

This Malaria Operational Plan has been approved by the U.S. Global Malaria Coordinator and reflects collaborative discussions with the national malaria control programs and partners in country. The final funding available to support the plan outlined here is pending final FY 2018 appropriation. If any further changes are made to this plan it will be reflected in a revised posting.



USAID
FROM THE AMERICAN PEOPLE

U.S. PRESIDENT'S MALARIA INITIATIVE



PRESIDENT'S MALARIA INITIATIVE

THAILAND, LAO PDR, and REGIONAL

Malaria Operational Plan FY 2018

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS	3
I. EXECUTIVE SUMMARY	5
II. STRATEGY	10
1. Introduction.....	10
2. Malaria situation in Thailand, Lao PDR, and Viet Nam.....	11
3. Health system delivery structure and Ministry of Health (MOH) organization	18
4. National malaria elimination strategies in Thailand, Lao PDR, and Viet Nam.....	20
5. Strategic updates in Thailand and Lao PDR	22
6. Integration, collaboration, and coordination in Thailand, Lao PDR, and Regional	23
7. PMI goal, objectives, strategic areas, and key indicators	30
8. Progress on coverage/impact indicators to date in Thailand, Lao PDR, and Viet Nam	31
III. OPERATIONAL PLAN (Thailand, Lao PDR, and Regional)	35
1. Vector monitoring and control.....	35
2. Malaria in pregnancy	42
3. Case management	44
4. Health system strengthening and capacity building.....	56
5. Social and behavior change communication.....	60
6. Surveillance, monitoring, and evaluation	63
7. Operational research	69
8. Pre-Elimination	70
9. Staffing and administration.....	74
Table 1: Budget Breakdown by Mechanism	76
Table 2: Budget Breakdown by Activity	77

ABBREVIATIONS AND ACRONYMS

ACPR	Adequate clinical and parasitological response
ACT	Artemisinin-based combination therapy
ACTMalaria	Asian Collaborative Training Network for Malaria
ADB	Asian Development Bank
AFRIMS	Armed Forces Research Institute of Medical Sciences
AL	Artemether-lumefantrine
ANC	Antenatal care
API	Annual parasite incidence
APLMA	Asia-Pacific Leaders Malaria Alliance
APMEN	Asia-Pacific Malaria Elimination Network
AS-MQ	Artesunate-mefloquine
BMGF	Bill & Melinda Gates Foundation
BVBD	Bureau of Vector-Borne Diseases (Thailand)
CDC	U.S. Centers for Disease Control and Prevention
CMPE	Centre for Malaria, Parasitology, and Entomology (Lao People's Democratic Republic)
CQ	Chloroquine
CSO	Civil society organization
DCDC	Department of Communicable Disease Control (Lao PDR)
DFAT	Australia's Department of Foreign Affairs and Trade
DFID	U.K. Department for International Development
DHA-Pip	Dihydroartemisinin-piperaquine
DHIS-2	District Health Information System 2
DOT	Directly observed therapy
DRS	Drug Resistance Surveillance
EAS	East Asia Summit
G6PD	Glucose-6-phosphate dehydrogenase
Global Fund	Global Fund to Fight AIDS, Tuberculosis, and Malaria
GMS	Greater Mekong Sub-region
IEC	Information, education, communication
IPTp	Intermittent preventive treatment for pregnant women
IRS	Indoor residual spraying
ITN	Insecticide-treated mosquito net
KAP	Knowledge, attitude, and practice
Lao PDR	Lao People's Democratic Republic
LLIHN	Long-lasting insecticide-treated hammock net
LLIN	Long-lasting insecticide-treated net
LMI	Lower Mekong Initiative
LSIS	Lao Social Indicator Survey
K13	Kelch 13 propeller
M1	Migrants residing in Thailand for six months or longer
M2	Migrants residing in Thailand for less than six months
M&E	Monitoring and evaluation
MICS	Multiple Indicator Cluster Survey

MIP	Malaria in pregnancy
MIS	Malaria indicator survey
MMFO	Management of Malaria Field Operations
MMP	Mobile and migrant populations
MNCH	Maternal and neonatal child health
MOH	Ministry of Health
MOP	Malaria Operational Plan
MOPH	Ministry of Public Health (Thailand)
MPSC	Medical Products Supply Center (Lao PDR)
NFM	New Funding Model
NGO	Non-governmental organization
NIMPE	National Institute for Malariology, Parasitology, and Entomology (Viet Nam)
NMCP	National Malaria Control Program
NSP	National Strategic Plan
OR	Operational research
PAMS	Provincial Anti-Malaria Station (Lao PDR)
PCR	Polymerase chain reaction
Pf	<i>Plasmodium falciparum</i>
PHO	Provincial Health Office
PMI	President's Malaria Initiative
PR	Principle recipient
Pv	<i>Plasmodium vivax</i>
RAI	Regional Artemisinin Initiative
RAI2E	Regional Artemisinin Initiative 2 Elimination
RDMA	Regional Development Mission Asia
RDT	Rapid diagnostic test
SBCC	Social and behavior change communication
SM&E	Surveillance, monitoring, and evaluation
SP	Sulfadoxine-pyrimethamine
SR	Sub-recipient
SRRT	Surveillance and Rapid Response Teams
SSF	Single Stream Funding
UNOPS	United Nations Office for Project Services
USAID	United States Agency for International Development
USG	United States Government
WHO	World Health Organization

I. EXECUTIVE SUMMARY

When it was launched in 2005, the goal of the President’s Malaria Initiative (PMI) was to reduce malaria-related mortality by 50% across 15 high-burden countries in sub-Saharan Africa through a rapid scale-up of four proven and highly effective malaria prevention and treatment measures: insecticide-treated mosquito nets (ITNs); indoor residual spraying (IRS); accurate diagnosis and prompt treatment with artemisinin-based combination therapies (ACTs); and intermittent preventive treatment of pregnant women (IPTp). With the passage of the Tom Lantos and Henry J. Hyde Global Leadership against HIV/AIDS, Tuberculosis, and Malaria Act in 2008, PMI developed a U.S. Government Malaria Strategy for 2009–2014. This strategy included a long-term vision for malaria control in which sustained high coverage with malaria prevention and treatment interventions would progressively lead to malaria-free zones in Africa, with the ultimate goal of worldwide malaria eradication by 2040-2050. Consistent with this strategy and the increase in annual appropriations supporting PMI, four new sub-Saharan African countries and one regional program in the Greater Mekong Sub-region of Southeast Asia were added in 2011. The contributions of PMI, together with those of other partners, have led to dramatic improvements in the coverage of malaria control interventions in PMI-supported countries, and all 15 original countries have documented substantial declines in all-cause mortality rates among children less than five years of age.

In 2015, PMI launched the next six-year strategy, setting forth a bold and ambitious goal and objectives. The PMI Strategy for 2015-2020 takes into account the progress over the past decade and the new challenges that have arisen. Malaria prevention and control remains a major U.S. foreign assistance objective and PMI’s Strategy fully aligns with the U.S. Government’s vision of ending preventable child and maternal deaths and ending extreme poverty. It is also in line with the goals articulated in the RBM Partnership’s second generation global malaria action plan, *Action and Investment to defeat Malaria (AIM) 2016-2030: for a Malaria-Free World* and WHO’s updated *Global Technical Strategy: 2016-2030*. Under the PMI Strategy 2015-2020, the U.S. Government’s goal is to work with PMI-supported countries and partners to further reduce malaria deaths and substantially decrease malaria morbidity, towards the long-term goal of elimination.

In 2011, PMI support 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 (PDR), Thailand, and Viet Nam. This FY 2018 GMS Malaria Operational Plan (MOP) presents detailed implementation plans for Thailand and the Regional program which includes the Lao People’s Democratic Republic (Lao PDR) and Viet Nam.

Although considerable progress has been made in malaria control in the Greater Mekong Sub-region (GMS) during the past 10 years, malaria remains a major concern for the international community, ministries of health, and the people of the region. This is due primarily to the development and 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 was first confirmed in western Cambodia; treatment failures to artemisinin-based combination therapy (ACT) as well as their partner drugs 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 throughout the region.

The FY 2018 Malaria Operational Plan (MOP) for Thailand, Lao People's Democratic Republic (PDR), and Regional was developed with the Regional Development Mission for Asia (RDMA) during a planning visit in March 2017 by representatives from United States Agency for International Development, the U.S. Centers for Disease Control and Prevention, and the national malaria control programs of Thailand and Lao PDR with the participation of other major donors and partners working on malaria in the area.

The FY 2018 MOP supports regional/cross-cutting activities, such as surveillance for therapeutic efficacy and antimalarial drug resistance, National Malaria Control Program (NMCP) capacity strengthening, and malaria prevention and control activities to reduce transmission and eliminate malaria. PMI will also consider emergency assistance, including commodity support and technical assistance for surveillance, case management, and social and behavior change communication (SBCC) in other GMS areas threatened by artemisinin resistance. The activities proposed using FY 2018 funding are in line with the national malaria control program strategies of Thailand and Lao PDR and are intended to complement ongoing Global Fund malaria grants and contributions from other donors.

The proposed FY 2018 PMI budget is \$3 million to support activities for Thailand, Lao PDR, and Regional programming. PMI will support the following intervention areas with these funds:

Entomological monitoring and insecticide resistance management: Malaria transmission in Thailand and Lao PDR is closely associated with two malaria vectors that inhabit the forest and forest fringe, *Anopheles dirus* and *An. minimus*. Countries have made progress in monitoring vector distribution and insecticide resistance, which to date has not been a major problem in the GMS area. Entomological surveillance will focus on geographically at-risk areas with an emphasis on improved insecticide resistance monitoring and foci investigations, where epidemiologically appropriate in Thailand. PMI will also provide support for entomological capacity strengthening in the region, in response to the changing vector ecology.

Insecticide-treated nets (ITNs): Most studies suggest that insecticide-treated nets (ITNs) provide protection even with significant outdoor and early evening biting. There is a strong culture of bed net use in Thailand and Lao PDR and net ownership is quite high but many of those nets are untreated. With FY 2015 funding, PMI procured approximately 160,000 long-lasting insecticide-treated nets (LLINs) for Thailand and Lao PDR to fill gaps in Global Fund grants among vulnerable migrant and mobile populations.

With FY 2017 funding, PMI is procuring approximately 200,000 LLINs for migrant and vulnerable populations in at-risk areas. With FY 2018 funds, PMI will procure approximately 300,000 LLINs for Thailand and Lao PDR to address commodity gaps not covered by the Global Fund.

Indoor residual spraying (IRS): IRS is mostly limited to outbreak response and focal control and is not a key activity in national malaria control strategies in the GMS. Therefore, PMI funds will not be targeted for IRS in Thailand and Lao PDR.

Malaria in pregnancy: Given the relatively low prevalence of malaria in the GMS, intermittent preventive treatment for pregnant women (IPTp) is not part of national policies in Thailand and Lao PDR. However, PMI will support promotion of universal LLIN coverage and prompt diagnosis and treatment of clinical cases of malaria in pregnant women as they remain a vulnerable group in the region.

Case management: In Thailand and Lao PDR, diagnosis of malaria is based on laboratory tests with microscopy or rapid diagnostic tests (RDTs). Although all countries in the GMS recommend ACTs as the first-line treatment of *Plasmodium falciparum* infections, artemisinin resistance has been confirmed throughout the Sub-region. Treatment failures to ACT partner drugs have now been documented in Western and Eastern Thailand. Case management of malaria, especially in Lao PDR, is further complicated by the fact that *P. vivax* and *P. falciparum* are co-endemic.

The majority of RDT and ACT needs in Thailand and Lao PDR is anticipated to be met by those countries' Global Fund grants through 2017 when the Global Fund malaria grants will end; however, it is expected that continued Global Fund resources will be available through the Regional Artemisinin Initiative 2 Elimination (RAI2E) grant for all countries in the GMS from 2018 through 2020. Previously, PMI has contributed to the ACT and RDT needs of Thailand and Lao PDR to fill commodity gaps and respond to outbreaks. With FY 2018 funding, PMI will procure small quantities of RDTs to fill gaps and strengthen laboratory capacity in targeted areas. PMI will also procure ACT treatments to fill any gaps in Thailand and Lao PDR and respond to urgent needs in the region, but it is anticipated that the majority of RDTs and ACTs will be adequately covered.

Because of concerns about the quality of malaria diagnosis areas as malaria burden decreases, PMI with FY 2018 funding will continue to support in-service training, accreditation of microscopy trainers, maintenance of a regional slide banks and quality assurance of the parasitological diagnosis of malaria for Thailand and Lao PDR. As part of the regional program, PMI will continue to support the drug therapeutic efficacy and drug resistance monitoring network at 45 sites (alternating every other year) in the GMS, with focus on integrating the monitoring of treatment outcomes within the routine surveillance system in Thailand and Viet Nam.

Health systems strengthening and capacity building: In the GMS, PMI supports a broad array of health system strengthening activities which cut across intervention areas, such as training of health workers on microscopy, supply chain management, and health information systems strengthening, drug quality monitoring, and NMCP capacity building. Strengthening of national program capacity is a critical area of strategic focus within the PMI strategy. With FY 2016 and FY 2017, PMI continued to support national and regional capacity building and training efforts on program management, quality assurance/quality control for diagnostics, monitoring and

evaluation (M&E), entomology, and surveillance. With FY 2018, PMI will support updating of malaria epidemiology, entomology, and program management curricula used for regional training, and particularly focused on innovative and more effective training and learning methodology.

Social and behavior change communication (SBCC): PMI will continue to provide technical support to national programs to facilitate the development and use of effective communication strategies and appropriate SBCC approaches. As countries move from malaria control to elimination, SBCC interventions will need to be more tailored and targeted for hard-to-reach populations that remain at risk, including mobile and migrant populations. PMI supports integration of SBCC activities in the delivery of malaria services (e.g., distribution of LLINs and case management). With FY 2018 funding, SBCC interventions will be integrated with LLIN distribution activities and emphasis placed on sustaining community engagement and ownership, supporting promotion of healthy behaviors, and reducing risk-taking in the context of malaria exposure.

Surveillance, monitoring and evaluation (SM&E): The quality of malaria case detection and reporting systems varies widely within the GMS. In the context of malaria elimination, accurate and timely data are essential to identify cases, mount a timely response, inform policy decisions, and focus resources to areas of ongoing malaria transmission. United States Government (USG) funding for SM&E during the past several years has focused on updating national M&E plans, providing technical assistance for surveys, and capacity development at the national level.

With FY 2018 funding, PMI will focus efforts on implementing systems and practices to foster timely collection and use of quality surveillance data and strategic information. At the national and sub-national levels, PMI will provide technical support to Thailand and Lao PDR on improving surveillance systems, particularly on data quality and SM&E capacity for data management, analysis, and use. In Thailand, technical support will be provided to pilot electronic case reporting, investigation and response.

Operational research (OR): PMI has supported key operational research activities in the region in the past to address outdoor transmission by assessing the acceptability and entomological efficacy of insecticide-treated clothing and the safety of low-dose primaquine in those with glucose-6-phosphate dehydrogenase deficiency and infected with *P. falciparum*. Some relevant operational research such as evaluation of the highly sensitive RDT has been proposed to be funded by the Global Fund in Thailand. No OR is currently planned with FY 2018 funding, but PMI will continue to keep abreast of key programmatic bottlenecks and plan for OR to address those gaps as necessary.

Pre-elimination: All GMS countries are moving towards the regional goal of malaria elimination by 2030. Thailand has seen a continuous decline in malaria burden from 64,957 reported cases in 2010 to 17,153 in 2016. Much of the malaria transmission in Thailand remains concentrated along international borders. Thailand envisions the elimination of malaria by 2024 and sets out to target malaria elimination in more than 95% of districts by 2021, and all districts will be malaria-free by 2024. As Thailand has re-orientated its malaria control program to an elimination program, malaria stratification has been reclassified based on the district as the

lowest administrative unit for elimination. Lao PDR also has experienced similar declines of malaria burden from 50,659 reported cases in 2014 to 15,457 in 2016. The Lao PDR's National Strategy for Malaria Control and Elimination (2016-2030) describes three phases with the aim of eliminating all forms of malaria by 2030 in the entire country. As outlined in the new PMI Strategy (2015-2020), PMI supports working with national malaria programs and partners to further reduce malaria deaths and substantially decrease malaria morbidity and assist five countries to reach pre-elimination nationally or sub-nationally by 2020. In the GMS, PMI is providing technical support to Thailand and Lao PDR as the countries develop and implement their plans towards achieving malaria elimination by 2024 and 2030, respectively. In particular, PMI is working to improve technical and programmatic capacity for use of strategic information and strengthen national malaria surveillance and M&E systems for malaria control and elimination.

II. STRATEGY

1. Introduction

When it was launched in 2005, the goal of the President’s Malaria Initiative (PMI) was to reduce malaria-related mortality by 50% across 15 high-burden countries in sub-Saharan Africa through a rapid scale-up of four proven and highly effective malaria prevention and treatment measures: insecticide-treated mosquito nets (ITNs); indoor residual spraying (IRS); accurate diagnosis and prompt treatment with artemisinin-based combination therapies (ACTs); and intermittent preventive treatment of pregnant women (IPTp). With the passage of the Tom Lantos and Henry J. Hyde Global Leadership against HIV/AIDS, Tuberculosis, and Malaria Act in 2008, PMI developed a U.S. Government Malaria Strategy for 2009–2014. This strategy included a long-term vision for malaria control in which sustained high coverage with malaria prevention and treatment interventions would progressively lead to malaria-free zones in Africa, with the ultimate goal of worldwide malaria eradication by 2040-2050. Consistent with this strategy and the increase in annual appropriations supporting PMI, four new sub-Saharan African countries and one regional program in the Greater Mekong Sub-region (GMS) of Southeast Asia were added in 2011. The contributions of PMI, together with those of other partners, have led to dramatic improvements in the coverage of malaria control interventions in PMI-supported countries, and all 15 original countries have documented substantial declines in all-cause mortality rates among children less than five years of age, ranging from 18% (in both Liberia and Nigeria) to 55% (in both Senegal and Zambia).

In 2015, PMI launched the next six-year strategy, setting forth a bold and ambitious goal and objectives. The PMI Strategy for 2015-2020 takes into account the progress over the past decade and the new challenges that have arisen. Malaria prevention and control remains a major U.S. foreign assistance objective and PMI’s Strategy fully aligns with the U.S. Government’s vision of ending preventable child and maternal deaths and ending extreme poverty. It is also in line with the goals articulated in the Roll Back Malaria (RBM) Partnership’s second generation global malaria action plan, *Action and Investment to defeat Malaria (AIM) 2016-2030: for a Malaria-Free World* and World Health Organization (WHO)’s updated *Global Technical Strategy: 2016-2030*. Under the PMI Strategy 2015-2020, the U.S. Government’s goal is to work with PMI-supported countries and partners to further reduce malaria deaths and substantially decrease malaria morbidity, towards the long-term goal of elimination.

In 2011, PMI support extended to the GMS, which consists of six countries: Burma, Cambodia, China (Yunnan Province), Lao People’s Democratic Republic (PDR), Thailand, and Viet Nam. Bilateral funding to Cambodia and Burma began in 2013 and has evolved to having their respective Malaria Operational Plans (MOP). This FY 2018 MOP presents detailed implementation plans for Thailand and Lao PDR, and limited activities for Regional. PMI support to China has been phased out due to the low transmission burden and comprehensive domestic financing of malaria elimination.

PMI’s GMS program differs from its support to malaria programs in Africa in both its regional focus and its primary goal of responding to artemisinin resistance by eliminating *Plasmodium falciparum*. PMI’s original focus in the region was to address the emergence of artemisinin

resistance, which could undermine the tremendous progress made in the reduction of malaria morbidity and mortality both in the GMS and globally, if resistance were to spread to other regions. While initial PMI priority intervention areas focused on specific border areas between Thailand, Cambodia, and Burma, evidence from the network of PMI-supported therapeutic efficacy monitoring and other research documented that artemisinin resistance is present throughout the region, and has emerged *de novo* in some locations. In line with regional goals, PMI shifted its approach to support regional elimination of *P. falciparum* recognizing that this is the best and most sustainable approach to addressing multi-drug resistance. PMI supports the multi-country therapeutic efficacy monitoring network for antimalarial drug resistance surveillance as well as regional and in-country capacity building and training on malaria diagnostics and program management.

Although the Burma and Cambodia United States Agency for International Development (USAID) Missions now receive bilateral direct funding for malaria, regional support through the RDMA based in Bangkok continues to play an important role in providing specialized malaria expertise to assist National Malaria Control Program (NMCPs) and partners, including those in non-presence countries, as needed, to address crosscutting, trans-boundary issues that affect all GMS countries, and to build capacity at the regional level for NMCPs to address complex technical and programmatic challenges.

Outlined in the new PMI Strategy (2015-2020), United States Government (USG) funds support working with national malaria programs and partners to further reduce malaria deaths and substantially decrease malaria morbidity and assist five countries to reach pre-elimination nationally or sub-nationally by 2020. PMI provides technical support to Thailand and Lao PDR as the countries develop and implement their plans towards achieving malaria elimination by 2024 and 2030, respectively. In particular, PMI is working to improve technical and programmatic capacity for use of strategic information and strengthen national malaria surveillance and M&E systems for malaria control and elimination. PMI support for Viet Nam is limited to drug efficacy monitoring and regional capacity training activities.

This FY 2018 Malaria Operational Plan (MOP) presents the implementation plan for PMI's efforts in Thailand, Lao PDR and Regional activities in support of the strategies of PMI and relevant NMCP. Developed in consultation with the Thailand and Lao PDR NMCP and partners, activities described in the MOP support the national malaria control strategic plans and build on investments made by PMI and other partners including the Global Fund to improve and expand malaria-related services. This document briefly reviews the current status of malaria control policies and interventions for Thailand, Lao PDR and regional activities in the GMS, describes progress to date, identifies challenges and unmet needs to achieving the targets of the NMCP and PMI, and provides a description of activities that are planned with FY 2018 funding.

2. Malaria situation in Thailand, Lao PDR, and Viet Nam

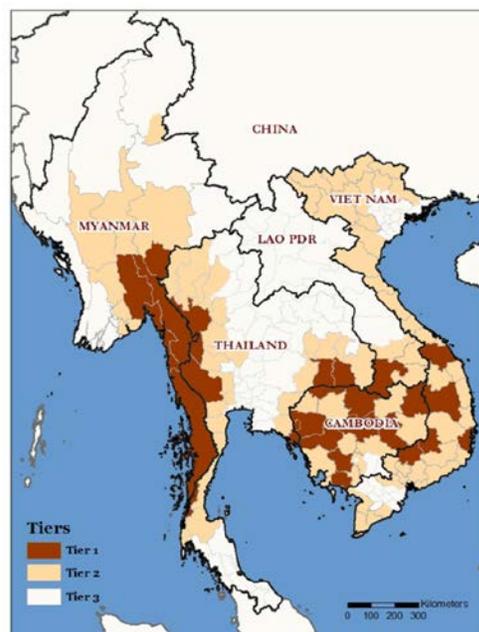
The GMS is considered the epicenter of antimalarial drug resistance starting with chloroquine (CQ) resistance in the late 1950s, followed by resistance to sulfadoxine-pyrimethamine (SP), mefloquine (MQ), and decreased sensitivity to quinine being identified in the 1980s and 1990s. Resistance to these antimalarials eventually spread or developed *de novo* throughout the region

and globally. The emergence of artemisinin resistance along the Thai-Cambodia border in the early 2000s has occurred in the same geographical area where chloroquine resistance emerged 50 years earlier.

WHO has classified geographical areas into three tiers of artemisinin resistance (Figure 1):

- Tier 1: Areas where there is credible evidence of artemisinin resistance
- Tier 2: Areas with significant inflows of people from Tier 1 areas, including those immediately bordering Tier 1
- Tier 3: Areas with no evidence of artemisinin resistance and limited contact with Tier 1 areas.

Figure 1: Map of suspected and confirmed areas with artemisinin resistance in the Greater Mekong Sub-region (as of February 2015) (Source: WHO/GMP)



According to the WHO, the working definition of partial artemisinin resistance was developed based on observations from routine therapeutic efficacy monitoring of ACTs, clinical trials of artesunate monotherapy, and mutations in the *Kelch13*-propeller (K13) sequence:

Suspected partial artemisinin resistance is defined as:

- $\geq 5\%$ of patients carrying K13 resistance-associated mutations; or
- $\geq 10\%$ of patients with persistent parasitemia by microscopy on Day 3 after treatment with ACT or artesunate monotherapy; or
- $\geq 10\%$ of patients with a parasite clearance half-life of ≥ 5 hours after treatment with ACT or artesunate monotherapy.

Confirmed artemisinin resistance is defined as: $\geq 5\%$ of patients carrying K13 resistance-associated mutations, all of whom have been found, after treatment with ACT or artesunate

monotherapy, to have either persistent parasitemia by microscopy on Day 3, or a parasite clearance half-life of ≥ 5 hours.

Beyond drug resistance, NMCPs in the GMS face several related challenges including variable quality and largely unquantified delivery of malaria services in the private sector; improved, but continuing infiltration of substandard medications due to weak regulation and enforcement; inadequate systems to ensure service delivery to populations most at risk, particularly mobile and migrant workers; and civil strife and occasional cross-border conflicts. As malaria burden continues to decrease in the GMS and becomes more heterogeneous, traditional one-size-fits-all approaches may not be relevant or efficient in these settings. This is the case for malaria treatment regimens across the region. Until there is an alternative to artemisinin, it is anticipated that these treatments may have to be rotated, even sub-nationally, as resistance develops to the respective partner drugs. In the interim, PMI supports therapeutic efficacy monitoring in 45 sites throughout the region to monitor the treatment efficacy of current first-line and potential second-line treatments. As treatment failures increase, countries need to quickly shift to alternative ACTs based on best available information, including those from therapeutic efficacy monitoring results.

All countries in the GMS now recommend ACTs for first-line treatment of *P. falciparum*; however, treatment regimens and drug choice differ from country to country and pose a particular challenge to monitor adherence among cross-border migrants.

The malaria situation across the GMS is very heterogeneous and ranges from countries on track for malaria elimination to areas still scaling up malaria control activities. Unlike most sub-Saharan African countries, *P. vivax* is a major cause of malaria in GMS countries and more prevalent than *P. falciparum* in some countries. Furthermore, at least ten species of anopheline mosquitoes are involved in malaria transmission in the GMS. Primary vectors include *An. dirus*, *An. minimus* and/or *An. maculatus*. Some of these vector species are not primarily endophilic (indoor biters). The vector mix varies with both location and season. Malaria burden is greatest in forest or forest-fringe areas, where the region's most efficient vector, *An. dirus*, exists.

Thailand

Malaria cases mainly occur in provinces bordering Burma, Cambodia, and Malaysia. The groups at risk for malaria in Thailand consist of refugees in camps, workers in rubber plantations and fruit orchards, people who spend the night in the forest (including the military), and ethnic minority groups living along the Thai-Burma border. The introduction of rubber plantations in many parts of the country during the past ten years and movement of workers has resulted in emergence of sporadic new foci. Conflict in southern Thailand has also contributed to a dramatic increase of malaria cases reported in 2016. For example, the southern provinces of Yala, Songkla, and Naratiwat bordering Malaysia experienced an increase of malaria cases (mostly *P. vivax* (Pv)) from only 317 in FY 2016 to 4,766 in FY 2017 during the same period from October to February.

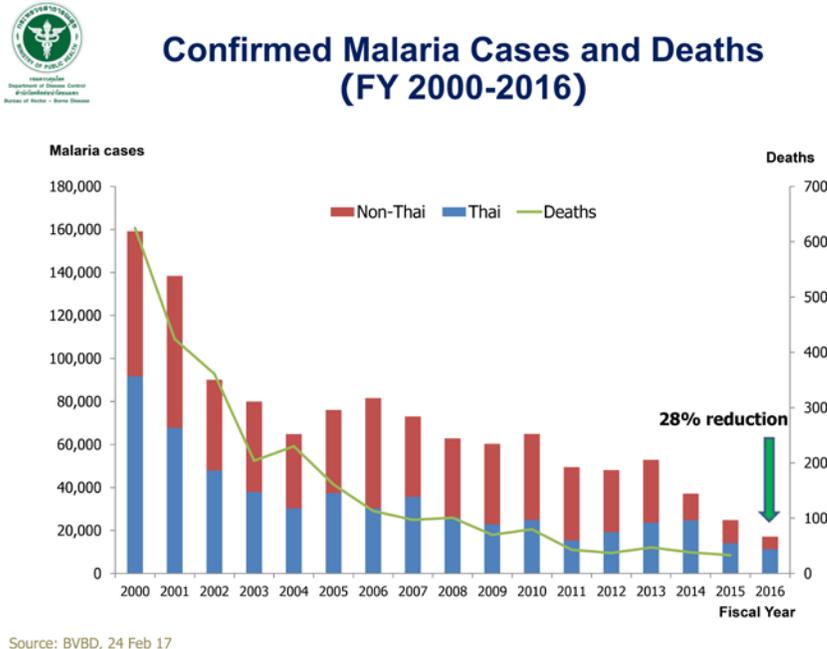
Due to labor shortages, Thailand has been drawing large numbers of migrant workers from Burma, Cambodia, and Lao PDR. These migrant workers live and work along border districts

and provinces where malaria is still endemic while others move back and forth between home communities and various work destinations in Thailand. Though national malaria incidence is decreasing, recent demand for expensive hard wood has precipitated illegal logging in the forests in the northeastern province adjacent to southern Lao PDR and north of Cambodia, leading to recent spikes in malaria cases in the area.

The graph below shows malaria cases among Thais and non-Thais (migrants residing in Thailand for six months or longer (M&E) and cases among migrants living less than six months in Thailand (M2)). There has been a reduction in malaria cases from 24,840 in 2015 to 17,153 in 2016. The Annual Parasite Incidence (API) decreased from 0.38 to 0.28 per 1,000 population during the same period. These cases included those who crossed the border and sought treatment at malaria posts and health facilities in Thailand. Mortality due to malaria has also declined from 47 deaths in 2013 to 33 deaths in 2015. The increasing proportion of *P. vivax* malaria cases is observed with the proportion attributable to Pv steadily increasing from 58% in 2010 to 72% in 2016.

Compared to the other countries in the GMS, Thailand’s malaria surveillance data is the most comprehensive and timely, which allows the NMCP to update village-level malaria risk on an annual basis. In 2016, the NMCP determined that local malaria transmission was still occurring in 215 out of 928 districts and 2,769 out of 89,761 villages in Thailand. The NMCP has been able to demonstrate a continual decline in the number of villages with local transmission thus far – from 5,502 in 2015 to 4,512 in 2016. At the beginning of 2017, the NMCP has identified 2,741 village clusters (of which 1,116 are classified as active foci).

Figure 2: Trend of malaria morbidity and mortality in Thailand among Thais and non-Thais (M1, and M2) (FY 2000-2016) (Source: BVBD)

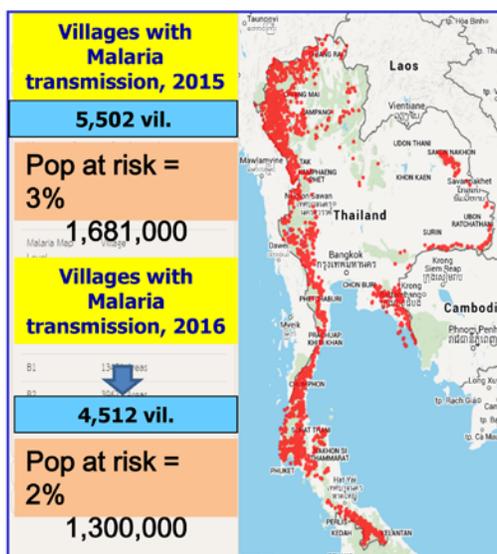


The NMCP stratifies malaria transmission risk for each village according to the following criteria:

- A1: perennial transmission area (transmission reported for at least six months per year)
- A2: periodic transmission area (transmission reported for less than six months per year)
- B1: high and moderate receptivity (transmission not reported within the last three years but primary and secondary vectors present)
- B2: low and no receptivity (transmission not reported within the last three years and primary and secondary vectors absent, suspected vector may be present)

Using such malaria risk stratification, the Bureau of Vector-Borne Diseases (BVBD) is able to identify indigenous transmission (A1 + A2) as illustrated in Figure 3. Malaria surveillance data shows that most malaria transmission occurs along the border areas, and, more importantly, that the number of villages with local malaria transmission has declined over time.

Figure 3: Map of villages with malaria transmission in Thailand, 2015-2016 (Source: BVBD)

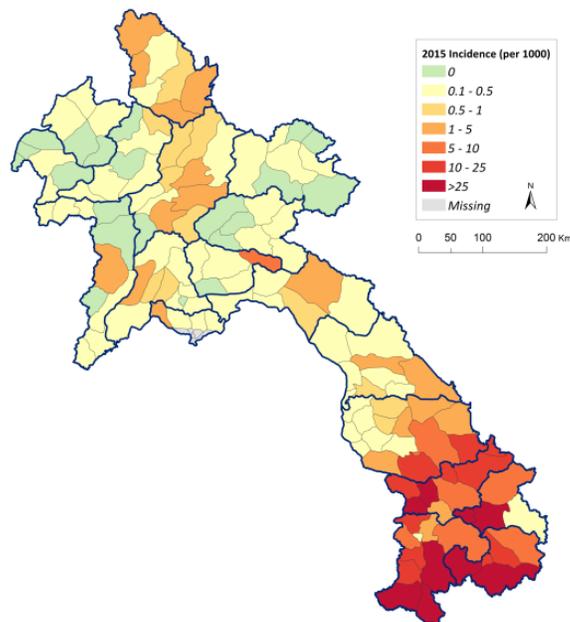


Note: Light green color represents forested areas and red dots indicate villages with malaria transmission. Population at risk estimates are those populations in A1 and A2 villages.

Lao PDR

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 ($API > 30$) in remote, forested areas of the south (Figure 4). *Plasmodium falciparum* has been the predominant species, accounting for 95% of all recorded malaria cases, although recent surveys suggest *P. vivax* prevalence of 33% and upwards of 63% in the Northern provinces. *Plasmodium vivax* accounted for 48% of all reported malaria cases in 2014. Groups at greatest risk include ethnic minorities, forest-related and agricultural workers, and miners.

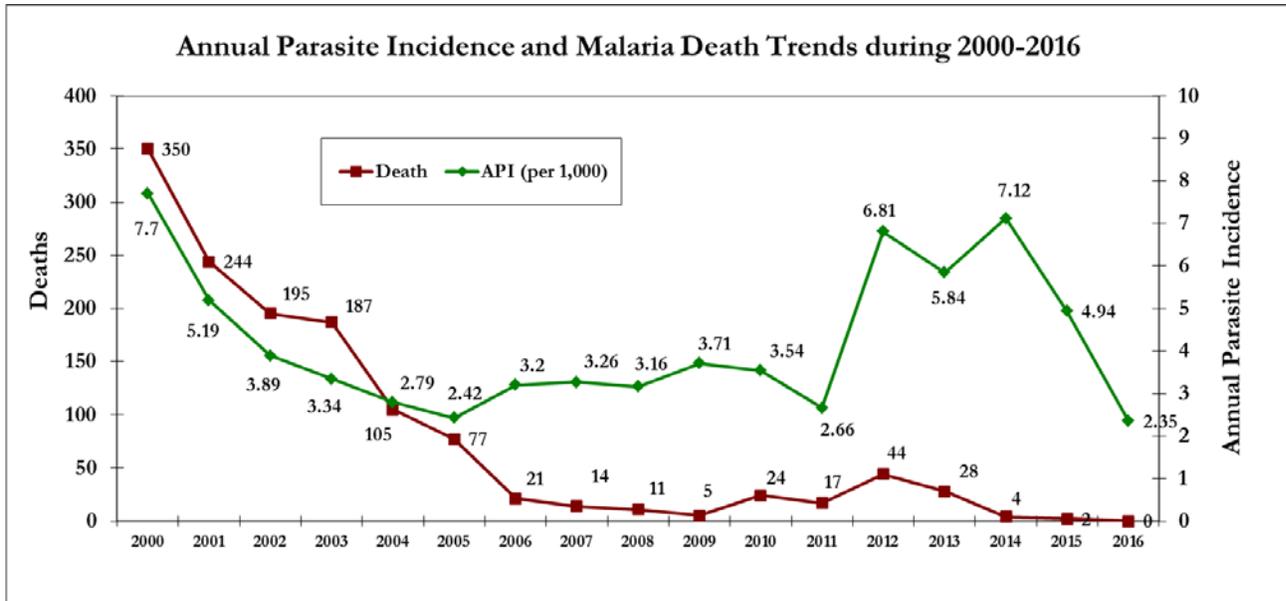
Figure 4: Stratification of districts by annual parasite incidence (API) in Lao PDR (2015)
(Source: CMPE)



Significant reductions in malaria transmission have been reported since the large-scale introduction of RDTs/ACTs and ITNs, in conjunction with socioeconomic and environmental changes mainly deforestation. The annual number of uncomplicated malaria cases (probable and confirmed) fell from 40,106 in 2000 to 20,800 cases in 2010 and the number of malaria deaths in hospitals dropped from 350 in 2000 to 24 in 2010; however, the influx of seasonal workers of mainly Vietnamese origin resulted in alarming increases of reported malaria cases in the southern provinces bordering Cambodia and Viet Nam and in the increase in API starting in 2011 (Figure 5).

Beginning in 2011, the Centre for Malaria, Parasitology, and Entomology (CMPE) began utilizing a more targeted approach for the implementation of malaria control measures. As detailed in their 2011-2015 National Strategy for Malaria Control and Pre-Elimination, rather than providing ITNs, RDTs, and ACTs in all villages, these resources were to be reserved for the villages with the highest burden of malaria. A survey of all malaria cases reported between 2006-2008 in each village was performed in 2009, and villages were stratified based on malaria incidence into four groups: Stratum 1 (0-0.1 cases/1,000 persons), Stratum 2 (0.1-10 cases/1,000 persons), Stratum 3 (>10 cases/1,000 persons), and Unknown (insufficient data). About two-thirds of the villages were determined to fall into Stratum 1, and the rest were divided between the remaining strata. Most of the Stratum 1 villages were in the north, whereas Stratum 3 villages tended to be concentrated in the south. Approximately 95% of all reported malaria cases are from five provinces in southern Lao PDR (Saravane, Savannakhet, Champasack, Sekong, and Attapeu). Subsequent to the Malaria Program Review in 2013, there has now been a shift away from a village-based to district-level stratification to facilitate planning and implementation.

Figure 5: Trend of malaria morbidity and mortality in Lao PDR (2000-2016) (Source: CMPE)



Viet Nam

In Viet Nam, malaria occurs in remote forest and forest-fringe communities, which are often inhabited by marginalized groups, including ethnic minorities and migrant settlers. The distribution of ITNs has occurred in all endemic villages with coverage estimated to be 70% by the National Institute for Malariology, Parasitology, and Entomology (NIMPE). Viet Nam, like other countries in the GMS, has a longstanding culture of bed net use that precedes the introduction of ITNs. As a component of Viet Nam's national malaria control strategy, the program treats approximately 4 to 5 million existing bed nets each year currently with lambda-cyhalothrin. In recent years, through Global Fund support, Viet Nam has introduced LLINs for certain provinces of the country, especially for hard-to-reach areas. In addition to this, NIMPE uses IRS to cover an additional 2 million people residing in hyper-endemic areas, where ITN use is low. The burden is concentrated at the border areas of Cambodia and Lao PDR (Figure 6). Viet Nam has dramatically reduced malaria cases from 293,016 to 15,752 and deaths from 148 to 6, between 2000 and 2014, respectively.

Figure 6: Malaria risk stratification in Viet Nam, 2015 (Source: NIMPE)

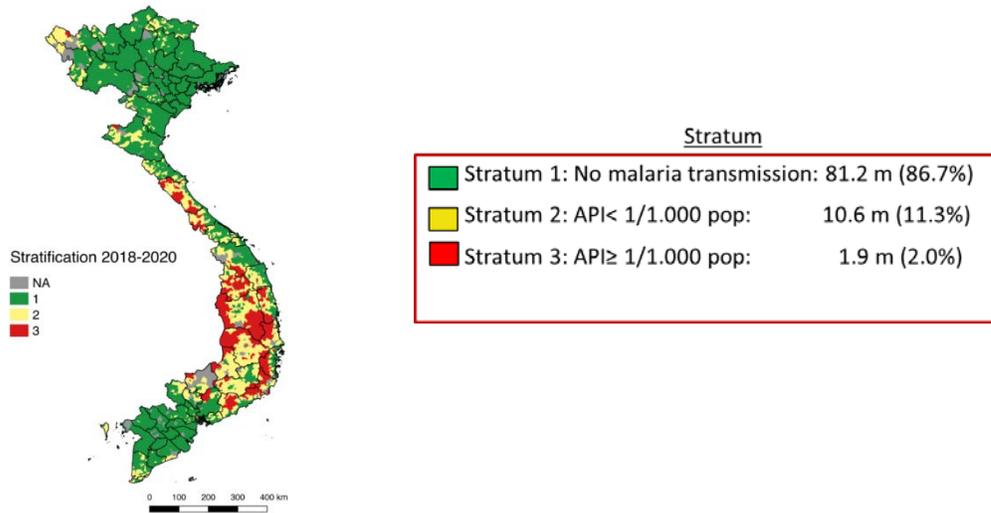
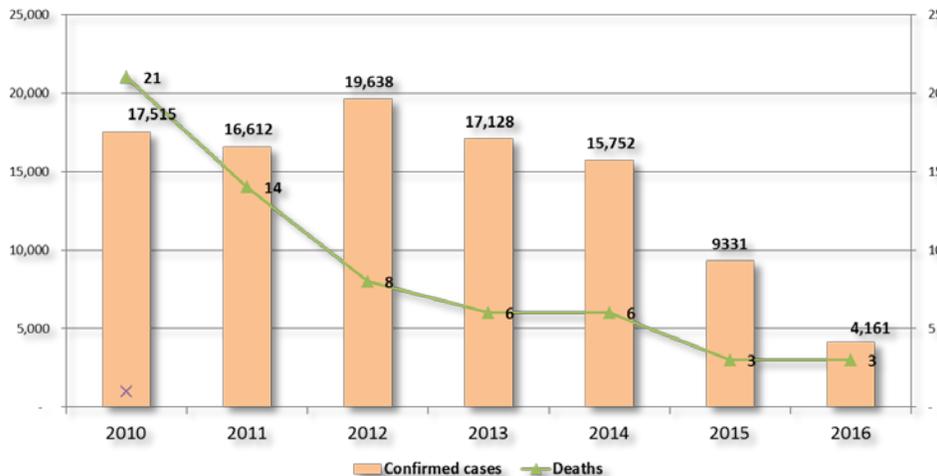


Figure 7: Malaria morbidity and mortality trend in Viet Nam (2010-2016) (Source: NIMPE)



3. Health system delivery structure and Ministry of Health (MOH) organization

Thailand

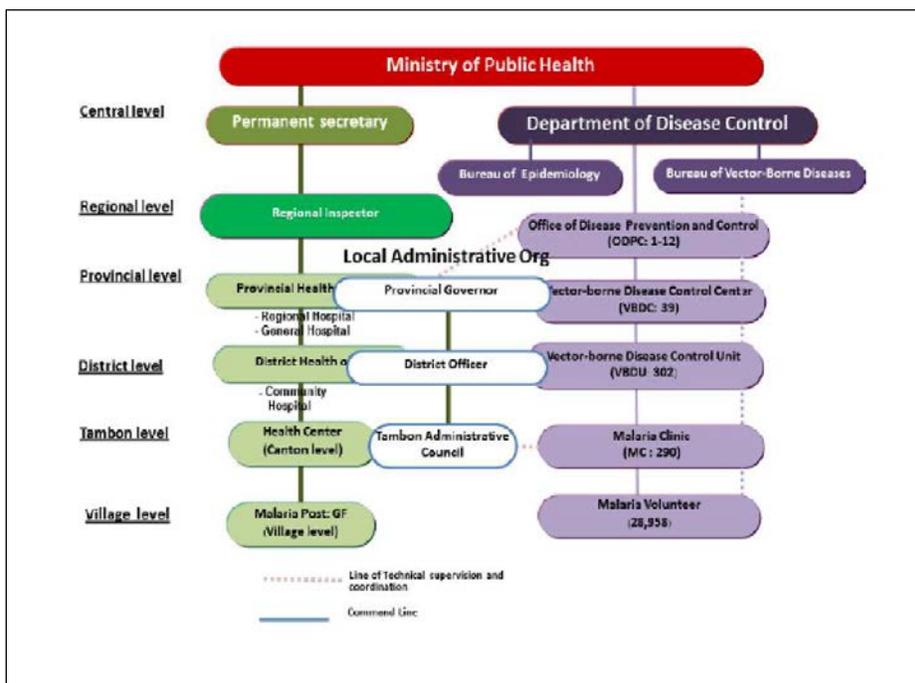
The Thai Malaria Control Program has been a vertical program from its inception in 1949 until 1996. In 1996, it was partially merged with other vector-borne disease programs (dengue fever and filariasis). It is now called the BVBD within the Department of Disease Control (DDC) in the Ministry of Public Health (MOPH). It is responsible for malaria-related research, generating policy for malaria control, and evaluating the program. At the regional level, the organization consists of 12 Disease Prevention and Control offices. Throughout the country, there are 39

Vector-borne Disease Centers at the provincial level and 301 Vector-borne Disease Units at the district level that are responsible for the prevention and control of malaria as well as other vector-borne diseases. There are currently 329 malaria clinics throughout the country. Additionally, village health volunteers are actively involved in prevention and control activities in each community.

Malaria services are provided both by the vertical program through the BVBD's networks of malaria clinics and through general health service facilities through district and provincial hospitals. Availability of Global Fund support in the past has boosted the role of the BVBD as it provides sub-grants to Provincial Health Offices (PHOs) to implement community-based services through malaria posts and border malaria posts making the services easily accessible to migrants. Health workers at malaria clinics use microscopes while those at malaria posts use rapid diagnostic tests (RDTs).

Currently, the NMCP is undergoing decentralization and reducing the funding and number of specialized field malaria officials. With this restructuring, health promotion hospitals, which are under the General Health Services, will be transitioned to provide malaria diagnosis with RDTs, provide treatment, as well as participate in conducting malaria case investigations, where appropriate. As of January 2017, the malaria information system previously managed by the BVBD with support from Mahidol University's Center of Excellence for Biomedical and Public Health Informatics (BIOPHICS) has been transitioned to the MOPH's Data Center (Information and Communications Technology Department) with the BVBD providing technical support and malaria-specific expertise.

Figure 8: Organizational structure of Thailand MOPH (Source: BVBD)



Lao PDR

The Ministry of Health has called for more integrated approaches, particularly for maternal and child health and immunization, decentralized service delivery methods, improved methods of health care financing, a unified and simplified health information system, and an emphasis on improvement of service quality in the next five years.

The public health system is predominant, although the private sector is growing. There are around 1,865 private pharmacies and 254 private clinics, mainly in urban areas. The state system is under-utilized, especially in the peripheral areas. In its efforts to increase access through village volunteers and village revolving drug funds, the government has managed to reach 5,226 villages.

Malaria activities are centralized at the CMPE which oversees 18 Provincial Anti-Malaria Stations (PAMS). Under the PAMS, there are 140 District Anti-Malaria Nuclei and Provincial Hospitals, including military hospitals. There are 879 health centers serving more than 11,000 villages. Each health center usually staffed with 1-3 health care providers is responsible for 5-12 villages in its service area and provides primary health care, basic training and health education, and referrals.

4. National malaria elimination strategies in Thailand, Lao PDR, and Viet Nam

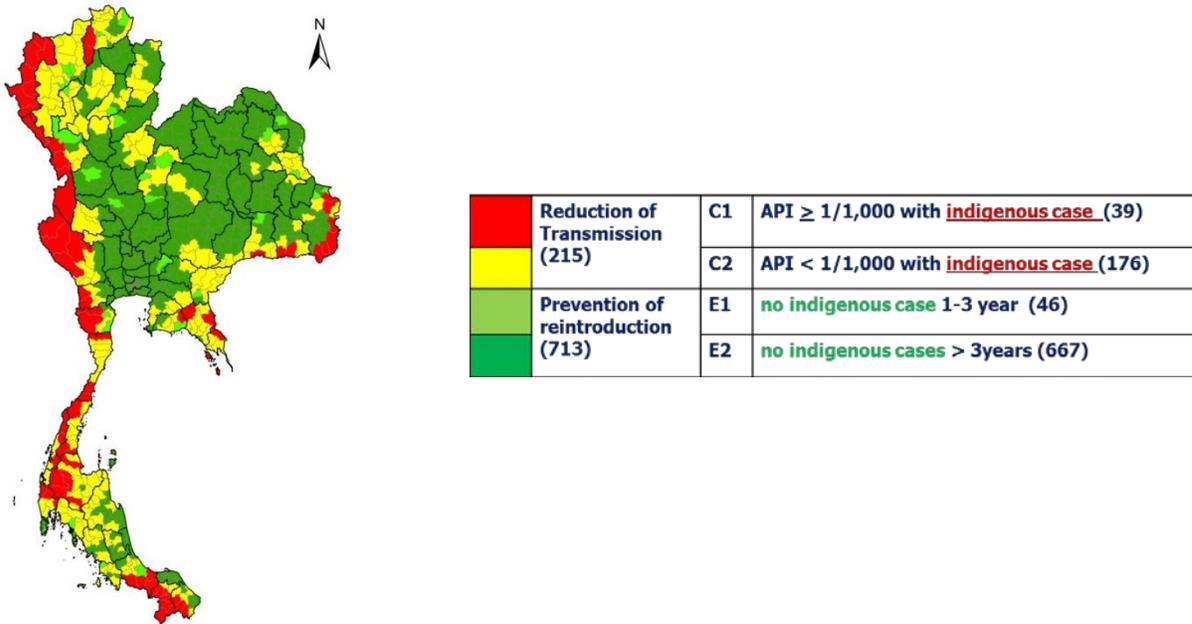
Thailand

Thailand envisions the elimination of malaria by 2024. The target sets out malaria elimination in more than 95% of districts by 2021, and all districts will be malaria-free by 2024. The objectives outlined in the new malaria elimination strategy include:

1. To reduce malaria morbidity to no more than 0.20 per 1,000 population by 2021.
2. To reduce malaria mortality to no more than 0.01 per 100,000 population by 2021.
3. To eliminate malaria transmission in at least 95% of total districts by 2021 (882 out of 928 districts/regions).
4. To prevent reintroduction of transmission in malaria-free areas.

The goal of the current National Strategic Plan (NSP) for Malaria Control and Elimination is to ensure 80% of the country will be free from locally acquired malaria transmission by the year 2016, 90% by 2018, and 95% by 2021 (Figure 9). This goal will be achieved through the following strategies: 1) accelerate malaria elimination in Thailand; 2) develop technology, innovation, measures, and models that are appropriate for malaria elimination; 3) establish collaboration with stakeholders at national and international networks for malaria elimination; and 4) promote community potential in protecting themselves from malaria.

Figure 9: Map showing control/transmission reduction and elimination districts in Thailand, 2017 (Source: BVBD)



* Numbers in parentheses indicate the number of districts.

The majority of the malaria burden in Thailand occurs along international borders; and resources from the Global Fund Single Stream Funding (SSF) and RAI grants have targeted malaria control and prevention activities along these border provinces. These two Global Fund grants will end by December 2017. Thailand anticipates receiving continued Global Fund support through the RAI2E grant (2018-2020) to focus its malaria elimination activities in remaining foci areas and expanding malaria services through some civil society organizations (CSOs) particularly along international borders. At the same time, Thailand has developed a transition and advocacy plan to mobilize domestic resources for malaria that will be required following the end of the RAI2E grant in 2020.

Lao PDR

Lao PDR has recently finalized their new Malaria NSP (2016-2020). The 2016-2020 Strategy is the first part of a three-phase approach to eliminate all forms of non-zoonotic human malaria in Lao PDR and includes strengthened interventions targeted to the southern part of the country to reduce the primary malaria burden while beginning efforts to eliminate malaria in the remaining focal areas in central and northern Lao PDR. The first five years of the strategy sets out to reduce the burden of malaria in the southern provinces below 5 cases per 1,000 population while eliminating *P. falciparum* malaria in primarily Northern provinces. By 2025, the country targets elimination of *P. falciparum* malaria and *P. vivax* from all Northern provinces and elimination of *P. falciparum* in the four southernmost provinces, and national malaria elimination is envisioned by 2030. Objectives for the first phase (2016-2020) are the following:

1. Establish effective program management and coordination at all levels of the health system to efficiently deliver a combination of targeted interventions for malaria burden reduction and elimination.
2. Achieve universal coverage of case management by 2018 to ensure 100% parasitological diagnosis of all suspected cases and prompt and effective treatment of all confirmed cases.
3. Protect at least 90% of all populations in burden reduction provinces with an appropriate vector control intervention by 2017.
4. Strengthen the surveillance system to detect, immediately notify, investigate, classify, report, and respond to all outbreaks and foci to move toward malaria elimination.
5. Implement a comprehensive Information, Education, and Communication and behavior change and communication approach to ensure that 90% of people seek treatment within 24 hours at an appropriate health facility or with a qualified care provider and at least 90% of populations residing in burden reduction areas utilize an appropriate protection tool by 2017.

Viet Nam

The National Strategic Plan for Malaria Elimination in Viet Nam aims to eliminate *Plasmodium falciparum* by 2025 and all malaria species by 2030. This will be achieved through the following objectives:

1. Ensure all people have better access to early diagnosis, prompt and effective treatment of malaria at public and private health facilities;
2. Ensure coverage of appropriate malaria control measures for all people at risk of malaria;
3. Eliminate malaria in provinces with low malaria endemicity and reduce malaria incidences in high and moderate endemic malaria areas;
4. Improve scientific research activities and apply the results of research in malaria control and elimination activities;
5. Improve the knowledge and behavior of people to protect themselves from malaria; Provide effective management and coordination of the national malaria control and elimination effort.

5. Strategic updates in Thailand and Lao PDR

Thailand

- In October 2015, Thailand conducted a Malaria Program Review to assess the progress made and challenges remaining in the areas of epidemiology, case management, vector control, M&E and surveillance, program management, strategy & policy, and financing and sustainability. Despite an encouraging declining trend in malaria cases, the Thailand Malaria Program Review identified malaria surveillance strengthening and response as one of the key recommendations to move towards elimination. Issues surrounding integration of the vertical malaria program with the public health services, data management capacity at the Ministry of Public Health Data Center, and mobilization of

response teams (e.g., Surveillance and Rapid Response Teams (SRRTs)) to conduct case investigations and response will need to be addressed as Thailand re-orientates its malaria program towards elimination.

- Since 2015, the BVBD created a Malaria Elimination Coordination Section to raise the profile of the malaria elimination agenda in Thailand. This group developed an operational plan for malaria elimination that has been approved by the Permanent Secretary. In addition, Thailand has developed a transition plan to shift resource mobilization for malaria, HIV, and TB towards domestic financing through a “Thai Fund.”

Lao PDR

- Under the new NSP (2016-2020), the Ministry of Health along with technical, implementation, and community partners will aggressively target southern areas and moderate burden areas in central and northern Lao PDR to provide quality diagnosis and treatment services for malaria, effective vector control measures to protect at-risk populations, and appropriate social and behavior change communication (SBCC). As part of general health systems strengthening initiatives led by the Ministry of Health, the national disease surveillance system will be upgraded to facilitate information-sharing and rapid response to the developing dynamics of malaria transmission in Lao PDR. This includes the rollout nationally of the District Health Information System 2 (DHIS-2) platform. In remaining focal areas of malaria transmission in northern provinces, elimination activities intended to interrupt transmission will be deployed and will serve as a model for eventual elimination nationally.
- Primaquine will be introduced to reduce transmission of *P. falciparum* and provide radical cure for *P. vivax* for Glucose-6-phosphate dehydrogenase (G6PD)-normal cases confirmed through the use of G6PD RDTs. To expand case management for migrant populations, the CMPE and partners will establish Mobile Malaria Teams and Malaria Posts to target mobile and migration population at their work sites.

6. Integration, collaboration, and coordination in Thailand, Lao PDR, and Regional

Thailand

At present, there are two concurrent malaria projects supported by the Global Fund; these are SSF from Round 10 (2014-2016) and the RAI for GMS (January 2014-December 2016; \$9.7 million). Thailand has successfully negotiated with the Global Fund for a no-cost extension of the SSF grant and a costed extension of the RAI grant through December 2017. Together with PMI support, malaria interventions are taking place in 46 malaria-endemic provinces. The support and activities target local Thai citizens, longer-term (M1) and short-term migrants (M2), refugees in camps, and people living in conflict zones along the Thai-Burma border. The projects aim to provide 100% LLIN coverage among these populations in both A1 and A2 areas (approximately 1.8 persons per LLIN). The inter-country component of RAI also addresses cross-border areas, initially between Thailand and Burma. In addition, LLINs for short-term,

non-Thai residents (M2) are provided when the person presents at a clinic with fever. Long-lasting insecticide-treated hammock nets (LLIHNS) and repellents are 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 index cases.

Under the RAI2E grant proposal for implementation in 2018-2020, Thailand has been allocated a total of \$23.3m over three years, which will support expansion of malaria services for mobile and migrant populations at all levels of the public health system, particularly through CSOs in hard-to-reach areas. Thailand will strengthen active case detection and case investigation of all malaria cases, as well as integrating drug resistance monitoring as part of the routine treatment follow-up surveillance system.

Table 1: Non-PMI funding landscape in Thailand

Funding Source	Total Budget in \$	Duration	Key Implementing Partners	Key Activities
Domestic	2,200,000	Annually	BVBD	Malaria Elimination Strategy
Global Fund SSF	29,203,469	2014-2016 (No cost extension to 2017)	BVBD, DDC (PR)	Containment of artemisinin resistance and moving towards the elimination of <i>Plasmodium falciparum</i>
Global Fund RAI	10,000,000	2014-2016 (cost extension to 2017)	BVBD, DDC (PR)	Artemisinin resistance containment
Global Fund RAI2E (country component)	23,300,000	2018-2020	BVBD, DDC, UNOPS (PR)	Accelerating to malaria elimination; targeting transmission foci

BVBD: Bureau of Vector Borne Diseases; DDC: Department of Disease Control; UNOPS: United Nations Office for Project Services; PR: Principal recipient

Lao PDR

The CMPE has in the past received funds from various donors which include the World Bank, Japan International Cooperation Agency, the European Union, and WHO. Commencing in 2004, the Global Fund has been the sole source of external funding for the program that accounts for more than 90% of total program funds. With Global Fund grant management structures, there has been a gradual improvement in the financial management system with the establishment of the principal recipient (PR), sub-recipients (SR) and sub-SRs at provincial levels. As a landlocked country sharing borders with all GMS countries, any resurgence of malaria in Lao PDR will inevitably affect its neighbors and jeopardize the region's goals for malaria elimination.

Organized by WHO, implementing partners working in Lao PDR meet on a monthly basis to share information and to coordinate program activities.

Table 2: Non-PMI funding landscape in Lao PDR

Funding Source	Total Budget in \$	Duration	Key Implementing Partners	Key Activities
Domestic	1,122,915	Annually	CMPE	Treatment services
Global Fund New Funding Model	7,039,151	2016-2017	CMPE, HPA, DCDC (PR)	LLIN scale-up activities, early diagnosis and treatment, Information System, project management; private sector involvement in five southern provinces.
Global Fund RAI	5,000,000	2014-2017	CMPE, HPA, DCDC (PR)	Artemisinin resistance in 5 southern provinces
Global Fund RAI2E (country component)	13,300,000	2018-2020	TBD	Scale up case management for hard-to-reach populations

CMPE: Center for Malariology, Parasitology, and Entomology; HPA: Health Poverty Action; DCDC: Department of Communicable Disease Control; PR: Principal Recipient; TBD: To be determined

Regional

In November 2014, regional leaders of 14 Asia-Pacific countries and those from the United States, China, Japan, and Australia, made an unprecedented commitment at the Ninth East Asia Summit to eliminate malaria across the region by 2030. This renewed attention and goal of elimination comes at an important juncture to address artemisinin resistance by eliminating malaria altogether in the region. Co-chaired by the Australian and Vietnamese Prime Ministers, the Asia-Pacific Leaders Malaria Alliance (APLMA) was tasked to develop a high-level framework to achieve malaria elimination in the region, which was presented to the Tenth East Asia Summit in Malaysia in 2015. Furthermore, WHO's Strategy for Malaria Elimination in the GMS (2015–2030) and the WHO Global Technical Strategy for Malaria (2016–2030) are aligned with this regional goal of malaria elimination.

The tremendous progress made in the region to date has paralleled the increase in malaria funding from external sources in recent years. As a whole, the region has been very successful in obtaining support from the Global Fund to Fight AIDS, Tuberculosis, and Malaria (Global Fund). All six countries have had at least one Global Fund grant; totaling over \$500 million for the GMS as a whole. To maximize efficiencies and to reduce management burden for countries, Global Fund has made the decision to consolidate all malaria grants in the region into one grant that is managed by one PR, namely the United Nations Office for Project Services (UNOPS). Table 3 details the various available funding sources, including domestic resources, for regional activities. This table includes current and active funding, and does not include potential future funding.

It is important to note that the funding landscape for the post-2020 period is uncertain. It is unclear whether eligibility for and resources from Global Fund will remain available to countries in the GMS, in light of the continued economic development and decreasing malaria burden.

Other funding sources in the region, including Australia’s Department of Foreign Affairs and Trade (DFAT), the Bill & Melinda Gates Foundation (BMGF), the Asian Development Bank (ADB), the United Kingdom’s Department for International Development (DFID), and bilateral aid from countries such as Japan and South Korea, may not be adequate to maintain and expand the intensified malaria control and prevention activities needed to move towards malaria elimination.

Table 3: Current (non-PMI) funding landscape for regional activities

Funding source	Total Budget in \$	Duration	Key Implementing Partners	Key Activities
ADB	4,500,000	Oct 2015- Jun 2017	MOH/CDC of Cambodia, Lao PDR, and Burma	Malaria and communicable diseases control in the GMS focused on malaria surveillance and diagnostic quality assurance (Burma), mobile and migrant populations (Burma, Cambodia and Lao PDR), and regional coordination
BMGF	29,000,000	2017-2020	UCSF	Achieving Global Malaria Eradication through Accelerated Regional Elimination
BMGF	30,000,000	2017-2019	CHAI	Acceleration of regionally coordinated malaria elimination in southern Africa and the GMS
BMGF	17,000,000	2017-2020	CHAI	Supporting malaria elimination in Southern Africa and the GMS through strengthened surveillance and response
BMGF	20,000,000	2017-2019	PSI	Strengthening malaria case management and surveillance to accelerated malaria elimination in Cambodia, Lao PDR, Myanmar, and Viet Nam
Global Fund RAI (ICC)	15,000,000	2014-2016*	SMRU, MAM, CPI	Cross-border; inter-country coordination; mass drug administration pilots; establishing malaria posts in Burma
Global Fund RAI2E (Regional Component)	\$34,000,000	2018-2020	TBD	Operational research, regional data sharing platform, CSO platform, etc.
DFAT	16,300,000	2014 - 2017	ADB (Secretariat)	Regional malaria and other communicable disease threats trust fund
DFID	19,400,000			

ADB: Asian Development Bank; BMGF: Bill & Melinda Gates Foundation; CDC: Communicable Diseases Control; DFAT: Department of Foreign Affairs and Trade; DFID: Department for International Development; PSI: Population Services International; RAI: Regional Artemisinin Resistance; RAI2E: Regional Artemisinin Resistance 2 for Elimination; ICC: Inter-Country Component; SMRU: Shoklo Malaria Research Unit; MAM: Medical Action Myanmar (Burma); CPI: Community Partners International; CHAI: Clinton Health Access Initiative; MOH: Ministry of Health; UCSF: University of California at San Francisco

* Costed extension through 2017

Sources: World Malaria Report; www.theglobalfund.org; www.gatesfoundation.org; www.3df.org; www.3mdg.org; www.adb.org

Regional Artemisinin Initiative 2 Elimination (RAI2E) (2018-2020)

Despite a steady decline in malaria burden, continued support for malaria elimination in the region remains critical in the context of ever increasing antimalarial drug resistance. Following a successfully implemented Regional Artemisinin Initiative (RAI) project (2015-2017), the Global Fund Board has decided to consolidate malaria funding for GMS countries into a single regional grant, where the activities covered under the New Funding Model (NFM) and RAI grants would form a “country component” with the regional grant. The RAI2E program grant period will be January 2018 through December 2020 with an allocation of \$242m for all 5 GMS countries, including a regional component (\$34m). To maximize efficiencies and to reduce management burden for countries, management of the regional grant will be implemented by UNOPS.

The regional component (\$34m) aims to address overarching issues affecting national strategies, enhancing country components and ensuring regional coherence. Seven packages of interventions have been identified:

1. Extending access to prevention tools and case management services amongst hard to reach populations through ‘Inter-Country Projects’ (ICP) that go beyond what is described in country components
2. Stimulating operational research and innovation to guide policy
3. Ensuring availability of quality health commodities across the GMS
4. Strengthening regional surveillance
5. Monitoring antimalarial drug efficacy and treatment policy updates
6. Providing advocacy and political support to constituencies to improve and expand service delivery in country components through regional multi-sectoral collaboration
7. Supporting the enabling environment to ensure quality implementation of RAI2E

Asia-Pacific Leaders Malaria Alliance (APLMA)

Established at the 2013 East Asia Summit and now based in Singapore, APLMA is co-chaired by the Prime Ministers of Viet Nam and Australia. Similar to the African Leaders’ Malaria Alliance, APLMA’s aim is to foster cooperation among governments and development partners for long-term response to malaria and communicable diseases in the region. With its Secretariat originally established at the ADB, APLMA was set up as a high-level political advocacy platform to accelerate political commitment, mobilize country and regional action, and track progress in line with global targets. In 2015, APLMA released a roadmap for malaria elimination in the Asia-Pacific¹, which estimated the indicative cost of elimination at just over \$1 billion per year on average in the first five-year phase and just under \$2 billion per year in subsequent phases.

This Leaders’ Malaria Elimination Roadmap has identified six essential priorities that Leaders will need to support to realize the 2030 goal of an Asia-Pacific that is malaria-free: 1) Unite national efforts and regional actions; 2) Map, prevent, test and treat the disease, everywhere; 3) Ensure high quality malaria services, tests, medicines, nets and insecticides; 4) Improve targeting

¹ http://aplma.org/upload/resource/files/APLMA_Roadmap_final_EAS_2015.pdf

and efficiency to maximize impact; 5) Mobilize domestic financing and leverage external support; and 6) Innovate for elimination.

The Secretariat is currently undergoing a transition, but remains focused on delivering outcomes in four key areas to maximize impact: 1) Leadership and advocacy to build increased political commitment to malaria elimination by Leaders in the Asia-Pacific Region; 2) Accountability to ensure Heads of Government in endemic and non-endemic countries increasingly hold each other mutually accountable for progress against agreed malaria targets using the APLMA Dashboard; 3) Financing to ensure national, regional, and global resource mobilization to progress malaria elimination and prevent its resurgence; and 4) Quality medicines to take forward the recommendations of the Access to Quality Medicines and Other Technologies Task Force, co-chaired by Australian Secretary of Health and Indian Secretary of Health.

Under APLMA, two task forces have been established: 1) Access to Quality and Affordable Medicines and Other Technologies Taskforce and 2) Regional Financing for Malaria Task force.

Asia-Pacific Malaria Elimination Network (APMEN)

Established in 2009, APMEN is composed of 18 Asia-Pacific countries (Bangladesh, Bhutan, Cambodia, China, Democratic People's Republic of Korea, India, Indonesia, Lao People's Democratic Republic, Malaysia, Nepal, Papua New Guinea, Philippines, Republic of Korea, the Solomon Islands, Sri Lanka, Thailand, Vanuatu and Viet Nam) and partner institutions consisting of multilateral and bilateral partners and research groups. APMEN links eliminating countries with experts from multilateral, non-governmental and academic institutions, as well as the World Health Organization. APMEN seeks to collaboratively address the challenges of elimination in the Asia Pacific through a forum to develop leadership, advocacy, capacity, knowledge exchange, and the evidence base for malaria elimination.

Under a new Strategic Plan (2017-2020), APMEN's organizational objectives are the following:

- 1) Contributing to improved evidence and action for malaria elimination particularly in the areas of *Plasmodium vivax* diagnosis and treatment, vector control and surveillance and response;
- 2) Facilitation of, and support to, work by other institutions with the specific objectives of strengthening evidence and action for malaria elimination; and
- 3) In areas of specific technical focus, targeted human resource capacity development;
- 4) Networking of malaria elimination stakeholders

The network shares programmatic experience among NMCPs through network meetings, study visits, and cross-country fellowships and serves as a conduit for linking OR to programmatic implementation. Originally funded by DFAT, the network is now coordinated through the Global Health Group at the University of California San Francisco with funding support from the BMGF. APMEN now has an Asia-based secretariat located within APLMA in Singapore. The Secretariat serves to plan and facilitate all APMEN activities and manage the implementation of the annual work plans developed and endorsed by Network members. Communications and other support functions will be shared with APLMA.

Asian Development Bank Regional Malaria Trust Fund (RMTF)

In 2013, the ADB established a health financing facility that provides financing for activities designed to curb regional epidemics. This regional trust fund is envisaged as a fund for communicable diseases in the long term; however, in the short term the focus will be full support to malaria elimination and containment of artemisinin-resistant malaria with the aim of addressing urgent gaps in the response to drug-resistant malaria in South East Asia and to help prevent its spread to Africa. The RMTF focuses its efforts on strengthened regional leadership; increased financing for malaria; increased availability, market share and use of quality-assured commodities; increased availability and use of quality information, tools, and technology on malaria and other communicable disease threats; improved national capacity to detect and respond to drug-resistant malaria and other communicable disease threats; and addressing malaria in large commercial and development projects.

The RMTF's financing partners are Australia's DFAT, the Government of Canada (Department of Foreign Affairs, Trade and Development), and the United Kingdom's DFID. To date, the RMTF management has approved a total of \$13.6 million for four technical assistance projects:

1. R-CDTA 8485: Strengthening Regional Response to Malaria and Other Communicable Diseases in Asia and Pacific (support for APLMA) (\$750,000)
2. R-CDTA 8763: Results for Malaria Elimination and Control of Communicable Disease Threats in Asia and the Pacific, with a focus on the GMS (\$12,000,000)
3. R-CDTA 8681: Awareness Raising to Adopt Action for Malaria Elimination in Asia-Pacific (support for APLMA) (\$225,000)
4. R-CDTA 8656: Malaria and Dengue Risk Mapping and Response Planning in GMS (implementing partners Mahidol Oxford Tropical Medicine Research Unit, Harvard School of Public Health, and University of Tokyo) (\$600,000 for Cambodia, Burma, Thailand)

Furthermore, \$9.5 million in additional financing is planned for ADB's Second Greater Mekong Sub-region Regional Communicable Diseases Project (CDC2) for Cambodia, Lao PDR, and Viet Nam, and \$4.5 million for Burma for technical assistance.

USG coordination

Lower Mekong Initiative

PMI embraces the goals of the Lower Mekong Initiative (LMI), a multinational partnership between Cambodia, Lao PDR, Burma, Thailand, Viet Nam, and the United States, established to support integrated sub-regional cooperation among the five Lower Mekong countries. The LMI serves as a platform to address complex, transnational development and policy challenges in the Lower Mekong Sub-region. Specifically, PMI objectives for the LMI include: 1) focusing on malaria and the need to develop and strengthen a coordinated response; 2) prevention and control of counterfeit and substandard medications; 3) fostering regional collaboration to support implementation of the International Health Regulations and regional-level emphasis on

surveillance and response; and 4) sharing good practices across USG health initiatives. Furthermore, cross-border and migrant issues are concerns for LMI. Burma joined the initiative in 2012, ensuring a strong geographic overlap between the PMI GMS countries and the LMI. Along with the United States, Burma is the co-chair of the Agriculture and Food Security Pillar to improve agriculture and food security sector growth throughout the Mekong Sub-region in an environmentally sustainable manner.

Other USG partners

The Department of Defense's Armed Forces Research Institute of Medical Sciences (AFRIMS) has been conducting clinical research and surveillance activities in western Cambodia since 2003. After AFRIMS conducted the first study to document artemisinin resistance in 2008, subsequent research has focused on determining optimal dosing strategies for the artemisinin component of ACTs, and assessing treatment responses to first-line ACTs in Thailand and Cambodia. Currently AFRIMS is partnering with Cambodia's National Centre for Parasitology, Entomology, and Malaria (CNM) and the Royal Cambodian Armed Forces to build malaria capacity and test strategies for malaria elimination in the military sector. AFRIMS' work has been pivotal in informing national treatment policies being developed by the CNM. AFRIMS is also programming \$30 million for a Defense Malaria Elimination Program for applied research in the GMS for 2018-2022.

The Department of Defense's Naval Malaria Research Center-Asia also conducts drug resistance and clinical efficacy monitoring in the Mekong Region, focusing much of its activity in Viet Nam and Cambodia. Current activities include evaluating the efficacy of artemether-lumefantrine (AL) +/- artesunate, syndromic surveillance, and characterizing malaria epidemiology with different levels of endemicity to allow more effective application of limited resources.

The Department of Health and Human Services, National Institutes of Health, through the National Institute of Allergy and Infectious Diseases, conducts basic research in Cambodia to improve knowledge of malaria pathogenesis and protection to aid in the development of new antimalarial therapeutics and vaccines. The National Institutes of Health has studied parasite clearance rates in response to artemisinin in 500 patients from western, northern, and eastern Cambodia and, by studying clinical responses to dihydroartemisinin-piperaquine (DHA-Pip) in the northern provinces, has directly influenced national treatment guidelines.

7. PMI goal, objectives, strategic areas, and key indicators

Under the PMI Strategy for 2015-2020, the U.S. Government's goal is to work with PMI-supported countries and partners to further reduce malaria deaths and substantially decrease malaria morbidity, towards the long-term goal of elimination. Building upon the progress to date in PMI-supported countries, PMI will work with NMCPs and partners to accomplish the following objectives by 2020:

1. Reduce malaria mortality by one-third from 2015 levels in PMI-supported countries, achieving a greater than 80% reduction from PMI's original 2000 baseline levels.
2. Reduce malaria morbidity in PMI-supported countries by 40% from 2015 levels.
3. Assist at least five PMI-supported countries to meet the World Health Organization's (WHO) criteria for national or sub-national pre-elimination.²

These objectives will be accomplished by emphasizing five core areas of strategic focus:

- Achieving and sustaining scale-up of proven interventions
- Adapting to changing epidemiology and incorporating new tools
- Improving countries' capacity to collect and use information
- Mitigating risk against the current malaria control gains
- Building capacity and health systems towards full country ownership

To track progress toward achieving and sustaining scale of proven interventions (area of strategic focus #1), PMI will continue to track the key indicators recommended by the Roll Back Malaria Monitoring and Evaluation Reference Group (RBM MERG) as listed below:

- Proportion of households with at least one ITN
- Proportion of households with at least one ITN for every two people
- Proportion of children under five years old who slept under an ITN the previous night
- Proportion of pregnant women who slept under an ITN the previous night
- Proportion of children under five years old with fever in the last two weeks for whom advice or treatment was sought
- Proportion of children under five with fever in the last two weeks who had a finger or heel stick
- Proportion receiving an ACT among children under five years old with fever in the last two weeks who received any antimalarial drugs

8. Progress on coverage/impact indicators to date in Thailand, Lao PDR, and Viet Nam

As malaria incidence declines and malaria becomes more heterogeneous, the need for large-scale population-based surveys will wane and more emphasis will be placed on strengthening malaria surveillance systems. As countries in the GMS move towards malaria elimination, it will be critical that malaria surveillance systems adequately capture patient level information for timely response. Thailand's malaria surveillance system is probably the most robust with data reported from public and private hospitals and non-governmental organizations (NGOs), with presumably no malaria treatment in the private sector. Data from the private sector is grossly under-estimated in some countries in the region and further work is needed to incorporate, report, and respond to malaria case data detected in this sector.

² http://whqlibdoc.who.int/publications/2007/9789241596084_eng.pdf

Table 4: Evolution of Key Survey Based Malaria Indicators in Thailand, Lao PDR, and Viet Nam

Indicator	Thailand			Lao PDR		Viet Nam	
	Migrant RDS, Ranong (2012)	TMS (2012)	KAP Survey (2015)	MICS (2006)	LSIS (2012)	MICS (2006)	MICS (2011)
Malaria prevalence (%)	0	0.1 (PCR)	-	-	-	-	-
Households with at least one net (%)	83-94	92.2	90.1	93.6	94.0	99.0	95.5
Households with at least one ITN (%)	-	46.5	51.0	45.0	50.0	19.0	9.5
Persons who slept under an ITN the previous night (%)	1-2	28.7	38.5	-	-	-	-
Children under five years old who slept under an ITN the previous night (%)	-	32.5	56.4	40.5	43.2	5.0	9.4
Pregnant women who slept under an ITN the previous night (%)	-	36.2	-	-	43.2	-	11.3

TMS: Thailand Malaria Survey; KAP: Knowledge, Attitudes, and Practices; ITN: insecticide-treated net; MICS: Multiple Indicator Cluster Survey; PCR: polymerase chain reaction; RDS: Respondent-driven sampling; LSIS: Lao Social Indicator Survey

Thailand

Thailand had not conducted a nationwide malaria survey in several decades due to the fact that it has a fairly comprehensive routine surveillance system in place. However, with funding from the Global Fund in 2012, Thailand conducted a national malaria survey (using microscopy and polymerase chain reaction (PCR)) to help with measuring progress and outcomes for the Global Fund grant as well as indicators for the national program. The design of the survey aimed to compare coverage of malaria interventions in at-risk villages along the Thai-Cambodia border, Thai-Burma border, and the rest of Thailand. Overall, malaria prevalence with PCR was very low (0.1%), but the survey indicated some areas for improvement in terms of coverage and use of LLINs. Approximately 80% of all people living in sampled households slept under a mosquito net the previous night; however, only 29% used an ITN. Household coverage and use of ITNs was slightly better in the provinces along the Thai-Cambodia border compared to the Thai-Burma border.

In 2015, the BVBD conducted a Knowledge, Attitude, and Practice (KAP) survey to evaluate coverage and usage of malaria prevention methods and associated malaria risk factors among at-risk populations in Thailand (43 provinces of Phase I and an additional 2 provinces of Phase II Global Fund SSF grants). The KAP survey served as a mid-term evaluation for the Global Fund SSF grant and as a comparison to the Thailand Malaria Survey in 2012. The KAP survey found improvements in key areas such as malaria knowledge and net usage compared to 2012 levels. Knowledge about how malaria is transmitted increased from 48% to 92% and ITN use the previous night increased from 28% to 39%. Despite these improvements, the survey found that coverage of households with ITNs and LLINs still remain relatively low.

Table 5: Evolution of Key Malaria Indicators reported through routine surveillance systems in Thailand

Indicator	2012	2013	2014	2015	2016
Total # Confirmed Cases	32,569	41,362	37,921	24,875	17,153
Total # inpatient malaria deaths	37	47	38	33	TBD
Data Completeness* (%)	100	100	100	100	100
Test Positivity Rate (TPR)	2.1%	2.1%	2.0%	2.4%	1.3%
Annual Parasite Incidence (per 1000)	0.54	0.59	0.50	0.38	0.28

*Percentage of health facilities reporting each month
Sources: World Malaria Report 2015 and BVBD

Lao PDR

The last national survey in Lao PDR was the Lao Social Indicator Survey (LSIS) conducted in 2011-2012. This survey was a household-based survey that applied the technical frameworks of the Multiple Indicator Cluster Survey (MICS) and DHS, which captures data for nutrition, fertility and reproductive health, and maternal and child health, including malaria. Both the MICS (2006) and LSIS (2012) in Lao PDR indicated modest coverage of households with at least one ITN, but there were significant gaps in diagnostic testing and prompt treatment-seeking behaviors. For example, only 10% of children less than five years of age with a fever within the past two weeks were screened with a diagnostic rapid test or other method. With support from USAID, United Nations Children's Fund (UNICEF), and other partners, another follow-up LSIS is planned for 2017.

Table 6: Evolution of Key Malaria Indicators reported through routine surveillance systems in Lao PDR

Indicator	2012	2013	2014	2015	2016
Total # Confirmed Cases	46,819	41,385	50,659	36,056	15,457
Total # inpatient malaria deaths	44	28	4	2	1
Data Completeness* (%)	n/a	n/a	n/a	n/a	n/a
Test Positivity Rate (TPR)	13.7%	11.0%	16.2%	12.7%	6.5%
Annual Parasite Incidence (per 1000)	6.8	5.8	7.1	4.9	2.3

*Percentage of health facilities reporting each month
n/a: not available
Sources: World Malaria Report 2015 and CMPE

Viet Nam

Multiple Indicator Cluster Surveys have been conducted in 2006 and 2011 in Viet Nam. Results from these surveys indicate that net coverage with conventional nets is high; however, availability and use of ITNs remain low. Plans are underway to conduct another MICS in 2017.

Table 7: Evolution of Key Malaria Indicators reported through routine surveillance systems in Viet Nam

Indicator	2012	2013	2014	2015	2016
Total # Cases	43,717	35,406	27,868	19,252	10,446
Total # Confirmed Cases	19,638	17,128	15,752	9,331	4,161
Total # inpatient malaria deaths	8	6	6	3	3
Data Completeness* (%)	n/a	n/a	n/a	n/a	n/a
Test Positivity Rate (TPR)	n/a	n/a	n/a	n/a	n/a
Annual Parasite Incidence (per 1000)	1.18	0.8	1.35	0.77	0.35

*Percentage of health facilities reporting each month

n/a: not available

Sources: World Malaria Report 2015 and NIMPE

III. OPERATIONAL PLAN (Thailand, Lao PDR, and Regional)

This section covers PMI's operational plan for Thailand, Lao PDR and Regional using FY 2018 funding.

Based within the USAID/ Regional Development Mission for Asia (RDMA), PMI works closely with Thailand's NMCP staff to strengthen their capacity towards progress in elimination of malaria in Thailand. PMI supports the NMCP with technical and programming activities across a package of malaria control interventions and cross cutting areas including procurement and distribution of commodities, strengthening surveillance and monitoring and evaluation systems in order to support the NMCP's elimination strategy. With FY 2018 Thailand funding, PMI also supports training of malaria program managers from across the Greater Mekong Sub-region (GMS) as well as support for a regional slide bank.

With a more limited presence in Lao PDR, PMI operates through the USAID/RDMA Mission platform in an effort to support the NMCP in controlling malaria, responding to and mitigating malaria outbreaks and targeting select technical assistance activities at sub-national levels in support of the country's elimination strategy. PMI also provides support to the NMCP to strengthen its malaria surveillance and supply chain management systems.

This FY 2018 MOP also supports TES activities in Viet Nam to ensure capacity and foster greater collaboration and coordination among the GMS NMCPs in malaria control and elimination efforts. As Viet Nam has detected artemisinin as well as partner drug resistance, PMI continues to support TES in Viet Nam and regional engagement around drug resistance monitoring.

Regionally, this FY 2018 MOP supports 1) technical assistance to NMCPs for the implementation and analysis of therapeutic efficacy monitoring in the GMS and 2) capacity strengthening and training for NMCPs in malaria diagnostics, microscopy accreditation, entomology, and program management.

1. Vector monitoring and control

NMCP/PMI objectives

There are two priorities for entomological monitoring in the GMS: 1) mapping of vectors in areas where epidemiologic data indicate that malaria transmission continues to occur and 2) improved surveillance for insecticide resistance. Forests in the GMS are home to the region's most efficient malaria vector, the *An. dirus* group, while secondary vectors, *An. minimus* and *An. maculatus*, are also found in some newly established plantations near forests. Beyond these species, there are many minor vectors whose populations are temporally and spatially heterogeneous and whose importance in the rapidly changing ecology of the region is still largely unknown.

Unlike the therapeutic efficacy monitoring network, the entomological surveillance undertaken by NMCPs and some foundations, universities, and research institutions within each of the GMS countries is often uncoordinated and the results are not widely disseminated. Throughout the region, surveys on vector bionomics and insecticide resistance need to be better correlated with malaria transmission and epidemiological data.

In border areas with Cambodia and Burma, where PMI and other donors are supporting efforts to scale up LLINs, the NMCP needs to monitor and evaluate a few basic entomological parameters. A third border area with indigenous transmission within Thailand along the Malaysian border is difficult to access due to political unrest. The proper approach towards entomological surveillance is complicated by the shifting ecology of forest habitats, the complexity of vector bionomics and behavior, and the varying malaria epidemiology as programs shift from control to elimination on a sub-national scale. However, the geographic scope of entomological surveillance can be much more focused, as such surveillance is needed only in areas of residual malaria transmission.

All NMCPs in the GMS support free mass distribution of LLINs to targeted areas. While in the past – and to some extent now – the areas targeted were those with high levels of artemisinin resistance, NMCPs have shifted to a strategy of stratifying levels of endemicity and providing mass distribution of LLINs in areas with high malaria incidence. In areas with low endemicity, which are reorienting the NMCP's efforts towards elimination, the NMCP's strategy is to ensure LLIN coverage in transmission foci; thus, distribution is targeted to villages or clusters of villages with active transmission. In addition to LLINs, there is provision – sometimes at no cost and sometimes through social marketing – of long-lasting insecticide-treated hammock nets (LLIHNS), intended for forest workers. Traditionally, there has been a very large and active private sector sale of untreated nets of varying quality throughout the GMS. In general, household ownership of untreated nets is high throughout the region.

Mosquito coils, repellents, protective clothing, and fumigation with smoke are also used within the GMS as personal protective measures. A presentation at the 2013 Vector Control Working Group meeting reported that many rubber tappers in Burma used mosquito coils attached to a hat or headlamp when tapping. There have been several efforts in Burma, Thailand, Cambodia, and Viet Nam to reinforce personal protection through use of repellents and treated materials. However, the use and effectiveness of topical repellents in different settings has not been adequately assessed and widespread deployment has not occurred.

The Thai Bureau of Vector-Borne Diseases (BVBD) NSP for Malaria Control and Elimination targets one LLIN for every 1.8 resident, migrant, and military personnel based in malaria-endemic villages. LLINs are to be replaced every three years. Long-lasting insecticide-treated hammock nets are distributed in endemic villages of targeted provinces where LLINs cannot be used (e.g., migrants and soldiers spending nights in the forest and on the Thai-Cambodia border). Thailand is also a major net manufacturer. IRS is conducted in Thailand with support primarily from Global Fund and domestic resources, and implemented by local administrations using one of three insecticides: deltamethrin 5% WP and 25% WG; bifenthrin 10% WP; or alphacypermethrin 10% SC.

In Laos, the NSP (2016-2020) has set out to protect 90% of the all the populations in burden reduction provinces with appropriate vector control interventions including LLINs. The NMCP's primary distribution channel is through mass distribution campaigns every three years and targeting high-risk rural populations. In the rest of the country, only those areas with suspected transmission of foci and areas with major development projects that are likely to attract mobile and migrant populations (MMPs) will receive nets. The Centre for Malaria, Parasitology, and Entomology (CMPE) conducted one mass distribution campaign in 2016 to distribute 1.3 million LLINs in areas with the highest incidence of malaria or where high-risk groups such as MMPs exist. The next mass distribution campaign is planned for 2019 in Strata 3 areas across the country and in Strata 2b areas in the five prioritized southern provinces (Savannakhet, Saravane, Sekong, Champasack, and Attapeu). Under the Global Fund grant, CMPE will procure sufficient LLINs to reach a population of 1.685 million. In addition, the CMPE will support mass distribution campaigns and replacement from 2018-2020 in order to target at-risk mobile migrant populations and the military.

a. Entomological monitoring and insecticide resistance management

Progress since PMI was launched

Thailand's workforce of entomologists is a particular strength, with a highly trained technical staff. As with other malaria specific skills, technical expertise will become more challenging as malaria burden wanes and fiscal concerns encourage integration of vertical programs into larger structures. PMI continues to support regional strengthening of entomological surveillance, insecticide resistance monitoring, and development and evaluation of methods to interrupt outdoor transmission in the region.

Working in collaboration with WHO and Roll Back Malaria, PMI continues assisting with coordination of personnel and resources to strengthen entomological monitoring in the region. PMI continues to engage with Japan International Cooperation Agency, Mahidol University, Institute of Tropical Medicine Antwerp, and Armed Forces Research Institute of Medical Sciences to strengthen entomological capacity in the region. PMI entomologists are active participants in the Vector Control Working Group of the Asia-Pacific Malaria Elimination Network (APMEN), which has brought together programs in the GMS and elsewhere in Asia to learn from their respective experiences.

With support from the government-to-government grant to the Ministry of Public Health, BVBD in collaboration with the Office of Prevention and Control conducted entomological surveillance in Mae Ramat district, Tak province in October 2014. The results indicated that both *An. minimus* complex and *An. maculatus* group were nearly 100% susceptible to deltamethrin, permethrin, and alpha-cypermethrin.

Progress during the last 12-18 months

Work partly funded by PMI over the past year highlighted the need to better understand how to reduce risk of transmission in targeted MMPs and to develop better approaches for reduction of outdoor transmission. PMI and APMEN worked together to bring together partners in the region

in Thailand to map out priorities for operational research. As the products developed would be niche products without a broad or sustained market, private sector engagement is a challenge. In addition, the level of evidence needed to attain an endorsement from WHO would need to be entomological, not epidemiological, otherwise the needed trials would be too costly to undertake, given the low levels of transmission involved. While studies from various countries in the region, including PMI-funded research in Burmese rubber tappers show that insecticide-treated clothing may decrease mosquito biting and are acceptable to plantation workers, how to scale up delivery of such interventions to those truly at risk is as yet undefined.

Plans and justification

In Thailand, PMI will support a workshop in June 2017 to train central and regional entomologists in intensity bioassays to allow better mapping of insecticide resistance in the country. At present, such surveillance is done in an ad hoc manner by national authorities; decentralization of this technology will allow better mapping of resistance and more rapid response to changes in patterns of resistance. Of note, Thailand is one of the few countries in the GMS (Viet Nam being the other) with sufficient entomological capacity at regional level to allow such an approach to succeed.

In addition, PMI will support piloting and rollout of integrated investigation of foci of transmission and support training for staff in this methodology. Such combined epidemiological and entomological rapid investigations will be needed as the region moves towards malaria elimination.

Proposed activities with FY 2018 funding: (\$79,000)

- **Training in integrated foci evaluation.** Regional training in investigation of foci of transmission will be conducted in collaboration with BVBD and other stakeholders. (\$50,000)
- **Technical support for entomology.** Two TDYs from Centers for Disease Control and Prevention (CDC) entomologists are planned to provide technical assistance to Thailand and the region and will emphasize regional planning and coordination. (\$14,500 for Thailand, \$14,500 for Regional)

b. Insecticide-treated nets

Progress since PMI was launched

Programs in the GMS have broadly increased coverage of LLINs and LLIHNs over the past years; the primary issue facing programs is better targeting of net distribution guided by information on malaria transmission. In Thailand, the NMCP has the needed information for effective targeting, while in other GMS countries coordination is more challenging due to dispersion of data amongst various partners. PMI has supported procurement of both

commodities since FY 2012 based upon the principal of gap filling or response to outbreaks, particularly in Laos.

A Global Fund Knowledge, Attitude, and Practice (KAP) survey conducted in 2015, evaluating coverage and usage of malaria prevention methods in areas with malaria transmission in Thailand, found improvements in key areas such as net usage and malaria knowledge since the 2012 baseline survey. Net usage of LLINs had significantly increased from 19% in 2012 to 30% in 2015, as did the proportion of individuals sleeping under any net (conventional or treated). Knowledge of malaria in the study area was high, with 92% of interviewed household heads knowing that malaria is transmitted by mosquito bites and caused by staying in the forest. This is a large improvement from the Thailand Malaria Survey in 2012 when only 41% of respondents knew the mode of malaria transmission. There was also a significant increase in the proportion of household heads who knew at least one key malaria containment/elimination message (25% in 2012 to 63% in 2015), indicating successes in SBCC strategies focused on supporting the containment and elimination of *P. falciparum* parasites. While these successes in net usage and malaria knowledge and awareness are encouraging, the KAP survey showed that universal coverage of ITNs has not yet been achieved in the areas surveyed and where nets were targeted in Thailand. Ownership of “sufficient” mosquito nets, defined as at least one net for every two people in the household, was achieved by 62% of households for any type of net, while only 23% of household had sufficient ITNs and 17% had sufficient LLINs. The report concluded with recommendations to explore alternate strategies of LLIN distribution to ensure that the entire population has access to LLINs.

Progress during the last 12-18 months

PMI has been able to fill unanticipated LLIN gaps for both Thailand and Lao PDR. At the request of CMPE and with FY 2015 funds, PMI procured and distributed 120,000 LLINs for the five southern provinces of Lao PDR in preparation for the upcoming transmission season.

In Thailand, PMI procured 40,000 LLINs to be distributed in the southern provinces bordering Malaysia where there has been an increase in malaria cases detected. These provinces in the south are conflict areas and the national program is coordinating with local authorities and CSOs to ensure that malaria commodities are available for those populations affected.

Table 8: ITN Gap Analysis (Thailand)

Calendar Year	2017	2018	2019
Total Targeted Population*	1,145,532	1,033,326	933,940
Continuous Distribution Needs			
Continuous Distribution Needs	0	0	0
	0	0	0
Mass Distribution Needs**			
Estimated Total Need for Thai+M1	298,398	14,908	151,340
Estimated Total Need for M2	112,100	63,950	51,200
Total Calculated Need (Continuous and Campaign):	410,498	78,858	202,540
Partner Contributions			
ITNs carried over from previous year			
ITNs from Government			
ITNs from Global Fund (SSF)	364,536		
ITNs from Global Fund (RAI)	4,300		
ITNs planned with PMI funding	40,000	78,858	259,722
Total ITNs Available	408,836	78,858	202,540
Total ITN Surplus (Gap)	(1,662)	0	57,182

* Estimated pop at risk endemic villages (A1 and A2) including Thai, M1, M2, and refugees, which is reduced by 10% each year

** Estimated need using a ratio of 1 LLIN:1.8 persons for Thai + M1 and a ratio of 1 LLIN:1 M2 migrant

M1 = migrant in Thailand for 6 months or more; M2 = migrant in Thailand for less than 6 months

Data source: BVBD and Global Fund

Table 9: ITN Gap Analysis (Lao PDR)

Calendar Year	2017	2018	2019
Total Targeted Population (Strata 3)	679,491	689,343	699,339
Total Targeted Population (Strata 2b)	958,092	971,984	986,078
Total Targeted Population*	1,637,583	1,661,328	1,685,417
Continuous Distribution Needs			
Continuous Distribution Needs	0	0	0
	0	0	0
Estimated Total Need for Campaigns**			
Estimated Total Need for Campaigns**	120,000	367,912	468,217
Total Calculated Need: Continuous and Campaign	120,000	367,912	468,217
Partner Contributions			
ITNs carried over from previous year	0	0	0
ITNs from Government	0	0	0
ITNs from Global Fund (SSF)	0	0	0
ITNs from Global Fund (RAI2E)	0	367,912	501,039
ITNs planned with PMI funding	120,000	0	40,278
Total ITNs Available	120,000	367,912	541,317
Total ITN Surplus (Gap)	0	0	73,100

*Assumes 1.45% annual population growth rate

** Mass campaigns conducted in 2016 and 2019; only replacements are anticipated in 2017 and 2018 (at an annual rate of loss of 8%, 20%, and 50% each year after distribution)

Data source: CMPE and Global Fund

Plans and justification

PMI has consulted closely with the national programs of both Thailand and Lao PDR to determine gaps in coverage. In contrast to previous years, PMI will procure standard LLINs only, with the respective country programs through Global Fund supporting distribution costs and outreach to MMPs. Continued efforts are needed to increase access to LLINs/LLIHNs for hard-to-reach populations, especially MMPs, forest-goers, and women of childbearing age. FY 2018 funds will be used to procure LLINs that will be delivered and distributed in calendar year 2020, when the Global Fund RAI2E is anticipated to end.

Proposed activities with FY 2018 funding: (\$864,000)

- **Procurement of LLINs:** In coordination with the NMCPs of Thailand and Lao PDR and the Global Fund Regional Artemisinin Initiative 2 Elimination (RAI2E), PMI will procure 300,000 LLINs for MMPs and to fill gaps not covered by Global Fund in these countries. Distribution costs will be covered by the respective national programs. (\$748,000 for Thailand, \$116,000 for Lao PDR)

2. Malaria in pregnancy

NMCP/PMI objectives

Thailand

The 2012 Thailand Malaria Survey reported an overall polymerase chain reaction (PCR) malaria prevalence of 0.1% and none of the positives were pregnant women. Given the very low overall prevalence of malaria, IPTp is not recommended and has not been implemented. PMI therefore supports a two-pronged approach to prevent malaria infection among pregnant women including provision of LLINs and early effective case management of malaria and anemia. The NMCP strategy supports distribution of LLINs to households in malaria risk areas. According to the Thailand Malaria Survey, 89% of pregnant women slept under a net, but only 36% used an ITN. A Global Fund KAP survey conducted in 2015, evaluating coverage and usage of malaria prevention methods in areas with malaria transmission in Thailand, found ITN use amongst pregnant women surveyed was low at 15%. PMI has supported SBCC activities to encourage people at risk to use LLINs rather than conventional bed nets. These SBCC activities are conducted jointly with distribution campaigns in the border focus areas.

Pregnant women with suspected malaria are referred to the district hospitals for malaria diagnosis and treatment. First-line treatment for *P. falciparum* is quinine in the first trimester and artesunate-mefloquine (AS-MQ) in the second and third trimesters. *P. vivax* is treated with chloroquine in all trimesters. There is no policy to prevent vivax relapses during pregnancy. Antenatal care (ANC) attendance is generally high in all GMS countries. ANC attendance is very high in Thailand (99%) and most pregnant women complete the recommended four visits (80%).

NMCP/PMI objectives

Lao PDR

Although policy documents including the new National Strategic Plan for Malaria Control and Elimination 2016-2020 and the Strategy and Planning Framework for the Integrated Package of Maternal Neonatal and Child Health Services 2009-2015 do not specifically mention the case management aspects of malaria in pregnancy (MIP), the malaria NSP does include plans for the CMPE to mobilize Ministry of Health funding to procure small batches of LLINs for continuous distribution via health centers primarily for pregnant women and MMPs, for replacement of damaged LLINs, and for new residents in high-risk areas. In 2014, only 12% (5,893/50,663) of cases were in females greater than five years of age in Laos.³ Research conducted by the *Institut de Recherche pour le Développement* showed that malaria prevalence was <1% by RDT, but by PCR, 12% of adults (positivity among adults was 6% for women and 20% for men), 0% of children, and 6% of pregnant women were positive.⁴ Another research study in southern Laos

³ National Strategic Plan for Malaria Control and Elimination 2016--2020. Health Department of Communicable Diseases Control Centre of Malariology, Parasitology and Entomology. January 2016.

⁴ Rapid assessment of malaria in pregnancy in Lao PDR. Malaria Consortium. October 2015.

noted that women make up a considerable proportion of the workforce where 31.7% of the migrants were women and 75.7% of migrants were accompanied by family members including pregnant women and children. MIP-specific SBCC activities are primarily delivered with the distribution and promotion of use of LLINs through campaigns.

Treatment guidelines advise oral quinine in the first trimester but this is rarely found in hospital outpatients or ANCs nor is clindamycin widely available. Artemether-lumefantrine is first-line for management of malaria in the second and third trimesters for both *vivax* and *falciparum* malaria. Similar to most countries in the Mekong with the exception of Burma, there is no policy or strategy to prevent vivax relapses during pregnancy.

Progress since PMI was launched

Following a MIP assessment in 2011, PMI provided support to Ministries of Health to revise policies especially for areas of confirmed artemisinin resistance, ensuring recognition and integration of malaria in pregnancy across relevant national programs and improving data on pregnant malaria patients at all health system levels. The assessment found that malaria programs focused on elimination and containment of artemisinin resistance did not address the role of pregnant women (with no policy of how to manage MIP in the Tier I areas) and that data on the true burden of the disease are not often available (especially from areas where malaria transmission is highest and pregnant women are most at risk). With FY 2013 funding, PMI supported an assessment of MIP policies, guidelines, and practices in Laos in both high and low malaria transmission settings.

In FY 2015, PMI provided technical assistance for SBCC activities, which included support for translating SBCC materials into the appropriate languages of the targeted populations. PMI also supported technical assistance for integrating malaria case management services, including for pregnant women, into routine health services in Thailand.

Progress during the last 12-18 months

In Thailand, PMI supported distribution of 2,245 LLINs to pregnant women at antenatal clinics at Health Promoting Hospitals along with the provision of health education on malaria prevention and risk in pregnancy. Health Promoting Hospital staff also screened pregnant women with fever or signs and symptoms of malaria using RDTs. A PMI-supported partner conducted an end-line survey in May 2016 in Kraburi District, Ranong among 218 households. Results of the survey indicated that 100% of pregnant women surveyed used an LLIN the previous night.

In Lao PDR, a rapid assessment of MIP was completed which noted low level of awareness of malaria in pregnancy among health staff, with very few women attending ANC being tested. None of those interviewed during the assessment had recent training and some doctors (obstetricians) have not had any training on malaria since medical school and were unaware of the national treatment guidelines on managing malaria cases. Lao PDR did record pregnancy status in their data collection forms. Only 360 pregnant women were recorded as being tested for malaria since 2009. The positivity rate had remained stable since 2011 at around 14%. The majority of malaria infections recently detected was due to *P. vivax*. They also noted that a

common term for mosquito fever, ‘*Kai-ngoong*’, was used incorrectly to describe different presentations, methods of prevention and management of both malaria and dengue among women and some lower level staff. To strengthen MIP policies and practices, a regional dissemination workshop focused on the recommendations from all four countries’ MIP assessments was conducted in Bangkok in March 2016. Specific recommendations for Lao PDR included the need for frontline staff, including those primarily employed by reproductive health services, to have refresher training on MIP including on the prevention, diagnosis, signs and symptoms which would lead to better awareness of MIP infection, more comprehensive testing, and improved case management in all trimesters.

Plans and justification:

With the integration of malaria services with the health promotion hospitals (where ANC is provided) in Thailand, there are further opportunities to ensure that targeted SBCC for MIP is provided through interpersonal communications approaches. PMI will continue to provide technical assistance to the BVBD to ensure that SBCC activities are linguistically and culturally appropriate (particularly in cross-border areas), and that SBCC approaches for MIP are included in health worker trainings for prevention and case management. PMI’s support for MIP in Thailand will focus primarily on support to fill gaps in needed commodities, including LLINs, ACTs, and RDTs. (see ITN and Case Management sections)

Similarly, in Lao PDR, PMI will strive to fill any commodity gaps around LLINs and RDTs and ACTs needed for case management. As Lao PDR introduces DHIS-2 to all areas, their plans will build upon a piloted maternal and neonatal child health (MNCH) module. PMI will continue to engage in surveillance strengthening at the national level and coordinate, where feasible, to ensure cooperation and cross capacity building between the malaria and MNCH departments.

Proposed activities with FY 2018 funding: (\$0)

(See ITN, Case Management, Social and Behavior Change Communication, and Surveillance, Monitoring and Evaluation sections)

3. Case management

a. Diagnosis and treatment

NMCP/PMI objectives

Confirmatory testing, with microscopy or RDTs, is required in all GMS countries before treatment is prescribed. Microscopy is available at most health facilities, while multi-species RDTs are used at the community level.

Thailand’s network of vertical malaria clinics and malaria posts using RDTs continues to be the bulwark of service delivery in malaria-endemic areas. Malaria clinics are staffed with microscopists while malaria posts providing community level case management utilize RDTs for diagnosis. With decreasing malaria burden, BVBD has been integrating and expanding malaria

case management services into health promotion hospitals under the supervision of Provincial Health Offices. Some NGOs provide primary health care services, including malaria case management to the 100,000 refugees along the Thai-Burma border. Active case detection using microscopy and/or RDTs in high-risk villages/ foci as well as reactive case detection around index cases are conducted.

Thailand updated their Malaria Diagnosis and Case Management Guidelines in 2015 in response to treatment failures to AS-MQ (Table 7). The first-line treatment for uncomplicated *P. falciparum* is now with DHA-Pip with single low-dose primaquine. Chloroquine plus primaquine (0.25mg/kg for 14 days) remains the first-line treatment for *P. vivax*. Injectable artesunate is available for treatment of severe malaria and generally administered in hospital settings. The treatment guidelines also recommend directly observed treatment (DOT) until completion of treatment for both *P. falciparum* and *P. vivax* and case follow-up to monitor treatment response with microscopy on days 3, 7, 28 and if possible day 60 for *P. falciparum* and days 14, 28 and if possible day 60 for *P. vivax*.

In Lao PDR, the public sector primarily provides health care services but private sector alternatives are increasing in response to patient demand for better quality health care. The Malaria Treatment Guidelines for Provincial and District Hospitals released in July 2015 (Table 7) in Lao PDR maintained AL as the first-line treatment for *P. falciparum* and *P. vivax* malaria that remains efficacious despite the recent finding of *Kelch13*-propeller (K13) artemisinin-resistant genotypes and high percentage of Day 3 positives at therapeutic efficacy monitoring sites in the south.

The regional PMI-supported network for drug efficacy monitoring has been instrumental in the detection of emerging resistance to antimalarial medicines, including artemisinins, since 2008. Along with therapeutic efficacy monitoring sites supported by other donors (e.g., the Global Fund and BMGF), the therapeutic efficacy monitoring network has since expanded from 35 to 48 sentinel sites throughout the GMS (three of which are not PMI-supported). In addition to monitoring clinical and parasitological outcomes, samples collected during therapeutic efficacy monitoring are being tested for the presence of K13 mutations, correlated with resistance to artemisinins, and other molecular markers of drug resistance. As malaria morbidity declines in the GMS, recruitment of patients for therapeutic efficacy monitoring becomes increasingly difficult – often resulting in prolonged periods of enrollment and inconclusive studies. As the standard WHO therapeutic efficacy monitoring protocols will not be appropriate in many low transmission settings, countries in the region (e.g., Thailand and Viet Nam) will begin to pilot routine drug resistance surveillance (DRS) to monitor treatment outcomes in all cases.

Table 10. Status of Case Management Policies in Thailand and Lao PDR

Status of Case Management Policy		
	Thailand (2015)	Lao PDR (2015)
What is the first-line treatment for uncomplicated <i>P. falciparum</i> (<i>P. vivax</i>) malaria?	DHA-Pip + SD PQ (CQ + PQ)	AL + SD PQ (AL + PQ after testing for G6PD)
What is the second-line treatment for uncomplicated <i>P. falciparum</i> (<i>P. vivax</i>) malaria?	Quinine + CDT; AS + CDT; AL; Atovaquone-Proguanil (DHA-Pip+PQ)	Quinine + Doxycycline
What is the first-line treatment for severe malaria?	IV AS	IV AS
In pregnancy, what is the first-line treatment for uncomplicated <i>P. falciparum</i> (<i>P. vivax</i>) malaria in the first trimester?	Quinine + Clindamycin (CQ)	Quinine (CQ)
In pregnancy, what is the first-line treatment for uncomplicated <i>P. falciparum</i> (<i>P. vivax</i>) malaria in the second and third trimesters?	DHA-Pip (CQ)	AL
In pregnancy, what is the first-line treatment for severe malaria?	IV AS	IV Quinine in 1 st trimester; IV or IM AS in 2 nd or 3 rd trimesters
Is pre-referral treatment of severe disease recommended at peripheral health facilities? If so, with what drug(s)?	IV loading dose of AS or Quinine	None
Is pre-referral treatment of severe disease recommended for community health workers? If so, with what drug(s)?	DHA-Pip	None
If pre-referral rectal artesunate is recommended, for what age group? (note: current international guidelines do not recommend administering to those ≥ 6 years)	NA	NA

AL: artemether-lumefantrine; AS: artesunate; CDT: Clindamycin or Doxycycline or Tetracycline; CQ: chloroquine; DHA-Pip: dihydroartemisinin-piperaquine; IM: intramuscular; IV: intravenous; SD PQ: single-dose primaquine

Progress since PMI was launched

Since the launch of PMI, PMI has procured RDTs and ACTs to fill national gaps and to respond to outbreaks. In 2012, Lao PDR experienced a large malaria epidemic in Attapeu which spread to all five southern provinces. In response, PMI supported CMPE by facilitating an emergency distribution of ACTs and RDTs to the southern provinces where malaria incidence remained high following the peak in 2012. In 2014 and 2015, PMI procured and delivered 152,073 and 226,624 RDTs, respectively, for Lao PDR.

With the exception of limited training of health workers at Malaria Posts and Border Malaria Posts in malaria diagnosis and treatment in Tak and Ranong Provinces prior to 2014, PMI has not been directly implementing delivery of case management services in the region, as these services are supported with domestic or Global Fund resources. However,

PMI has been supporting quality assurance/ quality control measures for malaria diagnostics through the maintenance of a regional slide bank used for regional malaria microscopy training as well as convening microscopy refresher training and external competency assessments. With PMI support, six rounds of regional certification trainings for malaria microscopy were carried out in 2014, which assessed the capacity of national-level trainers in the GMS countries. In June 2014, PMI supported External Competency Assessments for malaria microscopy in Thailand and Lao PDR. Efforts are ongoing to provide support to Thailand for the establishment of national slide banks.

In addition to ongoing regional therapeutic efficacy monitoring, PMI has also provided technical assistance to improve the quality and standardization of methods at the therapeutic efficacy monitoring sites and to ensure that measured efficacy rates are accurate and comparable from one location to another. PMI also has supported building molecular capacity that included K13 analysis of samples collected through the therapeutic efficacy monitoring network by training three BVBD staff in CDC, Atlanta.

In 2013, data from the therapeutic efficacy monitoring site in Champasack indicated that 22% of patients remained positive on Day 3 after treatment with an ACT. Among these patients, 21/27 (78%) had K13 mutations. In 2014-5, therapeutic efficacy monitoring data from Sekong Province (adjacent to Champasack) also showed that 20% of 50 patients enrolled remained positive on Day 3 with adequate clinical and parasitological response (ACPR) rates of 86%. Recent updates to the Lao National Treatment Guidelines (2015) included the use of single low-dose primaquine for the treatment of uncomplicated *P. falciparum* (Pf) cases.

In Viet Nam, PMI's support for therapeutic efficacy monitoring at four sites included DHA-Pip efficacy testing for *P. falciparum* in 2014 which showed 100% ACPR. Data from TESs conducted in 2015 in Binh Phuoc province reported high treatment failure (> 10%) and further investigation has confirmed the emergence of piperazine resistance⁵.

In December 2015, PMI co-funded the South-East Asia and Western Pacific Bi-regional Meeting of Malaria Drug Resistance Monitoring Networks in Siem Reap, Cambodia. For the first time, this meeting brought together program managers and therapeutic efficacy monitoring focal points and principal investigators of three regional networks: GMS (Cambodia, China (Yunnan), Lao PDR, Myanmar, Thailand, and Viet Nam), BBINS network (Bangladesh, Bhutan, India, Nepal, and Sri Lanka) and the Pacific network (Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands, Timor Leste, and Vanuatu). The meeting concluded that countries in the GMS need to test alternative ACTs (i.e., artesunate+pyronaridine) and that molecular resistance marker information on artemisinin (K13) and also piperazine (P14) and mefloquine markers (pfmdr1 copy number) are equally important.

Progress during the last 12-18 months

To assist Thailand to move forward in introducing the new malaria treatment guidelines with DHA-Pip, PMI procured 10,000 doses of DHA-Pip and provided training on the use of this new

⁵ Phuc BQ, et al., Emerg Infect Dis. 2017 Apr;23(4):715-717.

treatment regimen. To fill national gaps in response to the increase of malaria cases in the southern provinces of Lao PDR, 53,600 and 58,140 ACTs were procured and distributed in 2015 and 2016, respectively. To address national gaps in southern Thailand where there is an uptick in malaria cases, PMI is supporting the procurement of 10,000 RDTs. In addition, to replace outdated microscopes used in trainings, PMI is procuring 18 new microscopes and tally counters.

In June 2016, PMI supported a bi-regional training workshop on quality assurance for malaria microscopy that included two participants each from Cambodia, Lao PDR, Burma, Thailand, and Viet Nam. In addition, refresher microscopy trainings for 34 participants as well as on-the-job training on national slide banking for three participants were conducted in 2016 in Thailand. External competency assessments were conducted for 12 participants in Viet Nam in March 2016 and 12 participants in Thailand in August 2016.

PMI continues to support the regional therapeutic efficacy monitoring network that convened an annual meeting in October 2016 to review recent results, select future sentinel sites as well as implications for any treatment policy changes. Details of the sites, drugs tested, and outcomes for recently completed and on-going studies as well as future plans are detailed in Tables 11-13 for Thailand, Lao PDR, and Viet Nam.

As countries in the region move towards elimination, it is becoming increasingly challenging to conduct therapeutic efficacy studies using the standard WHO protocol that requires a defined sample size in specific strategically located sentinel sites with inclusion and exclusion criteria. Thailand has been piloting a new approach of routine DRS in Chiang Rai, Chiang Mai, and Mae Hong Song with community supervised DOT and patient follow-up on days 3, 7, 28, 42, and, if possible, 60. PMI supported technical assistance to review this data to help refine this approach. WHO has provided provisional guidance for DRS which requires all cases must be diagnosed microscopically with parasite counts, given supervised treatment (DOT) for 3 days and followed-up for 28/42 days with weekly follow-up (days 7, 14, 21, 28, 35 and 42) check-up visits, blood film examinations and filter paper collection for PCR correction and genotyping for markers of resistance.

Table 11. Therapeutic Efficacy Studies (TES) in Thailand

Completed TESs		
Year	Site name	Treatment arm(s) [ACPR]
2013-2015*	Mae Hong Song	AS-MQ for Pf [NA]
2013-2015	Tak	AS-MQ for Pf [80%]
2013-2015	Ratchaburi	AS-MQ for Pf [100%]
2013-2015	Kanchanaburi	DHA-Pip for Pf [94%]
2013-2015	Tak	DHA-Pip for Pv [100%]
2013-2015*	Ranong	DHA-Pip for Pv [NA]
2013-2015	Ubon Ratchathani	DHA-Pip for Pv [100%]
Ongoing TESs		
Year	Site name	Treatment arm(s) [ACPR]
2016	Srisaket	AS-MQ for Pf [94%]; CQ for Pv [100%]
2016*	Songkla, Surat Thani**, Prachuap Khirikan, Chumpon	AS-MQ for Pf [NA]
2016	Yala**	AS-MQ for Pf [100%]
2016*	Ranong	DHA-Pip [NA]
2016	Kanchanaburi	CQ for Pv [98%]
Planned TESs FY 2018		
Year	Site name	Treatment arm(s)
2017-2018	TBD (1 site)	Pyramax™
2017-2018	5 provinces (Routine DRS)	DHA-Pip

ACPR=adequate clinical and parasitological response; AS+MQ=artesunate + mefloquine; DHA-Pip=dihydroartemisinin-piperaquine; CQ=chloroquine; NA=not available; TBD=To be determined; DRS=drug resistance surveillance; Pf=*Plasmodium falciparum*; Pv=*Plasmodium vivax*

*<5 patients completed follow-up

**Funded by Global Fund

Table 12. Therapeutic Efficacy Studies (TES) in Lao PDR

Completed TESs		
Year	Site name	Treatment arm(s) [ACPR]
2014-2015	Champasack	AL for Pf [90%]
2014-2015	Sekong	AL for Pf [86%]
Ongoing TESs		
Year	Site name	Treatment arm(s) [ACPR]
2016-2017*	Champasack (2sites)**	DHA-Pip for Pf and Pv [NA]
2016-2017*	Salavanh	AL for Pf [NA]
Planned TESs FY 2018		
Year	Site name	Treatment arm(s)
2017-2018	TBD	AL for Pf
2017-2018	TBD	DHA-Pip for Pf

ACPR=adequate clinical and parasitological response; AL=artemether+lumefantrine; DHA-Pip=dihydroartemisinin-piperaquine; NA=not available; TBD=To be determined; Pf=*Plasmodium falciparum*; Pv=*Plasmodium vivax*

*<5 patients completed follow-up

**Funded by Global Fund

Table 13. Therapeutic Efficacy Studies (TES) in Viet Nam

Completed TESs		
Year	Site name	Treatment arm(s) [ACPR]
2014-2015	Binh Phuoc	DHA-Pip for Pf [100%]
2014-2015	Dak Nong	DHA-Pip for Pf [100%]
2014-2015	Gia Lai	DHA-Pip for Pf [100%]
2015	Binh Phuoc	DHA-Pip for Pf [50%]
Ongoing TESs		
Year	Site name	Treatment arm(s) [ACPR]
2016-2017	Binh Phuoc	DHA-Pip for Pf [49%]
2016-2017	Dak Lak*	DHA-Pip for Pf [NA]
2016-2017	Dak Nong	DHA-Pip for Pf [73%]
2016-2017	Khan Hoa	DHA-Pip for Pf [96%]
Planned TESs FY 2018		
Year	Site name	Treatment arm(s)
2017-2018	4 sites TBD**	Pyramax™
2017-2018	20 Districts (Routine DRS)	DHA-Pip

ACPR=adequate clinical and parasitological response; DHA-Pip=dihydroartemisinin-piperaquine; NA=not available; DRS=drug resistance surveillance; Pf=*Plasmodium falciparum*; Pv=*Plasmodium vivax*

*<5 patients completed follow-up **BMGF funded

Commodity gap analysis

Table 14: RDT Gap Analysis (Thailand)

Calendar Year	2017	2018	2019
RDT Needs			
Total country population*	68,302,731	68,507,639	68,713,162
Population at risk for malaria	1,136,658	1,033,326	933,940
PMI-targeted at-risk population	1,136,658	1,033,326	933,940
Total number of projected fever cases**	99,040	89,136	80,222
Percent of fever cases tested with an RDT	95%	95%	95%
Total RDT Needs	94,088	84,679	76,211
Partner Contributions			
RDTs carried over from previous year	-	-	-
RDTs from Government	94,088	84,679	76,211
RDTs from Global Fund (SSF)	-	-	-
RDTs from Global Fund (RAI2E)	-	-	-
RDTs planned with PMI funding	-	-	-
Total RDTs Available	94,088	84,679	76,211
Total RDT Surplus (Gap)	-	-	-

* Population growth rate estimated at 0.3% per annum

** Estimated number of patients presenting at Malaria Posts, Health Promotion Hospitals, and camps (declining 10% each year)

Abbreviations: SSF = Single Stream Funding; RAI2E = Regional Artemisinin Resistance 2 Elimination

Data source: BVBD

Table 15: RDT Gap Analysis (Lao PDR)

Calendar Year	2017	2018	2019
RDT Needs			
Total country population*	6,980,940	7,082,164	7,184,855
Population at risk for malaria	1,637,583	1,661,328	1,685,417
PMI-targeted at-risk population	1,637,583	1,661,328	1,685,417
Total number of projected fever	177,639	180,161	182,773
Percent of fever cases tested with an RDT	61%	61%	61%
Total RDT Needs	108,360	109,898	111,492
Partner Contributions			
RDTs carried over from previous year	-	-	80,378
RDTs from Government***	-	-	-
RDTs from Global Fund (NFM)	100,000	-	-
RDTs from Global Fund (RAI2E)	-	110,276	111,875
RDTs planned with PMI funding****	-	80,000	80,000
Total RDTs Available	100,000	190,276	272,253
Total RDT Surplus (Gap)	(8,360)	80,378	160,761

* Assumes population growth rate of 1.45% per annum

** Assumes fever rate of 5%

*** Government covers costs for microscopy

**** PMI planned RDT procurements for the region have been listed in this gap analysis table as Lao PDR is most likely to face commodity uncertainties due to reliance on external funds and the recent outbreaks in southern Lao. However, PMI funds can be used to fill gaps and respond to unanticipated outbreaks in either Thailand or Lao PDR
Abbreviations: NFM = New Funding Model; RAI2E = Regional Artemisinin Resistance 2 Elimination; SSF = Single Stream Funding

Data Source: CMPE

Table 16: ACT Gap Analysis for *P. falciparum* and mixed cases (Thailand)

Calendar Year	2017	2018	2019
ACT Needs			
Total country population*	68,302,731	68,507,639	68,713,162
Population at risk for malaria	1,136,658	1,033,326	933,940
PMI-targeted at-risk population	1,136,658	1,033,326	933,940
Total projected number of malaria cases**	12,683	10,147	8,117
Total ACT Needs	12,683	10,147	8,117
Partner Contributions			
ACTs carried over from previous year	-	-	-
ACTs from Government***	12,683	10,147	8,117
ACTs from Global Fund	-	-	-
ACTs from Other Donors	-	-	-
ACTs planned with PMI funding	-	-	7,950
Total ACTs Available	12,683	10,147	8,117
Total ACT Surplus (Gap)	-	-	7,950

* Population growth rate estimated at 0.3% per annum

** Baseline 2016 data with anticipated 20% reduction of malaria each year

*** Thailand procures all estimated ACT needs and other antimalarial drugs using domestic resources. PMI will help to fill any unanticipated ACT gaps as they arise.

Data source: BVBD

Table 17: ACT Gap Analysis for all malaria species (Lao PDR)

Calendar Year	2017	2018	2019
ACT Needs			
Total country population*	6,980,940	7,082,164	7,103,410
Population at risk for malaria	2,362,138	2,396,389	2,431,137
PMI-targeted at-risk population	2,362,138	2,396,389	2,431,137
Total projected number of malaria cases**	22,933	18,346	14,677
Total ACT Needs***	22,933	18,346	14,677
Partner Contributions			
ACTs carried over from previous year	18,602	-	32,134
ACTs from Government	-	-	-
ACTs from Global Fund (NFM)	-	-	-
ACTs from Global Fund (RAI2E)	-	18,980	15,885
ACTs planned with PMI funding***	-	31,500	7,050
Total ACTs Available	18,602	50,480	55,069
Total ACT Surplus (Gap)	(4,331)	32,134	40,392

* Population growth rate estimated at 1.45% per annum

** Baseline 2016 data with anticipated 20% reduction of malaria each year

*** PMI planned ACT procurements for the region can be used to fill gaps and respond to unanticipated outbreaks in either Thailand or Lao PDR

Abbreviations: NFM = New Funding Model; RAI2E = Regional Artemisinin Resistance 2 Elimination

Data source: CMPE

Plans and justification

In Thailand and Lao PDR, the majority of the case management commodities are procured through their respective country Global Fund grants or domestic funds. Viet Nam also procures its ACTs and RDTs through domestic and Global Fund resources, respectively. The small allocations for RDTs and ACTs for Thailand and Lao PDR are intended to fill unanticipated gaps, particularly for situations where Global Fund or country procurements are delayed, to respond to outbreaks or upsurges in cases, or to reach mobile and migrant populations. Currently, PMI support for Viet Nam is limited to drug efficacy monitoring and regional capacity training activities. PMI will continue to support refresher training of existing laboratory staff and health workers in the performance and use of malaria microscopy – integrating malaria case management into routine services where feasible, and strengthening quality assurance systems. In addition, PMI will continue its support for the regional accreditation training and for maintaining the regional slide bank, to ensure that each country has highly skilled trainers/supervisors to oversee diagnostic quality assurance.

PMI will continue to support the therapeutic efficacy monitoring network in all GMS countries using standardized WHO protocols and pilot routine DRS in Thailand and Viet Nam. PMI will ensure support for molecular detection of K13 mutant genotypes and other markers of partner drug resistance from patients enrolled in therapeutic efficacy monitoring sites in the region.

Proposed activities with FY 2018 funding: (\$734,200—Thailand \$186,000; Lao PDR \$134,000; Regional \$414,200)

- **Procure RDTs and microscopy supplies.** PMI will continue to fill gaps in country requirements by procuring multi-species RDTs and reagents and supplies for microscopy. This will include up to 80,000 RDTs as need arises in Thailand and Lao PDR. (Regional \$59,200)
- **Procurement of antimalarials.** PMI will procure approximately 15,000 ACTs to fill regional gaps and address outbreaks. (Thailand \$16,000; Lao PDR \$14,000)
- **Training and accreditation for microscopy:** PMI will continue support for refresher training and accreditation of supervisors of malaria microscopy throughout the GMS, maintenance of regional and national slide banks, and maintenance of microscopes. (Thailand \$20,000; Lao PDR \$20,000; Regional \$20,000)
- **Regional therapeutic efficacy monitoring network:** PMI will continue to support the NMCPs to conduct the standard therapeutic efficacy study in one site and pilot routine DRS in five provinces in Thailand, in two sites in Lao PDR, and routine DRS in 20 districts in Viet Nam. PMI will continue to support WHO to coordinate this therapeutic efficacy monitoring network, convene annual meetings, and provide technical assistance to the NMCPs in protocol adaptation, data analysis, and dissemination of results. PMI will also ensure support for drug resistance marker testing of samples collected from therapeutic efficacy monitoring. (Thailand \$50,000; Lao PDR \$100,000; Regional \$335,000)

- **Technical assistance support for routine treatment outcome monitoring in Thailand:** PMI will provide technical assistance to build capacity at the BVBD for routine therapeutic efficacy monitoring, analysis, and treatment policy updates including implementation in five provinces in coordination with WHO. (Thailand \$100,000)

b. Pharmaceutical management

NMCP/PMI objectives

In Thailand, the NMCP delivers commodities to facilities, particularly to the public sector malaria clinics and posts. With Global Fund support, the BVBD, Provincial Health Offices (PHOs), and District Health Offices have been strengthened to ensure that commodities are well monitored and distributed to provinces and districts. When there are problems with stock availability, antimalarial drugs are exchanged between facilities and districts. Though the principle of “first expired-first out” is applied, nearly expired drugs and nearly expired RDTs are found at malaria posts in border areas. The Thai Malaria Program Review in 2012 found that logistics and pharmaceutical management systems in the border provinces, particularly reaching migrant and mobile populations, need improvement. The review also recommended consideration of a buffer stock for medicines and diagnostics for potential epidemics. In response, the BVBD began including stock balances into the national malaria reporting system, Biomedical and Public Health Informatics.

In Lao PDR, health infrastructure and supply chain systems are relatively weak. Generally, the Procurement Unit of the Global Fund Principal Recipient procures most of the malaria commodities, according to a forecast provided by CMPE. The pharmaceuticals are stored with the Medical Products Supply Center (MPSC) within 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 CMPE’s recommendations. The provinces subsequently supply the districts that supply the health centers that then ultimately provide commodities to the village health workers.

Although the Global Fund provided support to renovate part of the MPSC building, significant quantities of expired commodities that needed disposal have been observed at the MPSC and there seems to be a lack of clear guidance about how to manage expired commodities. MPSC has been working with CHAI to pilot and scale up mSupply, a logistics and commodities management tool, in the central warehouse and selected regional warehouses.

The availability of high-quality antimalarials and removal of substandard drugs are essential to mitigating drug resistance in the region. All governments of the region have banned the import of oral artemisinin monotherapy and are taking additional measures to be able to detect and remove poor quality drugs in both the private as well as the public sector.

Progress since PMI was launched

PMI is providing support to strengthen pharmaceutical management and supply chain systems in the region through the procurement of supplies and strengthening the in-country systems that manage them. Activities have been organized around improving system performance and visibility to ensure that malaria products are available when and where they are needed, strengthening in-country supply systems and enhancing the capacity for effective management of malaria commodity supply chain. PMI has supported strengthening national counterparts' abilities to provide supply chain forecasting and monitoring data through technical assistance.

In Thailand, PMI supported an assessment in March 2014 that revealed that although there are some challenges in the pharmaceutical management and supply system, overall capacity and performance is strong. In contrast, an assessment carried out by PMI in 2013 in Lao PDR found that stockouts of RDTs and ACTs were common due to difficulty in transport and communication systems from lower level to provincial and national level. The challenges and limitations included delays in reporting, completeness, and collection of data.

PMI has been monitoring regional malaria commodity pipelines so potential bottlenecks in procurement and distribution of malaria commodities (including Global Fund-financed commodities) can be quickly addressed and availability of key commodities ensured. A preliminary assessment of quantification processes in some GMS countries has contributed to a better understanding of the NMCP's capabilities to monitoring commodities, resources, and gaps.

In 2015, PMI coordinated the hiring of a malaria supply chain advisor to support the CMPE with funding from the US 5% Initiative to build capacity in the area of procurement and supply chain management of malaria commodities, and to improve the ability of the CMPE to integrate into the overall national procurement and supply chain management processes. This advisor focused on national and provincial level coordination with other stakeholders, including the Global Fund and CHAI, and ensured that the logistics management information system tools were harmonized with the national information systems.

In past years, PMI supported periodic collection of field specimens for monitoring of drug quality to provide data to national and international authorities for enforcement action as well as provided technical assistance to build capacity and strengthen the national drug quality laboratories in the region with a focus on achieving International Organization for Standardization-17025 laboratory accreditation. With PMI support, the Viet Nam National Institute of Drug Quality Control and the Thailand Bureau of Drug and Narcotics laboratories had achieved WHO prequalification status.

PMI supported a regional drug quality assessment in March 2014, to take a closer look at what was achieved in the last decade and where donors should focus their efforts in years to come. The assessment highlighted what PMI has already known regarding the relatively good access to quality medicines in private sector outlets.

Progress during the last 12-18 months

In Lao PDR, PMI had provided support for a long-term consultant to work closely with CMPE staff and develop a logistics management information system to strengthen reporting of malaria commodities stock from district to national levels. With FY 2016 funds, PMI provided technical assistance to improve data use for forecasting of commodities and to identify and address bottlenecks in data and logistics management at the provincial, and district levels in Lao PDR.

In Thailand, PMI supported Chulalongkorn University's Pharmaceutical Technology Service Center toward receiving WHO Prequalification. In Lao PDR, PMI provided technical assistance to the Food and Drug Quality Control Laboratory Center toward re-establishing its International Organization for Standardization-17025 accreditation, which had lapsed.

Plans and justification

PMI will continue to coordinate closely with the MOH, other donors and partners (e.g. the Global Fund and CHAI) to improve the supply chain management systems at all levels focusing on forecasting, stockouts, expiries and their destruction, product optimization, storage, and support/development of future procurement and supply chain management plans. Moving forward, a regional supply chain advisor based in Bangkok will provide technical assistance for Thailand and Lao PDR. In Thailand, technical assistance will focus on the supply chain challenges of ensuring availability while limiting expiry of RDTs and antimalarials in areas that have eliminated malaria.

After many years of supporting limited post-market surveillance and technical assistance to the National Health Products Quality Control Center's laboratories in Thailand, Laos, and Viet Nam, PMI will shift from direct financial support to increased focus on coordination with national programs and other donors e.g. Asian Development Bank and Global Fund.

Proposed activities with FY 2018 funding: (\$250,000)

- **Support for supply chain management and logistics:** PMI will provide technical assistance to BVBD and CMPE for supply chain management, particularly at sub-national levels. This support will include an assessment of stock management practices and challenges in provinces in Thailand currently in the prevention of reintroduction phase. (\$200,000 for Thailand, \$50,000 for Lao PDR)

4. Health system strengthening and capacity building

In the GMS, PMI supports a broad array of health system strengthening activities, which cut across intervention areas, such as training of health workers on microscopy, supply chain management, and health information systems strengthening, drug quality monitoring, and NMCP capacity building.

NMCP/PMI objectives

Thailand

As the malaria burden continues to decline, the BVBD will face many challenges including shortages of skilled health workers and technical staff, high staff turnover, and lack of motivation among trained staff in remote and inaccessible areas. Decentralization of the health care system and integration of malaria control into general health services place an additional management burden on the provincial and district levels. To address this, one of the strategies of the Thailand National Malaria Elimination Plan is to promote and empower communities as part of the effort for decentralization. Integration of malaria services with the general health system is considered a priority for the malaria program. This is demonstrated by the current efforts to introduce malaria services including case detection and response at Health Promotion Hospitals. Furthermore, case investigations and responses will be coordinated with the Bureau of Epidemiology's Surveillance and Rapid Response Teams (SRRTs), where feasible.

Lao PDR

The Lao Government has committed to strengthening the health system through focusing on five priorities of the Health Sector Reform Framework. These are (i) strengthening human resource capacity, (ii) improving health sector financing, (iii) improving the governance, organization and management of the health system, (iv) improving health service delivery and hospital management and (v) improving the overall monitoring and evaluation framework and the Health Information System. The quality and deployment of health staff requires significant attention, including prioritizing the deployment of skilled health workers in rural and remote areas, strengthening the capacity of health professions education and training, and addressing specific skill gaps remain due to mismatches between training programs and demand by provincial health services.

Regional

PMI has provided long-standing support to strengthen regional technical and programmatic capacity of NMCPs through WHO and Asian Collaborative Training Network for Malaria (ACTMalaria). ACTMalaria is an inter-country training and communication network that includes NMCPs of Bangladesh, Burma, Cambodia, China, Lao PDR, Malaysia, Philippines, Republic of Indonesia, Thailand, Timor-Leste, and Viet Nam. ACTMalaria has been a primary mechanism for building technical and management capacity and facilitating information exchange among its member countries. ACTMalaria is also a key partner in capacity building within the APMEN. While continuing their work with established courses (e.g. the Management of Malaria Field Operations (MMFO), Quality Assurance for Diagnostics, and Integrated Vector Management), ACTMalaria explores opportunities to develop new curricula as identified by the Executive Board of the eleven member NMCPs.

Progress since PMI was launched

Thailand has become a regional training center for the GMS. With support from PMI, Thailand has been able to organize the flagship MMFO training course for participants in the region and beyond. Bringing together facilitators from various expert areas including entomology, epidemiology, program management, and social scientists, the 6-week international MMFO training course is targeted for mid-level program managers in malaria programs from the GMS countries. Several national malaria program managers are alumni of the MMFO training course.

At the request of the national malaria program, PMI support to Lao PDR for capacity strengthening has steadily increased, particularly for the national and sub-national MMFO training course to improve the skills and capacity of provincial and district level staff in data management, analysis, monitoring and evaluation, and program management.

PMI supported regional training courses to build the capacity of NMCPs in malaria management and field operations, M&E, diagnostics and case management and integrated vector management. Through PMI's support of this regional training and capacity building network, national programs have successfully leveraged domestic and/or Global Fund resources to support participation in these training opportunities. Technical assistance has been provided for updating and refining curricula that include integrated vector management, vector control for elimination, malaria elimination and surveillance, and MMFO training courses. To assess the impact of these trainings for the participants in their respective roles and responsibilities after the training, an external evaluation (Level 3: on-the-job application or transfer of learning) was commissioned in September 2012. The main findings from this evaluation were that, despite some attrition, those participants who have remained with the malaria programs have seen improvements in their skills and capacity to manage malaria programs as well as greater self-confidence, improved communication (especially in English), and other interpersonal skills.

Progress during the last 12-18 months

In 2016, PMI supported a refresher training on malaria microscopy for 34 participants as well as External Competency Assessments for 12 microscopists. The External Competency Assessments resulted in the accreditation of six microscopists as Level 1 (expert) microscopists. These expert microscopists will be facilitating cascade microscopy trainings at each of the regional offices in Thailand. In addition, PMI provided technical assistance for on-the-job-training of the national slide banking in Mae Sot, Thailand in September 2016.

In 2016, PMI supported sub-national MMFO trainings for provincial and district level staff (59 in total) in Lao PDR to improve basic skills in malaria epidemiology, program management, monitoring, and supervision. The national MMFO training was adapted from the international MMFO training curriculum to the local Lao context and capacity.

In 2016, PMI supported regional capacity building and trainings for participants from GMS NMCPs on integrated vector management and quality assurance for microscopy. PMI supported participants from Cambodia and Viet Nam to participate in the integrated vector management training course organized by the Research Institute for Tropical Medicine in Malaysia. Ten

participants from Cambodia, Lao PDR, Myanmar, Thailand, and Viet Nam also were supported in the WHO Bi-Regional Training Workshop on Quality Assurance for Malaria Microscopy at the Research Institute for Tropical Medicine/WHO Collaborating Center in the Philippines.

Plans and justification

Strengthening national program capacity is a critical area of strategic focus within the PMI strategy. Depending on need, PMI will continue to support national and regional capacity building and training efforts on program management, quality assurance/quality control for diagnostics, M&E, entomology, and surveillance. PMI-supported trainings strive to be performance-based, tailored to the needs of the participants, and led by NMCPs.

The long-term strategy to support Health System Strengthening and Capacity Building varies significantly between Thailand and Lao PDR. Thailand's improving health system does not require much support from PMI; however, Lao PDR's health system is still very weak and will continue to need support in capacity strengthening of human resources, supply chain management, and strategic information. PMI works with other donors and partners in Lao PDR to address these issues.

PMI has supported regional trainings for microscopy, diagnostic quality assurance, and program management for all GMS countries over the years, and there is a need to ensure proper measurement and evaluation of impact of such trainings, as well as updating tools and adopting adult-learning methodologies.

Proposed activities with FY 2018 funding: (\$150,000)

- **Strengthen NMCP capacity:** PMI will support updating of the MMFO curricula and relevant regional training in malaria (e.g. entomology, diagnostics, surveillance) to highlight programmatic considerations and challenges during elimination, as well as with particular focus on innovative and more effective training and learning methodology. (\$150,000 for Regional)

Table 18: Health Systems Strengthening Activities

HSS Building Block	Technical Area	Description of Activity
Health Services	Case Management	Improve quality assurance systems to monitor the quality of laboratory diagnostic service; training and supervision for health staff and village malaria workers to provide malaria services
Health Workforce	Health Systems Strengthening	Build, through training and technical assistance, host country managerial and leadership capacity for effective malaria control through courses such as national and regional MMFO training
Health Information	Monitoring and Evaluation	Strengthen disease surveillance systems to improve decision-making, planning, forecasting, and program management; provide support and technical assistance to improve M&E capacity at national and sub-national levels
Essential Medical Products, Vaccines, and Technologies	Case Management	Support technical assistance for improved forecasting, procurement, quality control, storage and distribution of malaria commodities, such as ITNs, ACTs, and RDTs in Thailand and Lao PDR
Health Finance	Health Systems Strengthening	Provide technical assistance to the Thai National Program to develop the business case for malaria elimination (cost-benefit analysis)
Leadership and Governance	Health Systems Strengthening	Support capacity strengthening of NMCP leadership through engagement and participation of the ACTMalaria Executive Board meetings

5. Social and behavior change communication

NMCP/PMI objectives

Thailand attracts migrant workers from neighboring countries, particularly from Burma and Cambodia. Approximately half of the malaria cases in Thailand are among migrant workers from neighboring countries. The majority of these workers are laborers in farms, fruit orchards, and plantations. Their employers are important gatekeepers for their access and movement. Access to prevention and treatment services has been improved through LLIN distribution and community-based services provided by malaria posts along border areas.

Both Thailand's Global Fund SSF and Regional Artemisinin Initiative (RAI) grants 2014-2016 aimed to provide comprehensive SBCC, community mobilization, and access to health services for both Thai people and migrants residing in malaria transmission zones in 44 provinces in Thailand that border with neighboring countries. BVBD developed a framework for SBCC for the Thai population that encourages acceptance of IRS, prompt treatment-seeking behaviors for forest-goers and pregnant women, drug adherence, use of LLINs, and use of LLIHNS when staying outdoors. The SBCC component targeting displaced Burmese along the Thai-Burma

border and other migrant populations in Thailand along border provinces is implemented by NGOs.

A Global Fund 2015 KAP survey conducted in Thailand between January and March 2015, found that coverage of SBCC messages, as measured by the proportion of individuals who had heard of malaria and have knowledge of malaria transmission, was high (96% and 92%, respectively). With most survey respondents indicating a preference for interpersonal communication for knowledge sharing, the survey report recommended training health care providers at public hospitals, in ANC and child health clinics, and in the private sector on effective interpersonal communication techniques to help optimize the awareness and retention of SBCC messages. Under the Thai Malaria Elimination Strategy, a Technical Committee is established to develop a comprehensive communication strategy for SBCC and community mobilization.

The Lao NSP (2016-2020) ensures at-risk populations gain access to and utilize interventions to prevent and/or treat malaria by increasing the populations' understanding of malaria through targeted messaging and appropriate media, including specific SBCC for malaria during pregnancy. The NSP objectives aim to implement SBCC campaigns to ensure 90% of people seek treatment within 24 hours at an appropriate health facility or with a qualified care provider and at least 85% of the population residing in burden reduction areas utilize an appropriate protection tool by 2017. To this end, CMPE works with the national Center of Information and Education for Health and key stakeholders to develop the national communication and advocacy plan in line with the NSP, and informed by any community surveys. There is a Technical Working Group for SBCC which involves key stakeholders, such the Ministry of Forest and Agriculture, the Ministry of Education, Ministry of Labor, Ministry of Defense, Ministry of Information and Culture, Lao Women's Union, and relevant youth organizations, and are sensitized to the annual SBCC Operational Plan.

The NSP targets both static and mobile populations for malaria SBCC activities. Static populations are defined as people who live in at-risk villages (mainly ethnic minorities) and who live in formal settlements in large-scale development, construction projects, plantations or army camps. MMPs are defined as any Lao or foreign worker or their family members who migrate or reside for less than six months (mobile people) or between six to 12 months (migrant people) for economic or labor-related reasons within Lao PDR or across borders in neighboring countries. They are a high-risk group for malaria infection due to their heightened exposure in remote or forest-areas, and lack of access to quality public health services among other reasons.

Under the new Global Fund RAI2E, CSOs and local NGOs will assist CMPE with implementing the SBCC strategy in Laos. Their activities include annual campaign planning meetings concerning messaging content and means of transmission and ensuring the successful development of SBCC messages for malaria control and elimination, targeting relevant at-risk populations. Mass communication campaigns for malaria include posters, pamphlets, radio adverts, signs, billboards, and social event involvement. Community mobilization to improve awareness about malaria risk, prevention, diagnosis and treatment are conducted through meetings for community engagement and World Malaria Day annually. CMPE and partners conduct site visits for supervision and monitoring of SBCC activities at provincial and district

levels. A KAP Survey is planned for 2019 with Global Fund support for evaluating community knowledge and behaviors related to malaria.

Progress since PMI was launched

PMI has supported the BVBD to increase the availability of multilingual SBCC materials appropriate for transnational migrants from other GMS countries to increase health-seeking behaviors and treatment compliance. In Thailand, PMI has taken advantage of regional cross-border presence by bringing personnel and SBCC staff from Burma and Cambodia to assist in training of migrant malaria volunteers in border provinces. In Lao PDR, PMI has emphasized the integration of targeted SBCC messaging as part of mass campaigns for LLIN distribution. Brochures in Lao language were provided with each LLIN to reinforce appropriate care and use of LLINs.

Progress during the last 12-18 months

With FY 2014 and FY 2015 funding for Thailand, PMI-supported project staff and volunteers conducted outreach and assisted Thai malaria workers with translation for migrants during case investigations and reinforced messages through interpersonal communications and provided LLINs to those who may not have them. The target audience for these outreach activities are households and communities living in malaria risk villages as well as migrant workers in those areas. Support was also provided for training of health staff and facilitators for bilingual case management. With FY 2015 funding, PMI reached over 57,300 people with SBCC activities (61% through interpersonal communication) in Thailand. Targeted behavior change focused on prevention and use of LLINs, and seeking appropriate treatment through village volunteers or health workers. PMI trained a network of 67 migrant and bi-lingual volunteers (Burmese and Khmer) to provide malaria interpersonal communications and health information. The project end-line survey indicated that knowledge and awareness improved among all target groups, including an increase of LLIN use among migrant workers from 12% to 44% over the project period.

In FY 2015, PMI provided technical assistance for SBCC, which included support for translating SBCC materials into the appropriate languages of the targeted populations. PMI also supported technical assistance for integrating malaria case management services, including for pregnant women, into routine health services in Thailand.

In Laos, the MIP-specific SBCC activities include ensuring that interpersonal communications and mass campaign activities conducted by the NMCP include targeting women of reproductive age. In Thailand, health promotion hospitals are now providing malaria testing and treatment services. These health promotion hospitals also provide antenatal care and MIP-specific SBCC is integrated at this level.

Plans and justification

With sufficient support for SBCC already being provided by the Global Fund in-country and upcoming RAI2E grants for Thailand and Lao PDR, no specific PMI funding in FY 2018 is allocated for SBCC activities. However, to the extent possible, PMI will continue to provide technical support and facilitate communication strategies and use of appropriate SBCC approaches among migrant and at-risk populations in Thailand and Lao PDR.

Proposed activities with FY 2018 funding: (\$0)

PMI supports integration of SBCC activities, particularly interpersonal communication, as part of the delivery of malaria services (e.g., distribution of LLINs and case management), and these are covered under the respective intervention areas.

6. Surveillance, monitoring, and evaluation

NMCP/PMI objectives

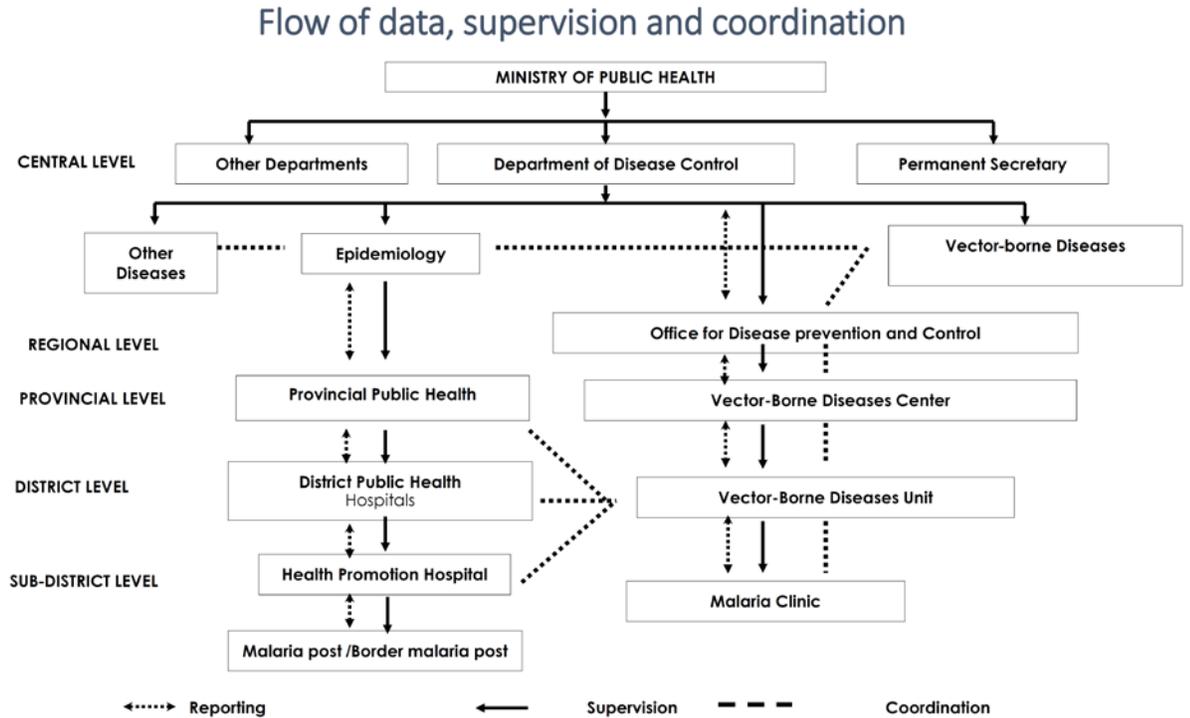
Thailand

As a vertical program, malaria surveillance is overseen by the Bureau of Vector Borne Diseases (BVBD), which is in the Department of Disease Control, through a network of Malaria Clinics and Malaria Posts, which are spread throughout the malaria-endemic areas of the country. Beneath the BVBD are 12 regional Offices of Disease Prevention and Control that coordinate with the 75 Provincial Health Offices. Under the 12 regional Offices of Disease Prevention and Control are 39 Vector Borne Disease Control Centers that coordinate with the District Health Offices. These in turn oversee the 302 Vector Borne Disease Control Units that coordinate with the Health Centers at the Canton level. The Vector Borne Disease Control Units oversee the 536 Malaria Clinics throughout the country.

The Office of the Permanent Secretary oversees general health services consisting of PHOs, District Health Offices, Health Centers), and Malaria Posts. The PHOs report to the Bureau of Epidemiology. Data from hospitals (including severe cases and deaths) also feed into the PHO and Bureau of Epidemiology system.

Case investigations on individual patients are conducted using EP-3 forms (Investigation and Radical Treatment of Malaria Case). These data are entered by Vector Borne Disease Control Units and some coordination is required to obtain data from district health offices and hospitals. Currently, efforts are ongoing to integrate the vertical malaria surveillance system with those of the general health system into one national surveillance system.

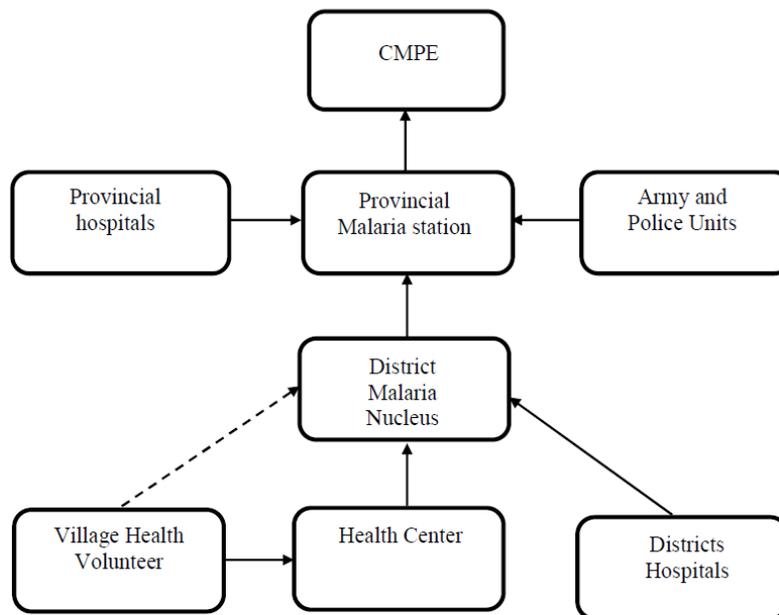
Figure 10. Data flow, reporting, supervision, and coordination in Thailand



Lao PDR

There are 18 Provincial Anti-Malaria Stations (PAMS) each with an organizational structure modeled after CMPE. Depending on the size of the province, the number of staff varies from 5 to 25. Typically, PAMS are comprised of the following units: administration, epidemiology, laboratory and treatment, entomology, and information, education, and communication. Malaria data collected at district level are routinely submitted to the PAMS on a monthly basis and the heads of the different units at the PAMS are in charge of collecting, verifying, compiling and reporting different types of data and submitting reports to their corresponding units in CMPE. The PAMS also consolidate malaria data reported from provincial hospitals and army and police units.

Figure 11. Flow of malaria data reporting in Lao PDR



Inclusion of malaria data from the private sector is a critical element for malaria elimination, particularly in a region where a significant proportion of individuals seek services from these largely unregulated outlets and clinics. This is the case in most GMS countries with the exception of Thailand where antimalarial drugs are not allowed to be sold in pharmacies or private clinics. More intensified effort will be needed to work with the private sector to consolidate data as part of one national surveillance system. The long-term goal is to have a single health management information system that incorporates both data from public and private sectors using the DHIS-2 platform. Although fairly limited through the Private-Public Mix strategy and now expanded to more Public-Private Mix sites in southern Lao PDR, some data from registered private providers are captured in the national surveillance system through a DHIS-2 based mHealth application piloted by Population Services International.

Progress since PMI was launched

Thailand

Thailand’s malaria surveillance system is a web-based system that was developed with Global Fund support and largely managed by Mahidol University’s Center of Excellence for Biomedical and Public Health Informatics (BIOPHICS) since 2011 for the malaria vertical program through the network of malaria clinics and malaria posts. Malaria case data are also routinely reported from hospitals to the district and provincial health offices, which are compiled by the Bureau of Epidemiology. These two parallel data reporting systems are duplicative and inefficient, as noted in the Malaria Program Review in 2015. With the decline in malaria burden, efforts have been made to integrate malaria services and reporting through the Health Promotion Hospitals as well

as to ensure that the database systems used by hospitals can be linked with the BVBD's malaria information system.

Lao PDR

With a limited presence in Lao PDR, PMI has supported a supply chain advisor to strengthen supply chain management and forecasting at national and provincial levels, particularly making linkages with the epidemiologic data in the malaria information system for more accurate forecasting. Additional support has been provided to transition the existing malaria information system from a paper-based to electronic-based platform.

Table 19: Surveillance, Monitoring, and Evaluation data sources in Thailand

Data Source	Activities	Year									
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Household surveys	Malaria Indicator Survey (MIS)			X*							
	KAP Survey						X*				
Other surveys	Migrant surveys	X* (RDS, Thai-Cam)		X (RDS, Ranong)							
Malaria surveillance and routine system support	Support to malaria surveillance system strengthening	X	X	X	X	X	X	X	X	X	X
Therapeutic efficacy monitoring	<i>In vivo</i> efficacy monitoring	X	X	X	X	X	X	X	X		
	Routine treatment outcome monitoring								X	X	X
Entomology	Entomological surveillance and resistance monitoring	X	X	X	X	X	X	X*	X*	X*	X*

* Not PMI-supported; KAP= knowledge, attitude, and practice; RDS=respondent-driven sampling

Table 20: Surveillance, Monitoring, and Evaluation data sources in Lao PDR

Data Source	Activities	Year										
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
Household Surveys	Multiple Indicator Cluster Surveys (MICS)		X*							X*		
Other surveys	Migrant surveys					X* (Lao-VTN-CAM border screening)						
Malaria surveillance and routine system support	Support to malaria surveillance system strengthening			X	X	X	X	X	X	X	X	X
Therapeutic efficacy monitoring	<i>In vivo</i> efficacy monitoring	X	X	X	X	X	X	X	X	X	X	X
Entomology	Entomological surveillance and resistance monitoring		X*	X*	X*	X*	X*	X*	X*	X*	X*	X*
Other data sources	Drug quality monitoring	X	X	X	X	X	X	X	X	X*	X*	X*

* Not PMI-supported;

Progress during the last 12-18 months

Thailand

As of January 2017, the BVBD’s malaria online system and its server have now been transitioned from BIOPHICS to the Ministry of Public Health’s Information and Communication Technology Data Center. Information technology and maintenance support for the malaria information system (Business Intelligence Solutions software application) is supported by the Ministry of Public Health’s Data Center, which currently also houses the databases for other disease programs in Thailand. With technical assistance from PMI, progress has been made to consolidate the BVBD’s malaria online system with the Bureau of Epidemiology’s database from hospitals into one system using a malaria software agent (MSA) program along with training on the standard operating procedures.

Lao PDR

The Ministry of Health in Lao PDR has made the decision to use the DHIS-2 platform for their Health Information System. The malaria program is the first disease program to pilot the use of DHIS-2 at district level. The pilot has demonstrated that reporting completeness has reached 80% at district level with some provinces such as Xayabury and Savannakhet lagging behind. Additional training was provided for those districts and provinces. In an effort to improve the rollout of the DHIS-2 in the country, PMI in collaboration with WHO and other stakeholders,

have planned a review and assessment of the DHIS-2 platform with a focus on identifying the operational gaps and developing a common roadmap for all partners to strengthen the malaria surveillance system in Lao PDR.

Plans and justification

Thailand

PMI supports BVBD's goal for malaria elimination and will focus our support on technical assistance to the national program in the following areas: 1) ensuring the collection and use of quality, standardized routine data that feeds into a comprehensive national surveillance system, particularly linking the data flow between the vertical and general health systems; 2) supporting BVBD in expanding the various modules of the malaria information system, including capacity for routine case follow-up and treatment outcome monitoring, entomological surveillance, foci investigations, and supply chain management; and 3) supporting BVBD to document and disseminate these lessons learned for the wider malaria community. Malaria is now a notifiable disease in Thailand, and PMI will continue to support the BVBD's capacity to monitor the 1-3-7 approach (i.e., reporting within 24 hours, investigation within 72 hours, and appropriate response within 7 days) which will include exploring mHealth tools to improve case notification, reporting and response, including follow-up of treatment outcomes to monitor therapeutic efficacy. Support will be provided to strengthen surveillance, monitoring, and evaluation (SM&E) at national and sub-national levels and to strengthen routine data collection, and its quality at the peripheral levels to complement the support provided by the Global Fund and domestic resources.

Lao PDR

PMI, in consultation with CMPE and other donors, will be able to determine the additional support needs for surveillance and M&E after the DHIS-2 assessment that is currently underway. It is envisioned that this assessment will provide a roadmap of surveillance gaps and needs.

At this time, PMI does not provide direct support for SM&E in Viet Nam.

Proposed activities with FY 2018 funding: (\$272,800)

- **Support for SM&E and surveillance system strengthening:** Technical assistance will be provided to strengthen malaria surveillance, ensuring data quality, and use of strategic information and evaluation of malaria elimination models and interventions such as case-based notification and response activities. (\$162,800 for Thailand, \$100,000 for Lao PDR)
- **Technical assistance on SM&E:** A CDC epidemiologist will provide technical assistance support with ongoing SM&E activities in the region and support NMCP's with their M&E plans. (\$10,000)

7. Operational research

NMCP/PMI objectives

To support the vision of a malaria free Thailand by 2024, BVBD aims to conduct research to develop technology, innovation, guidelines, and models on malaria elimination for using as guidelines for each geographical area. The National Malaria Elimination Strategy, 2017-2026, identified several research priorities related to malaria elimination (e.g., detection of asymptomatic cases, use of primaquine and drug toxicity, prevention of outdoor transmission, drug safety and drug resistance, development of information technology (IT) system, application of IT on drug resistance, insecticide resistance, etc.). BVBD identified research topics around reactive case detection, highly sensitive RDT, and long lasting insecticide jacket nets as short-term research priorities.

The Lao National Strategic Plan for Malaria Control and Elimination 2016–2020 aims to eliminate malaria by 2030 and includes a strategic intervention area to strengthen operational research (OR) to guide strategic decisions. Plans include an annual review of available and relevant national and regional research findings convened by CMPE and WHO. Their current prioritized topics include utility of mass drug administration within elimination-targeted provinces, potential opportunities for more sensitive diagnostics, and strategies for improving radical cure for *P. vivax* and gametocytocidal treatment for *P. falciparum*.

Progress since PMI was launched

In 2011, USAID supported a respondent-driven sampling study in Ranong, Thailand which looked to better understand migrant mobility, treatment-seeking behaviors, and malaria burden among Burmese migrants living and working in Ranong. The study showed that malaria burden was low among these sedentary immigrant populations, and their risk for transporting malaria from Burma was fairly limited.

Progress during the last 12-18 months

There were no PMI-supported OR activities in Thailand or Lao PDR during the last 12-18 months.

Plans and justification

There are no OR activities planned with FY 2018 funding but PMI will continue to keep abreast of the evolving country and regional OR priorities, OR results from both PMI-funded and non-funded studies in the region, and development of promising high sensitive point of care diagnostics or personal protection measures and will plan accordingly.

8. Pre-Elimination

NMCP/PMI objectives

Thailand

The Department of Disease Control through the Ministry of Public Health has developed the National Strategic Plan on Malaria Elimination in Thailand (2017-2026) with the vision that Thailand will be malaria-free by 2024. The National Strategic Plan for Malaria Elimination (2017-2026), including a Monitoring and Evaluation Plan, sets as their target malaria elimination in 95% of districts by the year 2021 and ultimately elimination of malaria by 2024.

There are four key Strategies:

- **Strategy 1:** Scale-up malaria elimination in Thailand;
- **Strategy 2:** Develop technology, innovation, measures and models that are appropriate for malaria elimination;
- **Strategy 3:** Develop partnership among stakeholders at national and international level in order to enable malaria elimination; and
- **Strategy 4:** Promote/empower community in taking care of themselves from malaria.

The proposed budget for Malaria Elimination Operation Plan during 2017-2021 is 2.283 billion Baht (approximately \$65.2m USD).

Thailand updates its malaria risk stratification at village level annually, which is based on epidemiological and entomological data and risk factors. As Thailand has re-orientated its malaria control program to an elimination program, malaria stratification has been reclassified based on the district as the lowest administrative unit for elimination. As such, districts are stratified into C1, C2, E1, and E2, where:

- C1 (control districts): high transmission districts where annual parasite incidence is higher than 1 per 1000 population;
- C2 (pre-elimination districts): low transmission districts where annual parasite incidence is lower than 1 per 1000 population;
- E1 (elimination district): districts without transmission for at least 1 year but less than 3 years;
- E2 (verified elimination areas): districts without transmission for at least 3 years

In 2017, there are 39 (4%) out of 928 districts that are C1; 176 (19%) that are C2; 46 (5%) that are E1; and 667 (72%) that are E2. Prevention of re-introduction of malaria in E2 districts will focus on strengthening collaboration with Provincial and District SRRTs and the general health services to detect and respond in a timely manner. Foci investigations are prioritized in these areas that have not had malaria reported for at least 3 years.

Based on the Thailand Malaria Program Review in 2015 that highlighted the need to shift the national malaria surveillance system from being used merely for reporting to inform action and

response, the National Strategic Plan acknowledges the need for a single, comprehensive surveillance system that is used by all relevant sectors. Timely notification, case investigation, and response to every malaria case (1-3-7 approach) will be critical to interrupt transmission and will require working together with the Bureau of Epidemiology, Provincial and District Health Offices, and other relevant stakeholders for detection, reporting, and response. The aim is to develop a single surveillance system that integrates epidemiology, entomology, treatment outcomes, and supply chain management.

Lao PDR

Lao PDR's National Strategy for Malaria Control and Elimination (2016-2030) describes three phases and the following specific objectives:

- 1) Phase 1 (2016-2020) aims to reduce the impact of multi-drug resistance malaria in the southern provinces, and to move progressively towards malaria elimination in the northern provinces while aligning with the GMS regional elimination efforts.
 - Reduce the incidence of *Plasmodium falciparum* to less than 5 per 1,000 in the southern provinces by 2020
 - Interrupt the transmission of *Plasmodium falciparum* in the Northern provinces by 2018.
 - Reduce the incidence of indigenous cases of *Plasmodium vivax* to <1 per 1,000 in the Northern provinces by 2020
 - Prevent reintroduction of malaria transmission in areas where it has been interrupted (defined as no local cases for at least two years)
- 2) Phase 2 (2021-2025) aims to eliminate *Plasmodium falciparum* malaria in the entire country and to eliminate all species of malaria in the northern provinces
 - Interrupt the transmission of *Plasmodium falciparum* in the entire country by 2025
 - Interrupt the transmission of *Plasmodium vivax* in the northern provinces by 2025
 - Prevent reintroduction of malaria transmission in areas where it has been interrupted.
- 3) Phase 3 (2026-2030) aims to eliminate all forms of malaria by 2030 in the entire country
 - Interrupt the transmission of all forms of malaria in the entire country by 2030
 - Prevent reintroduction of malaria transmission in areas where it has been interrupted
 - Apply for certification of malaria free status by 2030

Progress since PMI was launched

Thailand

The Thai program has been implementing pre-elimination activities well before PMI was launched. In 2009-2011, Thailand and Cambodia received funding from BMGF to implement the Containment Project that aimed to contain artemisinin resistant parasites along the Thai-Cambodia border. The need for timely village-based (and ultimately case-based data) led to the eventual development of an online case-based malaria surveillance system which is currently used in Thailand. PMI contributed to the Thailand Malaria Program Review in 2015 which

identified critical gaps in the malaria program with regards surveillance, vector control, case management, program management and re-orientation towards malaria elimination.

Lao PDR

PMI provided technical assistance and contributed to the development of the National Strategic and M&E Plans for malaria control and elimination. PMI also contributed to the Malaria Program Review in 2014 that recommended maintaining malaria control activities in the southern provinces and intensified malaria control/pre-elimination activities in the northern provinces using the district as the administrative unit.

Progress during the last 12-18 months

Thailand

PMI provided technical assistance and contributed to the development of the National Strategic and M&E Plans in Thailand, including the National Malaria Elimination Strategy (2017-2020). In addition, PMI supported BVBD to conduct a Cost-Benefit Analysis of the National Malaria Elimination Strategy as an advocacy tool for resource mobilization. Taking into account the projected indirect costs to households, labor and productivity lost due to malaria, and its effect on the tourism industry, the preliminary findings indicate that for every one Baht invested in malaria elimination, Thailand could expect to get five Baht in return over the next 20 years.

Following the recommendations from the Malaria Program Review in 2015, malaria is now a notifiable disease under 2016 Infectious Disease Act that requires a malaria case to be reported within 24 hours. BVBD has also incorporated the 1-3-7 approach, where cases are reported within 24 hours, case investigations conducted within 3 days, and response, as appropriate, within 7 days, as a core component of the National Malaria Elimination Strategy. Development of SOPs and training on this approach has been conducted using Global Fund resources, as well as piloting the integration of Provincial and District Health Office's SRRTs to conduct case investigations and response.

Lao PDR

Under the Global Fund RAI project in the 5 southern provinces, the Lao national malaria program initiated some pre-elimination activities. Case investigations of Pf cases were initiated but resulted with limited success. Only 77 (56%) out of 137 Pf cases were investigated due to staff turnover, procedures, and limited capacity. Directly observed therapy for confirmed cases was also initiated under the RAI, but results showed that only 1,705 (50%) out of 3,411 cases received DOT. DOT has since been dropped as an activity supported by the Global Fund.

Table 21: Pre-Elimination/Elimination Activities in Thailand

Technical Area	Description of Activity	Geographic Coverage
Prevention	LLINs and LLIHNs are provided to target populations, including mobile and migrant workers	A1+A2 transmission areas
Case management	Piloting of treatment outcome monitoring of all malaria cases through the routine surveillance system	Chiang Mai, Chiang Rai, Mae Hong Son
SBCC	Interpersonal communication by volunteers to reach targeted high risk populations e.g., migrant workers and mobile populations; emphasis on messaging around treatment adherence and follow-up	Nationwide
SME	Implementation of 1-3-7 approach for monitoring; web-based, case-based reporting that is integrated with hospital reporting	Nationwide
OR	N/A	N/A

Table 22: Pre-elimination Activities in Lao PDR

Technical Area	Description of Activity	Geographic Coverage
Prevention	LLINs are provided to target populations, including mobile and migrant workers	Strata 2 and 3 (high risk)
Case management	DOTs and case investigations initiated under RAI Project; Mobile Malaria Teams and Malaria Posts to target mobile and migration population at their work sites	5 southern provinces
SBCC	MMP-focused SBCC materials and approaches using interpersonal communication	Nationwide
SME	Assessment of the DHIS-2 platform, including operational feasibility of case-based reporting in the northern provinces (in collaboration with UCSF); expansion of the Public-Private Mix sites for testing, treatment, and reporting	Northern Provinces
OR	N/A	N/A

Plans and justification

As malaria incidence continues to decline, conducting traditional therapeutic efficacy studies (TES) has been a challenge. With technical assistance from WHO, PMI supported the national program to develop a protocol for routine DRS and follow-up for all malaria cases. DRS will be piloted in five provinces: Kanchanaburi, Chumpon, Surat Thani, Ubon Ratchathani and Srisaket. For malaria elimination and in the context of monitoring for drug resistance, the aim is to have individual treatment outcomes incorporated into the routine surveillance system.

PMI will focus support to Lao PDR on filling commodity gaps and strengthening malaria surveillance systems, including supply chain and logistics management. In an effort to improve the rollout of the DHIS-2 in the country, PMI in collaboration with WHO and other stakeholders, have planned a review and assessment of the DHIS-2 platform with a focus on identifying the operational gaps and developing a common roadmap for all partners to strengthen the malaria surveillance system in Lao PDR. The recommendations from this assessment will help identify the gaps where PMI might consider providing support in the future.

Proposed activities with FY 2018 funding:

These activities are described elsewhere in other sections of the MOP.

9. Staffing and administration

One health professional will serve as a Resident Advisor to oversee PMI in the Mekong. In addition, one Foreign Service National (FSN) works as part of the PMI team. All PMI staff members are led by the USAID Mission Director or his/her designee in country. The PMI team shares 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 Resident Advisor 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.

PMI professional staff work together to oversee all technical and administrative aspects of PMI, including finalizing details of the project design, implementing malaria prevention and treatment activities, monitoring and evaluation of outcomes and impact, reporting of results, and providing guidance to PMI partners.

The PMI lead in country is the USAID Mission Director. The day-to-day lead for PMI is delegated to the USAID Health Office Director and thus the Resident Advisor reports to the USAID Health Office Director for day-to-day leadership. The technical expertise housed in Atlanta and Washington guides PMI programmatic efforts.

The PMI Resident Advisor is based within the USAID health office and is expected to spend approximately half their time sitting with and providing technical assistance to the national malaria control programs and partners.

Locally hired staff to support PMI activities either in Ministries or in USAID will be approved by the USAID Mission 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 Mission Director and Controller, in addition to the US Global Malaria Coordinator.

Proposed activities with FY 2018 funding: (\$650,000)

- Support for USAID/PMI Resident Advisor and FSN (including 100% FSN and in-country support, administrative costs). (\$590,000)
- Travel cost support for regional TDYs from RDMA RA and FSN. (\$60,000)

Table 1: Budget Breakdown by Mechanism

**President's Malaria Initiative – THAILAND/REGIONAL
Planned Malaria Obligations for FY 2018**

Mechanism	Geographic Area	Activity	Budget (\$)	%
GHSC-PSM	Thailand; Lao PDR	Procurement of LLINs, RDTs, ACTs; Strengthening supply chain system	1,203,200	40.1
Inform Asia	Thailand; Lao PDR	Surveillance, M&E strengthening; Support for routine treatment outcome monitoring in Thailand	362,800	12.1
WHO Consolidated Grant	Thailand; Lao PDR; Regional	Therapeutic efficacy monitoring network	485,000	16.2
WHO Consolidated Grant/ ACTMalaria	Thailand; Lao PDR; Regional	Training and accreditation for microscopy	60,000	2.0
CDC IAA	Thailand; Lao PDR; Regional	Two Entomology TDYs; One SM&E TDY	39,000	1.3
USAID	Thailand; Lao PDR; Regional	Staffing; Administration and travel costs	650,000	21.7
TBD	Thailand; Lao PDR; Regional	Entomology training	50,000	1.7
TBD	Thailand; Lao PDR	Strengthen NMCP capacity	150,000	5.0
Total			3,000,000	100%

Table 2: Budget Breakdown by Activity

**President's Malaria Initiative – THAILAND/REGIONAL
Planned Malaria Obligations for FY 2018**

Proposed Activity	Mechanism	Budget				Geographic Area	Description
		Thailand	Laos	Regional	Commodity \$		
PREVENTIVE ACTIVITIES							
VECTOR MONITORING AND CONTROL							
Entomologic monitoring and insecticide resistance management							
Entomology training	TBD	\$ 50,000				Regional	Regional entomologic training on foci investigation
Technical assistance for entomology	CDC IAA	\$ 14,500		\$ 14,500		Thailand/ Regional	Two CDC TDYs
Subtotal Ento monitoring		\$ 64,500	\$ -	\$ 14,500	\$ -		
Insecticide-treated Nets							
Procurement of ITNs	GHSC-PSM	\$ 748,000	\$ 116,000	\$ -	\$ 864,000	Regional	Support for 300,000 LLINs to fill gaps in the region.
Subtotal ITNs		\$ 748,000	\$ 116,000	\$ -	\$ 864,000		
Indoor Residual Spraying							
		\$ -	\$ -	\$ -	\$ -		
Subtotal IRS		\$ -			\$ -		

SUBTOTAL VECTOR MONITORING AND CONTROL		\$ 812,500	\$ 116,000	\$ 14,500	\$ 864,000		
Malaria in Pregnancy							
		\$ -		\$ -	\$ -		
Subtotal Malaria in Pregnancy		\$ -	\$ -	\$ -	\$ -		
SUBTOTAL PREVENTIVE		\$ 812,500	\$ 116,000	\$ 14,500	\$ 864,000		
CASE MANAGEMENT							
Diagnosis and Treatment							
Procurement of RDTs, microscopes, and reagents	GHSC-PSM	\$ -	\$ -	\$ 59,200	\$ 59,200	Regional	Procure 80,000 RDTs/microscopy supplies to reach migrants and to fill regional gaps and outbreaks; microscopes for Thailand MCs.
Procurement of ACTs	GHSC-PSM	\$ 16,000	\$ 14,000	\$ -	\$ 30,000	Regional	Procure 15,000 antimalarials to reach migrants and to fill regional gaps and outbreaks.

Training and accreditation for microscopy	WHO Consolidated Grant / ACTMalaria	\$ 20,000	\$ 20,000	\$ 20,000	\$ -	Regional	Support for microscopy training and accreditation in the region and maintenance of regional and national slide banks; training of trainers for microscopy.
Therapeutic efficacy surveillance network	WHO Consolidated Grant	\$ 50,000	\$ 100,000	\$ 335,000	\$ -	Regional	Conducting TES studies in four countries (Thailand, Laos, Viet Nam); technical assistance and monitoring visits by WHO PI to all five GMS countries; support for drug policy review; convening of annual meetings; monitoring of K13 markers.

Technical assistance support for routine treatment outcome monitoring in Thailand	Inform Asia	\$ 100,000	\$ -	\$ -	\$ -	Thailand	Technical assistance support for monitoring use of routine surveillance/ case follow-up to collect efficacy and adverse events data in coordination with WHO
Subtotal Diagnosis and Treatment		\$ 186,000	\$ 134,000	\$ 414,200	\$ 89,200		
Pharmaceutical Management							
Supply chain strengthening	GHSC-PSM	\$ 200,000	\$ 50,000	\$ -	\$ -	Thailand, Laos	Provide technical assistance to BVBD and CMPE for supply chain management, particularly at sub-national level and assessment of stock management in provinces currently in the maintenance phase
Subtotal Pharmaceutical Management		\$ 200,000	\$ 50,000	\$ -	\$ -		

SUBTOTAL CASE MANAGEMENT		\$ 386,000	\$ 184,000	\$ 414,200	\$ 89,200		
HEALTH SYSTEM STRENGTHENING / CAPACITY BUILDING							
Strengthen NMCP capacity	TBD	\$ -	\$ -	\$ 150,000		Regional	Updating of the MMFO curricula to increase focus on elimination; Curriculum development and one regional training to focus on innovative approaches to training and supervision
SUBTOTAL HSS & CAPACITY BUILDING		\$ -	\$ -	\$ 150,000	\$ -		
SOCIAL AND BEHAVIOR CHANGE COMMUNICATION							
SUBTOTAL SBCC		\$ -	\$ -	\$ -	\$ -		
SURVEILLANCE, MONITORING, AND EVALUATION							

Surveillance, M&E strengthening	Inform Asia	\$ 162,800	\$ 100,000	\$ -	\$ -	Thailand/Laos	Technical assistance to improve M&E, data quality and use of strategic information, and evaluation of malaria elimination models and interventions in Thailand and Lao PDR; support will be provided in developing and implementing case-based reporting
CDC technical assistance for M&E	CDC IAA	\$ -	\$ -	\$ 10,000	\$ -	Regional	One CDC TDY
SUBTOTAL SM&E		\$ 162,800	\$ 100,000	\$ 10,000	\$ -		
OPERATIONAL RESEARCH							
		\$ -	\$ -	\$ -	\$ -		
SUBTOTAL OR		\$ -	\$ -	\$ -	\$ -		
PRE-ELIMINATION							
		\$ -	\$ -	\$ -	\$ -		
SUBTOTAL PRE-ELIMINATION		\$ -	\$ -	\$ -	\$ -		
IN-COUNTRY STAFFING AND ADMINISTRATION							

USAID Resident Advisor and FSN	USAID	\$ -	\$ -	\$ 590,000	\$ -	Regional	Support for USAID Resident Advisor, PMI Malaria FSN in Bangkok; administrative costs.
Travel costs	USAID	\$ -	\$ -	\$ 60,000	\$ -	Regional	Regional travel for RDMA PMI staff.
SUBTOTAL IN-COUNTRY STAFFING		\$ -	\$ -	\$ 650,000	\$ -		
GRAND TOTAL		\$ 1,361,300	\$ 400,000	\$ 1,238,700	\$ 953,200		