the M&E technical partners

led by MC. ACTMalaria with approval from their advisory board of all NMCP managers from the sub-region will coordinate the course.

Also at the regional level, it would be useful and desirable for the numerous implementing agencies to work from a common statistical database and share priorities for both programmatic interventions and data collection. The Faculty of Tropical Medicine at Mahidol University led previous efforts to gather and synthesize available information in 1999 (<http://www.tm.mahidol.ac.th/seameo/journal-30-4-1999-spp.html>) and in 2002 (<http://www.tm.mahidol.ac.th/seameo/2003-34-spp-4/Mekong-Malaria-II-content.pdf>) but much has changed since then. There is a need for updating, and for consensus-building about priorities among program staff and donors. It would be helpful to have an updated overview of malaria in the region similar to the Mekong Malaria II publication with an analysis of strategic priorities for learning and analysis. Three potentially major outcomes are anticipated: 1) an analysis of what is known about the development and spread of resistant malaria; 2) a review of public and private efforts to control malaria and prioritization of feasible donor and government interventions; and 3) some consensus among regional experts and leaders about shared interests and potential regional strategies.

Monitoring and Evaluation: Cross-border focus areas

Monitoring of PMI's activities in the cross-border focus areas will require strengthening the collection of routine data, and collection of survey data from resident households and migrants. The majority of the indicators to be monitored by PMI will come from routine surveillance data except for key ITN ownership and use numbers. M&E activities in the GMS have traditionally focused on routine surveillance systems and not cross-sectional surveys with the exception of Cambodia. Malaria Consortium has successfully supported Cambodia in conducting national malaria surveys which included household, health facility, and private sector questionnaires. These surveys have provided national malaria prevalence as well as ITN ownership and use estimates. Following the baseline survey data collection, PMI will reassess the need for on-going large cross-sectional surveys. ITN ownership data from the baseline surveys will be triangulated with programmatic data on number of ITNs distributed and retreated to assess the robustness of program data.

Planned activities with FY 2011 funding are as follows: (\$755,000)

Activities at the regional level (\$505,000):

- 1. Support to regional M&E activities and surveillance strengthening:** Adopting BMIF and supporting NMCPs in developing national M&E plans. A national M&E plan in line with the principles of the "Three Ones" will drive efforts to consolidate and harmonize different donor reporting requirements in order to improve the quality of donor reporting and decrease the reporting burden on the programs. The PMI will support providing technical assistance to countries undertaking national-level household surveys to estimate coverage of malaria control interventions and prevalence to ensure a representative and programmatically relevant evaluation. The PMI will support the M&E Network of technical partners and NMCP M&E focal points to improve coordination of M&E activities in the sub-region. The PMI will support NMCPs to strengthen routine data collection and reporting to collect the BMIF indicators, as well as data analysis, and use of data for decision making. Support collection of quality, disaggregated surveillance (e.g. migrant status) and follow-up data and timely analysis for programming purposes in all GMS countries with an emphasis on the

cross-border focus areas. To continue efforts to routinely track red-flag signs of emerging artemisinin resistance, the PMI will support analysis of follow-up data to map proportion of day 3 positives cases throughout Thailand and Cambodia. To move beyond the public sector, technical assistance to support engagement of the private sector in Cambodia and Burma in routine data collection as well as NGOs in Thailand will be provided. (\$170,000+ \$195,000)

2. **M&E Capacity Building:** M&E curriculum development to be facilitated by ACTMalaria with technical input from CDC/MC and the M&E Network. This curriculum has been identified as a priority topic by the member countries of ACTMalaria. The M&E curriculum will include an overview of general M&E components with specific modules addressing the new BMIF indicators and the data collection activities needed for the GMS. This course will serve as a training platform to assist countries in the rapid adoption of the BMIF indicators. This curriculum will focus not only on building capacity at the national level, but aims to train M&E educators within the NMCPs able to conduct cascade training to build their provincial/district-level capacity. (\$50,000)
3. **Situation Analysis for Strategic Information:** Support efforts to begin work on a situational analysis of malaria in the Mekong region by convening a small group of experts. The output of this exercise would be a scientific and programmatic review and identification of strategic and programmatic priorities for regional partners. This would include updating both epidemiological and entomological data and analysis on relationships with health systems, program costs and financing, community involvement, private sector engagement, and cross border collaboration. The analytical review would also discuss projected regional trends in socio-economic development, migration, and other factors likely to affect malaria transmission. (\$90,000).

Activities limited to the cross-border focus areas (\$250,000):

4. **Support for M&E data collection for the cross-border focus areas:** Evaluation data will be collected through regularly scheduled household and migrant surveys in the cross-border focus areas as well as strengthening collection of routine health facility surveillance data. Cambodia conducted a national survey in 2010, which should provide baseline data for Pailin. Household surveys assessing baseline coverage and malaria prevalence will be conducted for Ranong and Trat in coordination with Thailand’s national malariometric surveys. Similarly, collection of baseline data for Kawthoung will be coordinated with Burma’s Global Fund Round 9 malariometric survey. Migrants and mobile populations, the high-risk groups in the cross-border focus areas, are often not captured by traditional survey methods. Additional data collection activities such as respondent driven sampling (RDS) methods, which have been piloted in the BMGF-funded containment project, will be deployed in settings of mobile and migrant populations. Baseline RDS studies have been conducted in Trat in 2009 and in Pailin in 2010 as part of the containment project. A baseline RDS in Ranong is also planned for 2011 with USAID FY10 funding, which leaves only Kawthoung without baseline data on mobile populations. As some baseline data already exist, FY11 funds will be required to collect baseline migrant data from Kawthoung and baseline household data from Kawthoung, Trat, and Ranong. (\$250,000)

Table 9. Baseline survey requirements for the cross-border focus areas

Area	HH survey plans	HH survey source (costs)	Migrant survey plans	Migrant survey source (costs)
Pailin, Cambodia	Cambodia national malaria survey	BMGF and GF (\$158 k for ~50	RDS 2010*	BMGF

	2010*	clusters)*		
Trat, Thailand	National survey planned with GF R10 in 2012	PMI FY11 (\$50k)	RDS 2009*	BMGF
Ranong, Thailand	National survey planned with GF R10 in 2012	PMI FY11 (\$50k)	RDS 2011*	USAID FY10 (80k)
Kawthoung, Burma	National survey planned with GF R9 in early 2012	PMI FY11 (\$70k)	RDS early 2012	PMI FY11(80k)
Total		PMI FY11 (\$170,000)		PMI FY11 (\$80,000)

*Survey completed or planned; HH: household; BMGF: Bill and Melinda Gates Foundation; GF: Global Fund; RDS: Respondent- driven sampling

Surveillance: Therapeutic Efficacy

Background:

Resistance to antimalarial drugs has been a long standing problem in the GMS. While studies have reported varying degrees of drug resistance throughout the GMS, resistance has been most pronounced on the Thai–Cambodian border. Since 1991, drug efficacy monitoring has been carried out in several sentinel sites. This has led to the recognition of emerging artemisinin resistance at the Thai-Cambodian border.²⁸ Historically, a significant contributing factor to drug resistance in this region has been the extensive population movement among gem-miners, soldiers, refugees and plantation workers in this part of the country. Another related issue is the widespread availability of fake antimalarial drugs.

Since 2000, USAID has supported several regional meetings to address this important issue starting from the *Monitoring Resistance to Anti-malarial Drugs* in Phnom Penh, Cambodia in 2000 to the most recent *Workshop to review and plan therapeutic efficacy studies to monitor P. falciparum and P. vivax resistance to anti-malarial drugs in the Greater Mekong Sub-region* held in Mandalay, Burma in 2009.

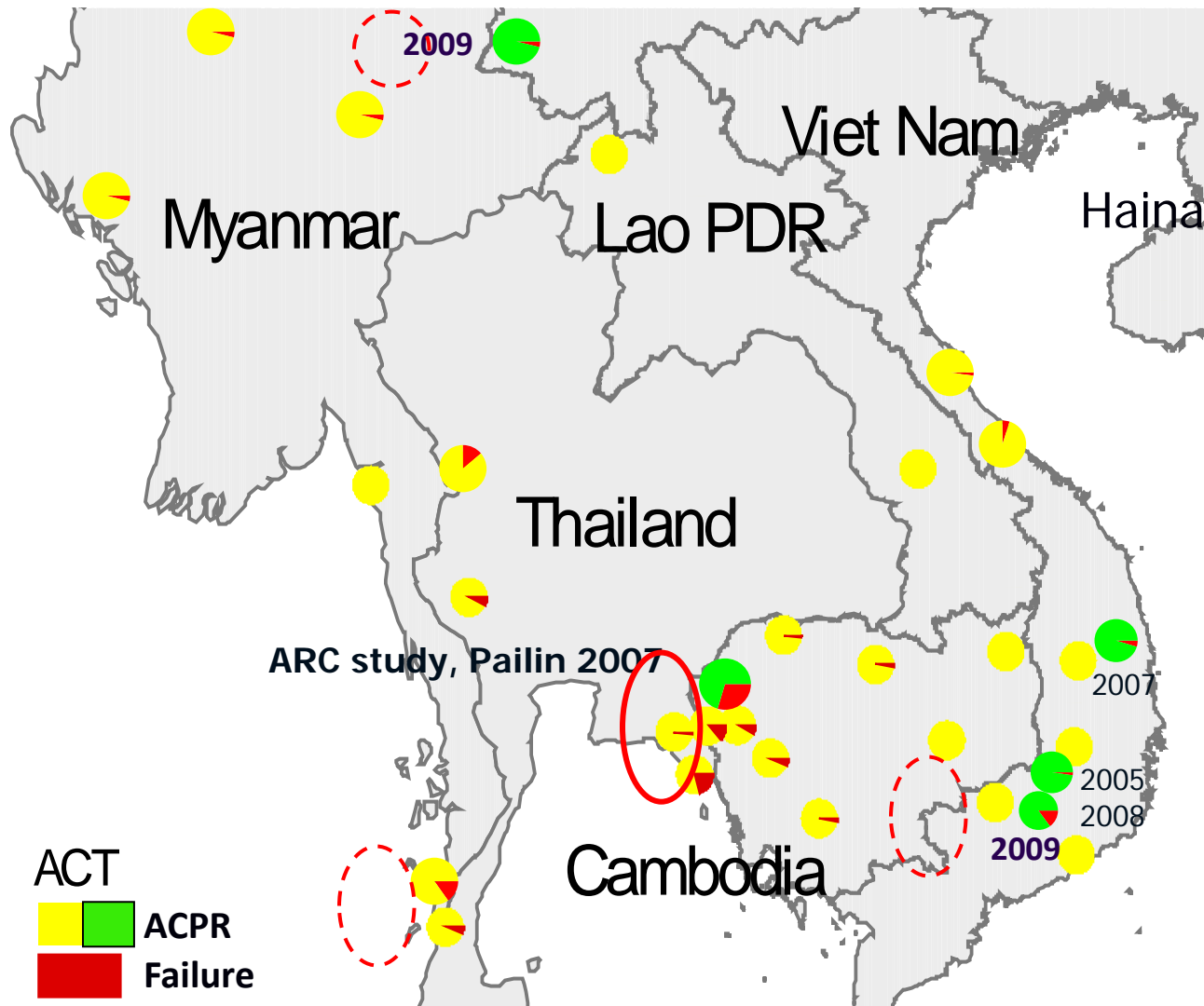
The Therapeutic Efficacy Study (TES) network in the GMS supported by USAID is one of the strongest regional TES networks and serves as a model for other regions. Currently, 35 sentinel sites are active in the six countries on a rotating basis (Cambodia- 8 sites with 4 alternating every two years; China- 2 sites in Yunnan; Lao PDR- 2 sites; Burma-8 sites with 4 alternating every two years; Thailand- 9 sites with 4-6 alternating every two years; Vietnam- 4 to 5 sites). This network has been strengthened in the past few years to include chloroquine-resistance *P. vivax* monitoring and to extend its geographic coverage. WHO, which coordinates this network, has been updating the database on drug resistance, convening regular network meetings to share data and publishing periodic reviews of the country data. The recent WHO report *Malaria: in the Greater Mekong Subregion* reviews the therapeutic efficacy data from 2001 to 2007 for the six GMS countries. They have focused on improving the quality of the TES data through standardizing the protocol and operating procedures around microscopy QA, data management

²⁸ World Health Organization. *Containment of malaria multidrug resistance on the Cambodia-Thailand border, Report of an informal consultation, Phnom Penh, 29-30 January 2007*. SEA-MAL-246.

and monitoring throughout the region. They have also contributed to the implementation and evaluation of the containment strategy and drug policy formulation.

Although these sentinel sites have now been maintained for several years and remain a priority of the NMCPs, the network faces several challenges. Due to the tremendous progress made in the region and thus a decline in malaria incidence, timely recruitment of patients has been a challenge at most sites. They have also faced some technical challenges around clinical trial registration, timely data entry and data validation, and report writing/publication.

Efficacy of the ACTs and AS7 mono- in the Greater countries, 2002 - 2009



* Yunnan, China and Vietnam tested 7-day ASU monotherapy in 2008-

Source: TES ACT Failures presentation by Dr. Dorina Bustos at WHO-MMP meeting, Phuket, Thailand, 2009

Planned activities with FY 2011 funding are as follows: (\$1,000,000)

1. **Regional TES network:** PMI will continue to support the NMCPs conducting therapeutic efficacy studies in the six countries. Along with testing the current first-line regimens, testing replacement first-line therapies is imperative especially as countries prepare to update

their treatment guidelines e.g. in Thailand. WHO will continue to provide TA around developing the guidelines for microscopy QA, maintaining a slide bank, and reviewing national drug policies. (\$1,000,000)

Surveillance: Molecular determination and surveillance

Background:

With the extensive TES network supported in the region, improving the molecular capacity of the national laboratories to distinguish true treatment failures (recrudescence) from re-infection, which is a standard component of falciparum *in-vivo* studies, became a priority for the MMP. Although, some countries had existing in-country academic institutions with this capacity, the national laboratories in the GMS had varying levels of infrastructure and personnel from having nothing in place to full capacity.

Since October of 2009, University of Maryland/Baltimore has been providing TA and support to the national laboratories with tailored training. They have begun working with laboratory counterparts at the NMCPs to: (1) strengthen the capacity to genotype and distinguish recrudescence from reinfection through training and mentoring, (2) establish and coordinate a network of molecular laboratories, (3) provide TA for laboratory and network system management, and (4) provide technical support for IT and information sharing. Further work toward implementing this network included establishing reference laboratories to provide support to network laboratories. The two laboratories serving in that capacity are Mahidol University Faculty of Tropical Medicine and University of Maryland School of Medicine. They developed a standardized tool and assessed the capacity and needs of NMCP labs in Cambodia, Thailand and Vietnam. Their initial focus was on labs in Cambodia, Lao PDR, Thailand, Vietnam, as well as the Mahosot Hospital/Wellcome Trust Unit lab in Vientiane Lao PDR. They plan to engage China and Burma in FY2010, and to provide training and support to improve surveillance of drug resistant parasites. Training materials cover: 1) techniques in genotyping including DNA extraction, polymerase chain reaction, and gel electrophoresis to differentiate recrudescence from re-infection; 2) general lab safety; 3) collection, transport and storage of DBS specimens; 4) implementing internal quality assurance and quality control measures; 5) required recordkeeping and retention; and 6) effective and efficient supply management. They have conducted their inaugural training which will occur on an annual basis. They plan to provide ongoing training on best laboratory practices, and provide guidance through developing 11 standard operating procedures (SOPs) for specimen handling, genotyping methodologies and interpreting results. They also developed an external quality assessment program that will include proficiency testing twice a year for distinguishing recrudescence from reinfection. They will provide additional support for improving surveillance by: 1) implementing cross-sectional surveys in 3-4 sentinel sites in each country that are not already collecting specimens for the TES studies; 2) providing IT support and technical assistance to improve data management and data sharing; and 3) providing assistance with ethic committee reviews, data analyses, and preparation of manuscripts.

Planned activities with FY 2011 funding are as follows: (\$276,000)

1. **Regional molecular surveillance and capacity:** PMI will continue to build capacity within the national laboratories for distinguishing re-infections from recrudescences for the therapeutic efficacy studies. PMI will support establishing and strengthening a molecular surveillance network for the sub-region. (\$276,000)

Surveillance: Entomology

USG support to entomological services in the GMS is new. Entomological resources exist in each of the GMS countries, with trained senior staff, but with limited activities aside from OR projects. There are also individual foundations, universities and research institutions supporting small-scale entomology studies.

Forested areas, and possibly some plantations, are home to the world's most efficient malaria vector, *An dirus* s.l., with a second major vector, *An minimus* s.l., found in the forest and forest-fringe areas, also possibly moving into the new orchard and rubber plantation ecologies. Beyond these two major vectors there is a plethora of "secondary" vectors, particularly in Burma whose importance in these rapidly changing ecologies is still largely unknown. In light of these changing ecologies, there are four areas of entomological monitoring or surveillance that need to be addressed:

1. The first critical parameter is the location of these vectors, especially as forests are cut for farming – with little shade canopy – or for orchards and rubber plantations, which may mimic the original forest ecology. Malaria programs need this most fundamental piece of information: where there is risk of malaria transmission and where there is not.
2. Second is vector biting time and place in relation to humans, and the potential impact of treated nets. Published studies are scarce, but as described below, for most of the region, and for the most important vector, *An dirus* s.s. biting peaks are generally late enough, after 2100 or 2200 hr that treated nets have an impact. The one published study showing no impact was in western Burma where *An dirus* and *An minimus* were not present, and with the exception of *An annularis*, the other 'minor vectors' fed soon after dusk.
3. Third, and presumably less important compared to Africa, is insecticide resistance. Studies are limited, but pyrethroid resistance does not appear widespread. Nevertheless, due diligence demands that this be tracked.
4. Finally, there is a set of OR issues around personal protection 'outside the house'. A number of commercial partners, foundations and research institutions are interested in supporting these additional preventive measures, including treated hammocks and hammock nets, treated clothing and temporary shelters, and topical and spatial repellents.

This FY11 MOP is investing a modest amount into entomology; it is expected that this can be a catalyst to partners and to help focus what other resources may be in the region to address these critical issues.

Planned activities with FY 2011 funding are as follows: (\$420,000)

1. **Strengthening of entomological support for mapping and insecticide resistance monitoring across the Mekong region:** Working through the WHO-MMP network, and in collaboration with ACTMalaria, PMI will facilitate entomological services, particularly for vector mapping and resistance monitoring. This will be done through a) inventory entomological resources in the region; b) convene regional entomological workshop where common protocols and strategies for mapping and resistance monitoring will be developed. There will also be a small contingency fund to fill gaps for follow-on activities. (\$220,000)
2. **Determination of vector transmission ecology in relation to current LLIN deployments in focused intervention area:** PMI will support enhanced entomological monitoring in the cross-border focus areas on both sides of the Thai-Burma and Thai-Cambodia border where there will be more focused interventions by PMI implementing partners. Entomological

monitoring will include vector presence and biting times to help determine the impact of program treated net distributions – including both treated hammock nets and treated traditional bednets. In addition, PMI will contribute to the RBM network for applied research into personal protection for mobile populations in this region. (\$200,000)

Operations Research

Background:

This region has been at the fore-front of malaria research, especially in the area of case management as the issues of drug resistance has forced the region to repeatedly introduce new regimens. The GMS faces additional challenges in exploring different surveillance strategies for lower transmission and elimination settings, vector control interventions that may or may not be effective for the vectors, as well as management of *P. vivax* in light of increasing chloroquine resistance. Thus, OR is essential in assessing innovative preventive and curative interventions and subsequent scale-up of these interventions in the Mekong context. Although numerous research partners exist in the region, many OR questions relevant to the control programs to improve decision-making and efficiency in delivering malaria care and control go unanswered. Furthermore, research agendas can be fragmented and often not operationally relevant to the control programs.

With support from USAID, WHO has conducted on-going field studies in Cambodia and Lao PDR to explore non-malarial causes of fever in a context of decreasing malaria transmission. They are also working with Institute Pasteur Cambodia to test a point of care G6PD deficiency test in Cambodia. To date, URC has conducted several OR projects. These include a socio-anthropological study conducted by *Institut de Recherche pour le développement* on mobile and migrant populations in western Cambodia, day three blood smear positive surveillance of *P. falciparum* malaria at community level as part of the pilot project in two health center catchment areas, mapping of hospitalized *P. falciparum* malaria cases for the patterns of drug resistance markers, and a study of RDT quality under field conditions.

To identify the priority OR questions for the GMS, an OR symposium was convened for the sub-region. Prior to the symposium, country level assessment of their current OR activities, priorities, and gaps were identified and synthesized for the regional meeting. This regional symposium facilitated the development of an OR framework for malaria control and elimination in the GMS, by identifying common regional malaria research priorities, facilitating linkages across the region, and promoting greater coordination and sharing of findings. The symposium identified several priority questions for six topic areas (vector control and prevention, case management, vivax and G6PD, vulnerable populations, M&E and surveillance, and health systems and private sector).

Planned activities with FY 2011 funding are as follows: (\$100,000)

- 1. Field testing of point of care G6PD test:** Although all GMS countries are expected to provide radical treatment for *P. vivax*, most countries lack the capacity to test for G6PD deficiency at the peripheral setting and thus do not provide primaquine therapy. The challenges of administering primaquine in settings of unknown G6PD status again arise in Pf cases where ACTs are supplemented with primaquine in order to accelerate gametocyte clearance and thus reduce malaria transmission. Some countries such as China and Thailand have incorporated primaquine treatment in their case management of both *P. vivax* and

P.falciparum without prior G6PD deficiency testing. Other countries such as Lao PDR will not initiate any primaquine therapy without individual G6PD results. Field-testing the G6PD rapid tests in these settings and monitoring the hematologic response to treatment based on the RDT results can provide the evidence for the programs to safely deploy primaquine treatment. (\$100,000)

CAPACITY BUILDING

ACTMalaria is an inter-country training and communication network which includes NMCPs of Bangladesh, Cambodia, China, Republic of Indonesia, Lao PDR, Malaysia, Burma, Philippines, Thailand, Timor Leste, and Vietnam. Since 1996, ACTMalaria has been a primary mechanism for building technical and management capacity among the countries in the GMS. The ACTMalaria Secretariat is located in the Philippines, while the chair of the Executive Board rotates every two years. In FY2011, PMI will continue to support ACTMalaria through a sub-grant from WHO. While continuing their work with the Management of Malaria Field Operations, Quality Assurance for Diagnostics, and Integrated Vector Management courses, they will continue to explore new curricula as identified by the executive board of NMCPs.

Planned activities with FY2011 funding are as follows: (\$350,000)

1. **Regional training courses:** Coordination and facilitation of training courses to build the capacity of NMCPs and their workforces, especially related to critical health systems bottlenecks, such as supply chain management, disease surveillance and reporting, monitoring and evaluation, and laboratory diagnostic services. Several courses addressing these bottlenecks include the Management of Malaria Field Operations, Quality Assurance for Diagnostics, and Integrated Vector Management. A course focusing on M&E in light of a new M&E indicators framework for the region will be added to their portfolio. (\$350,000).

COORDINATION

Coordination and communication among PMI and partners is key to the success of these efforts in the GMS. This is now more important than ever, as there are a number of new partners, foundations, and agencies supporting activities in the sub-region, especially with the emergence of artemisinin resistance. There is a danger that partner strategies and investments developed in isolation could imbalance the overall regional efforts.

Support to the WHO-MMP and its subcontract to ACTMalaria provides a strong and well-established mechanism for coordination among the six NMCPs and the PMI implementing partners. WHO-MMP, formerly the RBM-Mekong Programme, has been a coordinating body bridging the two WHO regions since 1998. Likewise ACTMalaria, established in 1996 comprises on its executive committee the NMCP directors from the six national programs, plus those from five additional surrounding countries. Therefore, PMI will continue to support the WHO-MMP and ACTMalaria as the central coordinating mechanism for activities in the sub-region. New partners, including universities, foundations, bi-lateral and international agencies will be encouraged to ensure their investments are coordinated with the national programs and WHO-MMP.

Planned activities with FY2011 funding are as follows: (\$630,000)

1. **Regional Coordination:** PMI will support WHO-MMP to coordinate bi-regional offices of SEARO and WPRO, convene Mekong Malaria Program Partners' Meeting, and support WHO country programs (Burma, Cambodia, China, and Vietnam). WHO-MMP also helps to coordinate and harmonize strategies in the region as well as assist USAID-supported partners to engage with NMCPs. (\$630,000)

INTEGRATION WITH OTHER GLOBAL HEALTH INITIATIVE PROGRAMS

The HIV/AIDS epidemic appears to have stabilized in the countries making up the GMS. Thailand is the only country with an HIV sero-prevalence as high as 1%, and its epidemic appears to be stable overall with a fall in incidence between 2001 and 2009. Across the sub-Region, most infections continue to occur in people who inject drugs, sex workers and their clients, and men who have sex with men, but as the epidemics mature, HIV is spreading more widely, with women accounting for 35% of all infections in 2009, compared with just 21% in 1990. There have been limited opportunities for integration with the USAID-funded HIV program in the GMS, as they focus mostly on prevention activities in their high-risk populations that differ from the high-risk populations for malaria. However, several USAID-funded malaria partners work on an integrated, multi-disease platform. For example, USP not only works to strengthen anti-malarial drug quality, but also tests influenza and tuberculosis drugs. Kenan also has an integrated infectious disease portfolio focusing on elimination and AED worked across influenza, malaria, and dengue.

PUBLIC-PRIVATE PARTNERSHIPS

Public-Private Partnerships

Public-Private Partnerships in the GMS can be divided into three broad areas: private practitioners and the private pharmaceutical sector; the private mosquito net sector; and private workplace programs.

Collaboration with the private practitioners and the private pharmaceutical sector

Cambodia has been doing extensive work with the private pharmaceutical sector. Partners involved with the private pharmaceutical sector include ACTWatch²⁹, USP³⁰ and PSI³¹ and the URC Project³². The draft Cambodia National Strategic Plan 2011–2015 emphasizes the need to improve malaria case management in the private sector and proposes to revise the ‘Malarine and Malacheck Project’ following an in-depth external evaluation. Second, with PSI, the CNM will provide training and follow-up supervision for early diagnosis and treatment to 4,200 private providers in 20 malaria endemic areas during 2011–2012. With PSI, there will also be an expansion of the medical detailer program to reach providers and different types of unregistered drug outlets in rural areas. Although Cambodia is an AMFm pilot country, these activities have

²⁹ http://www.actwatch.info/countries/general_information.asp?00=1&01=29

³⁰ <http://www.usp.org/worldwide/>

³¹ <http://www.psi.org/cambodia>

³² <http://www.urc-chs.com/news?newsItemID=105>

been delayed due to challenges in procuring DHA-Pip. The details of how best to scale-up AMFm in the setting of emerging artemisinin resistance are being addressed currently.

In Burma, PSI supports the “Sun Quality Health Network”, a franchise of licensed general practitioners serving low-income populations. As of December 2008, the network included 548 clinics, located in 126 townships, which were providing malaria diagnosis and treatment (the network tested 86,600 fever cases and treated 33,700 confirmed malaria cases in 2008). Similarly, the Myanmar Medical Association, with the support from Global Fund (Round 3), 3DF and WHO, has a network of private general practitioners (160 as of end of 2008) under its project “Quality Diagnosis and Standard Treatment of Malaria”. The private general practitioners are being supported with training and logistics to deliver quality-assured diagnosis and treatment of malaria. This is being expanded, and by the time Global Fund Round 9 implementation starts, it is expected that 325 private providers will be part of the network. In addition, with support from WHO and in collaboration with the VBDC, the Myanmar Medical Association is conducting continuing medical education to promote rational diagnosis and treatment of malaria.

In Thailand, antimalarials are prohibited in the private sector, and there is minimal engagement of private practitioners and the private pharmaceutical market.

Collaboration with the private sector for increased access to treated mosquito nets

While there is an entrenched “net culture” and vibrant private market for untreated nets, the PSI bundling program in Cambodia is the only current active collaboration with this sector. As described in the ITN section, PSI is bundling long lasting insecticidal treatments to the wholesale mosquito net distributors (Cambodia imports 900,000 untreated nets each year). At the same time, many of the WHOPES-approved LLIN companies manufacture their nets in the region – but for export or sale to public-sector programs and not to private institutional buyers or the retail markets. Discussions are underway through RBM and WHO to understand better the barriers to domestic retail sale of LLINs in the region. If these can be overcome, and a local market, especially for workplace programs by institutional buyers established, there may also be engagement with the commercial LLIN sector for broader, region-wide, communications and marketing related to malaria and LLINs.

Workplace programs

Cambodia, Thailand and Burma all have experience in developing “workplace programs” for malaria. In Cambodia, URC works with commercial farms in Western Cambodia to test a model of renting out LLINs to seasonal farm workers through farm owners. In Thailand, Kenan works with rubber plantation owners in Phuket to provide services to the largely Burmese workforce. Also in Thailand, under the BMGF-funded containment project, BVBD established a number of partnerships with plantation owners promoting malaria prevention and control amongst migrant workers (e.g. “malaria corners” in factories and workplace BCC campaigns).

In Burma, under the Global Fund Round 9 grant the Myanmar Business Coalition for AIDS (who are also on the CCM) will partner with the VBDC as a sub-recipient, to provide malaria prevention services to workers in mostly large-scale forestry enterprises. Another partner in Burma working with the private sector is the International Organization for Migration, who signed a Memorandum of Understanding with the MOH in 2004 which is renewed yearly to implement a community-based migration health project in Mon State. The Mon State project provides tuberculosis, malaria and HIV prevention, diagnosis, care, treatment and other capacity

building and health education activities in 76 villages across six townships. This project is funded by the Swiss Development Cooperation and the 3DF.

Possibly the most important workplace programs will be related to major development projects e.g. the Dawei Deep-sea Port project, an \$8 billion construction project in Tenasserim state across from Kanchanaburi Province Thailand. Development projects attract a large migrant worker population often into the heavily forested areas and thus workplace programs for malaria prevention and treatment should be emphasized.

Planned activities with FY 2011 funding are as follows (\$0):

Funding for specific public-private partnership activities are found under the sections for prevention, case management, and community interventions. The activities addressed under these sections mostly target the private delivery of malaria curative and preventive services. In addition, engagement of the private business sector through workplace programs especially major development projects e.g. Dawei Deep-sea Port Project should be further explored.

STAFFING AND ADMINISTRATION

Planned FY2011 Activities: (\$ 1,345,000)

Two health professionals will be hired as Resident Advisors to oversee PMI-supported activities in the RDMA, one representing USAID and one representing CDC during 2011. In addition, one or more Foreign Service Nationals will be hired to support the PMI team. They will be provided space within the RDMA offices in Bangkok, but are expected to travel widely within the sub-region. The PMI team will share responsibility for development and implementation of PMI strategies and work plans, coordination with national authorities, managing collaborating agencies, and supervising day-to-day activities. Candidates for these positions (whether initial hires or replacements) will be evaluated and/or interviewed jointly by USAID and CDC, and both agencies will be involved in hiring decisions, with the final decision made by the individual agency.

The PMI advisors will be part of a single inter-agency team led by the Director of the Office of Public Health, USAID Regional Health Development Mission-Asia. Both staff members report to the USAID Mission Director or his designee. The CDC staff member is supervised by CDC, both technically and administratively. All technical activities are undertaken in close coordination with the MOH/NMCP and other national and international partners, including the WHO, Global Fund, DfID, 3DF, BMGF and the private sector.

Locally-hired staff to support PMI activities in the RDMA will approved by the USAID RDMA Director. Because of the need to adhere to specific country policies and USAID accounting regulations, any transfer of PMI funds directly to Ministries or host governments will need to be approved by the USAID RDMA Director and Controller.

ANNEX

President's Malaria Initiative— Greater Mekong Subregion Planned Obligations for FY2011 (\$)

Proposed Activity	Mechanism	Total Budget	Commodities	Geographic Area	Description of Activity
PREVENTIVE ACTIVITIES					
ITN					
ITN procurement for control areas	Deliver	800,000	800,000	Cross-border Focus Areas	ITN procurement to fill gaps in the cross-border focus areas
Developing LLIN distribution strategies in targeted control areas	NetWorks	200,000		Cross-border Focus Areas	Evaluation of existing LLIN distribution strategies and support for evidence-based strategy development, monitoring and evaluation of LLIN programs in targeted control areas
<i>Subtotal ITN</i>		1,000,000	800,000		
IRS					
IRS		0			
<i>Subtotal IRS</i>		0			
MIP					
MIP		0			
<i>Subtotal MIP</i>		0			
CASE MANAGEMENT ACTIVITIES					
Diagnosis					
Procure RDTs and microscopy equipment and supplies	Deliver	310,000	310,000	Cross-border Focus Areas	Ensure adequate supply of RDTs and microscopy supplies in the cross-border focus areas
Microscopy QA/QC	WHO Umbrella grant	50,000		Cross-border Focus Areas	Microscopy training and accreditation; TA for adopting model systems for QA/QC
<i>Subtotal Diagnostics</i>		360,000	310,000		

Treatment					
Procure ACTs		0			
<i>Subtotal Treatment</i>		0			
PHARMACEUTICAL MANAGEMENT					
Strengthen logistics management for LLINs, ACTs, RDTs, and Primaquine	Deliver	120,000		Cross-border Focus Areas	Strengthening the pharmaceutical management system, forecasting, management and distribution of pharmaceuticals and RDTs. Prevent stock-outs of malaria commodities and ensuring that expired drugs are disposed of properly.
Strengthen post-marketing surveillance and response for drug quality	USP	750,000		GMS (6 countries)	Maintain sub-regional network of drug quality surveillance including support to Burma (Procure minilabs for Burma) and opportunities to engage in China. Strengthen national QC lab capacity (1 HPLC, 1 dissolution tester, 1 UV spectrophotometer for Burma),
<i>Subtotal Pharmaceutical Management</i>		870,000			
COMMUNITY INTERVENTIONS/BEHAVIOR CHANGE COMMUNICATIONS					
Community level engagement to deliver malaria prevention and treatment	New RFA	3,550,000		Cross-border Focus Areas	Community level interventions to support malaria prevention through LLIN distribution, accurate diagnosis, prompt and effective treatment, IEC/BCC activities to improve utilization as well as a robust system of monitoring and evaluation
Rapid start up bridge activity for community engagement in Burma, including behavior change communication	PSI	1,000,000		Burma	Engage communities through a launch of initial start-up activities in Burma which may include mass media messages and LLIN distribution campaigns in coordination with the RFA awardee

<i>Subtotal Community Interventions/ BCC</i>		4,550,000			
EPIDEMIC SURVEILLANCE AND RESPONSE					
Surveillance and response in epidemic settings	GMS-RID/Kenan	320,000		Thailand borders	Develop replicable approaches for maintaining MOPH surveillance and response capabilities in elimination provinces e.g. Phuket; continuation of surveillance activities in previously BMGF-funded containment project areas (Trat)
<i>Subtotal ESR</i>		320,000			
STRATEGIC INFORMATION					
Monitoring and Evaluation					
Surveillance and M&E strengthening	CDC IAA/MC	170,000		GMS (6 countries)	Adopting bi-regional M&E framework and developing national plans; Supporting collection of quality, disaggregated surveillance data and timely analysis for programming and decision-making purposes
	WHO Umbrella Grant	195,000			
M&E Capacity Building	CDC IAA/MC	50,000		GMS (6 countries)	M&E curriculum development to be coordinated by ACTMalaria
Updating Strategic Information for the region	WHO Umbrella Grant	90,000		GMS (6 countries)	Update of Mekong Malaria II document from 2003; identification of potential regional strategies.
Baseline coverage and prevalence data	CDC IAA/MC	250,000		Cross-border Focus Areas	Baseline data collection in cross-border focus areas with household surveys and migrant studies using respondent driven sampling methodology to capture data for survey indicators
<i>Subtotal M&E</i>		755,000			
Surveillance					

Therapeutic Efficacy Surveillance Network	WHO Umbrella Grant	1,000,000		GMS (6 countries)	Conducting TES studies in 6 countries (~30 sites), technical assistance (P4), microscopy QA, slide bank, drug policy review
Molecular determination and surveillance	University of Maryland	276,000		GMS (6 countries)	Increase national capacity for determination of re-infections from recrudescence in TES studies
Regional support to entomology and vector control activities	WHO Umbrella grant	110,000		GMS (6 countries)	Assessment of entomologic capacity and standardizing SOPs for insecticide resistance monitoring
	ACTMalaria (WHO Umbrella grant)	110,000			
Vector ecology in intervention areas	New RFA	200,000		Cross-border Focus Areas	Collect entomologic data and assess efficacy and acceptance of prevention measures
<i>Subtotal Surveillance</i>		1,696,000			
Operations Research					
Field-testing of G6PD RDT	CDC IAA/MC	100,000		Cross-border Focus Areas	Field-test G6PD RDTs and assess hemolytic sensitivity to primaquine
<i>Subtotal OR</i>		100,000			
CAPACITY BUILDING					

Strengthen NMCP capacity	ACT Malaria (WHO Umbrella Grant)	350,000		GMS (6 countries)	Coordinate and facilitate training courses e.g. Management of Malaria Field Operations
<i>Subtotal Capacity Building</i>		350,000			
REGIONAL COORDINATION					
Regional coordination	WHO Umbrella Grant	630,000		GMS (6 countries)	Coordinate bi-regional offices of SEARO and WPRO, convene Mekong Malaria Program Partners' Meeting, Support WHO country programs
<i>Subtotal Regional Coordination</i>		630,000			
IN-COUNTRY MANAGEMENT AND ADMINISTRATION					
USAID Staffing	USAID/RDMA	739,000		GMS (6 countries)	Support for Resident Advisor, PMI FSN, and Health FSN (Burma)
CDC Staffing	CDC IAA	606,000		GMS (6 countries)	Support for Resident Advisor and 3 TDYs
<i>Subtotal Admin</i>		1,345,000			
<i>Recission</i>		24,000			
TOTAL	0	12,000,000	1,110,000		

Year 1 (FY2011) Budget Breakdown by Partner*

Partner Organization	Geographic Area	Activity	Budget (\$)
CDC/ Malaria Consortium	Thailand, Cambodia, Burma	a) Assist NMCPs in adopting bi-regional M&E framework and developing national plans; b) Collect baseline prevalence and coverage data in focus areas; c) M&E curriculum development; d) Support collection of quality, disaggregated surveillance data; e) Field test G6PD RDTs	570,000
Deliver	Cross-border Focus Areas/ GMS (6 countries)	a) ITN, RDTs and microscopy supplies procurement in focus areas; b) Strengthening the pharmaceutical management system, forecasting, management and distribution of pharmaceuticals and RDTs	1,230,000
Kenan	Thailand	Develop replicable approaches for maintaining MOPH surveillance and response capabilities in elimination provinces e.g. Phuket; continuation of activities in previously BMGF-funded containment project areas (Trat)	320,000
Networks	Cross-border Focus Areas	Support strategy development, monitoring and evaluation of public and private sector LLIN programs	200,000
PSI	Burma	Rapid start up bridge activity for community engagement in Burma, including behavior change communication	1,000,000
University of Maryland	GMS (6 countries)	Increase national capacity for molecular determination of re-infections from recrudescence in TES studies	276,000
USP	GMS (6 countries)	Maintain drug quality surveillance network including equipment support	750,000
WHO umbrella grant	GMS (6 countries)	a) Coordinate bi-regional offices of SEARO and WPRO, convene biannual Mekong Malaria Program Partners' Meeting, Support WHO country programs; b) Provide microscopy/RDT QA/QC training and accreditation; c) Assist NMCPs to adopt bi-regional M&E framework and develop national plans; d) Conduct TES studies and maintain microscopy QA and slide bank; e) Assess entomologic capacity and standardize SOPs for resistance monitoring; f) collect entomologic data and assess efficacy of prevention measures; g) update of regional strategic information	2,075,000
WHO/ACT Malaria	Southeast Asia	Coordinate and facilitate training courses	460,000
TBD-new RFA	Cross-border Focus Areas	Community level engagement to deliver malaria prevention and treatment	3,550,000
TBD- new RFA	Cross-border Focus Areas	Collect entomologic data and assess efficacy and acceptance of prevention measures	200,000

* Does not include budget for USAID and CDC staffing/administration of \$1, 345,000 and 0.002% USG recission