

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 2017 appropriation. If any further changes are made to this plan it will be reflected in a revised posting.



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U.S. PRESIDENT'S MALARIA INITIATIVE



PRESIDENT'S MALARIA INITIATIVE

GREATER MEKONG SUB-REGION

Malaria Operational Plan FY 2017

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ABBREVIATIONS AND ACRONYMS

3DF	Three Diseases Fund
3MDG	Three Millennium Development Goal
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 index
APLMA	Asia-Pacific Leaders Malaria Alliance
APMEN	Asia-Pacific Malaria Elimination Network
AS-MQ	Artesunate-mefloquine
ASEAN	Association of Southeast Asian Nations
BMGF	Bill & Melinda Gates Foundation
BOE	Bureau of Epidemiology (Thailand)
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)
CMS	Cambodia Malaria Survey
CMSD	Central Medical Store Depot (Burma)
CNM	National Centre for Parasitology, Entomology, and Malaria (Cambodia)
CQ	Chloroquine
DDF	Department of Drugs and Food (Cambodia)
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
ERAR	Emergency Response to Artemisinin Resistance
FDA	Food and Drug Administration
FETP	Field Epidemiology Training Program
G6PD	Glucose-6-phosphate dehydrogenase
Global Fund	Global Fund to Fight AIDS, Tuberculosis, and Malaria
GMS	Greater Mekong Sub-region
HMIS	Health management information system
IEC	Information, education, communication
IPTp	Intermittent preventive treatment for pregnant women
IPC	Interpersonal communications
IRS	Indoor residual spraying
ISO	International Organization for Standardization
ITN	Insecticide-treated mosquito net

JICA	Japan International Cooperation Agency
Lao PDR	Lao People's Democratic Republic
LLIHN	Long-lasting insecticide-treated hammock net
LLIN	Long-lasting insecticide-treated net
LMI	Lower Mekong Initiative
LMIS	Logistic Management Information System
K13	Kelch 13 propeller
MARC	Myanmar (Burma) Artemisinin Resistance Containment Project
M&E	Monitoring and evaluation
MEAF	Malaria Elimination Action Framework
MIP	Malaria in pregnancy
MIS	Malaria indicator survey
MMFO	Management of Malaria Field Operations
MMP	Mobile and migrant populations
MMW	Mobile malaria worker
MOH	Ministry of Health
MOP	Malaria Operational Plan
MOPH	Ministry of Public Health (Thailand)
MPSC	Medical Products Supply Center
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
OD	Operational district
OR	Operational research
PCR	Polymerase chain reaction
PHD	Provincial Health Department
PLE	Project for Local Empowerment
PMI	President's Malaria Initiative
PSI	Population Services International
QA	Quality assurance
QC	Quality control
RAI	Regional Artemisinin Initiative
RBM	Roll Back Malaria
RDMA	Regional Development Mission Asia
RDT	Rapid diagnostic test
SBCC	Social and behavior change communication
SM&E	Surveillance, monitoring, and evaluation
SP	Sulfadoxine-pyrimethamine
SSF	Single Stream Funding
TSG	Technical and Strategic Group
UNICEF	United Nations Children's Fund
UNOPS	United Nations Office for Project Services
USAID	United States Agency for International Development

USG	United States Government
VBDC	Vector-borne Disease Control Program (Burma)
VMW	Village Malaria Worker
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 2017 GMS Malaria Operational Plan (MOP) presents detailed implementation plans for Burma, Cambodia, and Thailand/Regional which includes the Lao People’s Democratic Republic (Lao PDR) and Viet Nam.

Although considerable progress has been made in malaria control in the GMS during the past 10 years, malaria remains a major concern for the international community, ministries of health, and the people of the region. This is due primarily to the development and possible spread of resistance to artemisinin drugs, the principal component of the combination therapies for malaria that now are the first-line treatment for malaria throughout the GMS and the world. *Plasmodium falciparum* resistance to artemisinin drugs was first confirmed in western Cambodia; treatment

failures to artemisinin-based combination therapy (ACT) have been reported from multiple sites on the Thai-Cambodian border; and an early warning sign of artemisinin resistance — prolongation of parasite clearance times — has been reported throughout the region.

The USG has supported malaria control efforts in the GMS since 2000. These regional efforts have focused on antimalarial drug resistance monitoring and drug quality surveillance. All GMS countries have received Global Fund to Fight AIDS, Tuberculosis, and Malaria (Global Fund) support. The other major sources of funding for malaria in the region include the Three Millennium Development Goal Fund in Burma, Australia's Department of Foreign Affairs and Trade, the United Kingdom's Department for International Development, the Asian Development Bank, and the Bill & Melinda Gates Foundation. In addition, the Global Fund supports a 3-year \$100 million Regional Artemisinin Initiative to reduce malaria transmission and respond to resistance in GMS countries.

The FY 2017 PMI MOP for the GMS was developed with the Regional Development Mission for Asia (RDMA), and Burma and Cambodia USAID Missions during a planning visit in March 2016 by representatives from USAID, the Centers for Disease Control and Prevention, and the national malaria control programs of Burma, Thailand, and Cambodia, with the participation of other major donors and partners working on malaria in the area.

The FY 2017 MOP supports regional/cross-cutting activities, such as surveillance for antimalarial drug resistance and antimalarial drug quality assurance, and malaria prevention and control activities to reduce malaria transmission in geographically targeted areas. PMI is also supporting a pilot package of elimination activities in one operational district in Cambodia for potential scale up to other areas. 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 PMI is proposing to support with FY 2017 funding are in line with the national malaria control program strategies of the six countries and are intended to complement ongoing Global Fund malaria grants and contributions from other donors.

The proposed FY 2017 PMI budget for the GMS includes \$9 million for Burma, \$4.5 million for Cambodia, and \$3 million to the Thailand/Regional program. PMI will support the following intervention areas with these funds:

Entomological monitoring and insecticide resistance management:

Malaria transmission in the GMS 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 geographically on targeted areas with an emphasis on improved insecticide resistance monitoring and foci investigations, where epidemiologically appropriate. PMI will also provide support for entomological training 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 the GMS and net ownership is quite high, especially in Burma and Cambodia, but many of those nets are untreated. Considerable numbers of long-lasting ITNs targeted for high-risk areas in Burma, Cambodia, and Thailand are included in their respective Global Fund grants. With FY 2014 and FY 2015 funding, PMI procured approximately 823,000 and 423,000 long-lasting insecticide-treated nets (LLINs) in Burma and Cambodia, respectively, to fill gaps in Global Fund grants in the PMI focus areas and developed innovative SBCC approaches to improve LLIN use among vulnerable migrant and mobile populations.

With FY 2016 funding, PMI is procuring approximately 607,000 LLINs and hammock nets for migrant and vulnerable populations in targeted focus areas. With FY 2017 funds, PMI will procure approximately 686,000 LLINs for Burma, Cambodia, Thailand, and Lao PDR. Indoor residual spraying (IRS) is mostly limited to outbreak response and focal control and is not a key activity in national malaria control strategies in the GMS with the exception of Thailand. Therefore, PMI funds will not be targeted for IRS in the Sub-region.

Malaria in pregnancy: While intermittent preventive treatment for pregnant women (IPTp) is not part of national policies for any country in the Sub-region, given the low prevalence of malaria in the GMS, 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. PMI supported a rapid assessment of malaria in pregnancy to identify programmatic areas for strengthening in Burma, Cambodia, Thailand, and Lao PDR in 2015. With FY 2016 funding, PMI is building on the assessment findings and recommendations to ensure all GMS national programs have updated policies and guidelines. With FY 2017 resources, PMI will support procurement of LLINs, training and supervision of facility staff, and updating training materials and job aids to strengthen malaria case management and prevention activities provided through antenatal clinics in Burma and Cambodia.

Case management: In all countries making up the GMS, 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 ACTs have now been documented in Western and Northern provinces of Cambodia. Case management of malaria in the GMS is further complicated by the fact that *P. vivax* and *P. falciparum* are co-endemic. With FY 2015 and FY 2016 funding, PMI has supported training of community health and malaria volunteers and health facility staff in Burma, Cambodia, and Thailand in malaria case management including diagnostic testing.

The majority of RDT and ACT needs in Burma, Cambodia, Lao PDR, and Thailand is anticipated to be met by those countries' Global Fund grants through 2016 when the Global Fund

malaria grants in Burma and Thailand will end; however, an anticipated extension of Thailand and Burma's Global Fund malaria grant is expected through 2017. With FY 2017 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 Burma and Cambodia and respond to urgent needs in the region. Because of concerns about the quality of malaria diagnosis and treatment in targeted areas, PMI will support in-service training, accreditation of microscopy trainers, development of slide banks, and quality assurance of the parasitological diagnosis of malaria. In addition, PMI will continue to support drug quality assurance efforts by helping the national pharmaceutical reference laboratories in Burma, Cambodia, Lao PDR and Thailand achieve and maintain international accreditation. PMI will continue to support drug therapeutic efficacy and drug resistance monitoring at 45 sites (alternating every other year) in all six GMS countries.

Social and behavior change communication (SBCC): PMI will continue to provide technical support to national programs to facilitate 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). A multi-pronged, comprehensive approach for SBCC interventions will be emphasized to sustain community involvement, support promotion of healthy behaviors, and reduce risk-taking in the context of malaria exposure. With FY 2017 funding, PMI will support development of effective SBCC approaches for elimination in targeted areas of Cambodia. In Burma, with FY 2017 funding, PMI will support efforts to standardize and harmonize key SBCC materials and messages at the community level.

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. 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 2015 and FY 2016 funding, PMI is supporting strengthening and scale-up of surveillance systems in Burma, Cambodia, and Lao PDR, providing technical assistance for national surveys in Cambodia and Burma, and supporting collection and reporting of routine surveillance and survey data in PMI target areas.

With FY 2017 funding, PMI will focus efforts on targeted areas to implement systems and practices to foster timely collection and use of quality surveillance data. At the national level, PMI will provide technical support to all national malaria control programs on their national M&E plans, through support for national/sub-national malaria surveys, and build SM&E capacity within their national programs and at state/province and district levels, including technical support for surveillance systems and databases. In Cambodia and Burma where many patients seek care in the private sector, PMI will continue to strengthen collection and integration of malaria data from private providers.

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*. No OR is currently planned with FY 2017 funding, but PMI will continue to keep abreast of key programmatic bottlenecks and plan for OR to address those gaps as necessary.

II. INTRODUCTION

1. Greater Mekong Sub-region Malaria Operational Plan

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 percent (in both Liberia and Nigeria) to 55 percent (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 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. This FY 2017 GMS Malaria Operational Plan (MOP) presents detailed implementation plans for Burma, Cambodia and Thailand/Regional, which primarily focuses on regional, as well as Thailand and Lao PDR activities. Support to Viet Nam and China is limited to drug efficacy monitoring and regional trainings.

The MOPs were developed in consultation with the Burma, Thailand, Cambodia, and Lao NMCPs and with the input of multiple national and international partners involved with malaria prevention and control in the Sub-region. The activities that PMI is proposing to support with FY

2017 funding contribute to the countries' national malaria control and elimination strategies and plans, and build on malaria investments made by the United States Government (USG) in the Sub-region since 2000.

PMI's GMS program differs from its support to malaria programs in Africa both in its regional focus and its primary goal of responding to artemisinin resistance by eliminating *Plasmodium falciparum*. PMI recognizes the original intent of its engagement in the region was principally due to the emergence of artemisinin resistance, which could undermine the tremendous progress made in the reduction of malaria morbidity and mortality globally if resistance were to spread to Africa. While initial PMI priority intervention areas focused on specific border areas between Thailand, Cambodia, and Burma, more recent evidence from the network of PMI-supported therapeutic efficacy monitoring and research suggests that artemisinin resistance is present throughout the region, and is emerging *de novo* in some locations. In line with regional goals, PMI has 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.

The FY 2017 MOPs for the GMS support both regional/cross-cutting activities, such as surveillance for antimalarial drug resistance and regional capacity building, as well as targeted malaria control and elimination activities with a country-specific focus through bilateral funding, particularly in Cambodia and Burma. Support for control and elimination activities in the GMS includes distributing long-lasting insecticide-treated nets (LLINs) to protect against indoor biting mosquitoes; improving access to rapid diagnosis and effective treatment of malaria cases in the public and private sectors; promoting appropriate social and behavior change communications (SBCC) to reinforce use of personal protection measures and appropriate care-seeking; strengthening routine malaria surveillance systems; supporting entomological monitoring for insecticide resistance and foci investigation; and identifying operational research (OR) to improve program implementation and test the feasibility of new tools.

Regional, cross-cutting activities will benefit all six countries in the GMS. Particularly with country-specific bilateral activities in Burma and Cambodia, it will be important to ensure that activities and lessons learned are coordinated and shared as much as possible for maximum impact. In support of NMCP strategies and coordination with other donor efforts, PMI's commodity investments will be focused on filling gaps that are not otherwise met by domestic or Global Fund support, with a specific emphasis on increasing access for mobile and migrant populations (MMPs).

This document reviews the current status of malaria control and elimination policies and interventions in the GMS, describes progress to date, identifies challenges and unmet needs if the targets of the NMCPs and PMI are to be achieved, and provides a description of planned activities with FY 2017 funding.

2. Malaria situation in the GMS

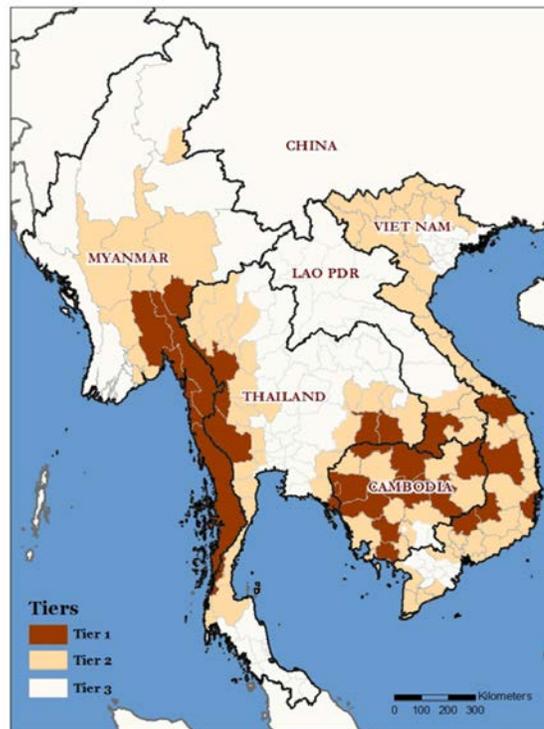
The GMS is considered the epicenter of antimalarial drug resistance starting with chloroquine (CQ) resistance in the late 1950s, followed by resistance to sulfadoxine-pyrimethamine (SP),

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 effective 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.

National treatment guidelines and policies of the countries comprising the GMS are listed in Table 1. 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 ensure adherence among cross-border migrants.

Table 1: National treatment guidelines, strategies, and policies in the GMS

	Burma	Cambodia	China	Lao PDR	Thailand	Viet Nam
Year in which treatment guidelines were most recently updated	2015	2014	2009	2013	2015	2009
First-line treatment for <i>P. falciparum</i>	AL + PQ at Day 0	AS-MQ (FDC) (Provinces with high DHA-Pip failures); DHA-Pip (all other provinces);	DHA-Pip; AS+AQ; AS+ naphthoquine; AS+PIP (Pip monotherapy as chemo-prophylaxis)	AL	DHA-Pip (Tak, Trat, Surin, Sisaket, Ranong, Kanchanaburi and Ubon) AS-MQ (all other provinces)	DHA-Pip
Anti-gametocytocidal treatment	45 mg PQ	15 mg PQ given on Day 0 (if G6PD status is known)		45 mg PQ	30 mg PQ	30 mg PQ
First-line treatment for <i>P. vivax</i>	CQ+PQ (14d)	DHA-Pip + PQ (0.25 mg/kg x 14 days OR 0.75 mg/kg weekly x 8 weeks)	CQ+PQ (180 mg over 8d)	AL	CQ+PQ (14d)	CQ+PQ (14d)
Treatment of malaria in pregnancy	Pf: 1 st Trimester: Quinine + Clindamycin 2 nd and 3 rd Trimesters: AL Pv: CQ for all trimesters	1 st Trimester: Quinine 2 nd and 3 rd Trimesters: AS-MQ FDC or DHA-Pip		1 st Trimester: Quinine For 2 nd and 3 rd Trimesters: AL	Pf: 1 st Trimester: Quinine + Clindamycin 2 nd and 3 rd Trimesters: DHA-Pip Pv: CQ for all trimesters	
Number of antimalarial therapeutic efficacy monitoring sites (total since 2008)	10	10	3	3	11	8
Number of insecticide resistance monitoring sites	12	3	N/A	10	3	>10

AL- artemether-lumefantrine; AS- artesunate; MQ- mefloquine; FDC – Fixed-Dose Combination; DHA- dihydroartemisinin; Pip- piperazine; CQ- chloroquine; PQ- primaquine; AQ- amodiaquine

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 10 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. Approximately three-quarters of the reported cases in the GMS occur in Burma. The annual figures reported by the NMCPs to the World Health Organization (WHO) for the GMS underestimate the true burden of malaria as these only capture data from the public sector (Table 2).

Table 2: Malaria burden and trends in the GMS from the public sector (2011-2014)

	2014 UN Population (millions)	2014 Estimated population in malaria-endemic (high + low-risk) areas (millions) (%)	Number of confirmed cases (by year)	Proportion due to <i>P. falciparum</i> (2014) (%)	Number of inpatient malaria deaths (by year)	Artemisinin resistance (suspected and confirmed)
Burma	52	22.5 (43)	567,452 (2011) 480,586 (2012) 333,871 (2013) 205,658 (2014)	72.4	581 (2011) 403 (2012) 236 (2013) 92 (2014)	Confirmed in Tanintharyi (2009), Kayin, Kayah, and Bago (2012), and Mon (2012)
Cambodia	15.3	10.8 (71)	57,423 (2011) 40,476 (2012) 21,309 (2013) 25,152 (2014)	58.8	94 (2011) 45 (2012) 12 (2013) 18 (2014)	Confirmed in Battambang (2012), Oddar Meanchey, Pailin (2009-10), Pursat (2011-12), Preah Vihear (2013-14), Stung Treng and Siem Reap (2015)
China	1,377	575.9 (42)	3,367 (2011) 2,603 (2012) 4,086 (2013) 2,921 (2014)	63.5	33 (2011) 14 (2012) 23 (2013) 24 (2014)	Suspected in Yingjian (2010)
Lao PDR	6.7	4.0 (60)	17,835 (2011) 46,202 (2012) 38,131 (2013) 48,071 (2014)	52.9	17 (2011) 44 (2012) 28 (2013) 4 (2014)	Confirmed in Champasack and Attapeu (2013); Sekong (2015)
Thailand	67.7	39.3 (58)	24,897 (2011) 32,569 (2012) 33,302 (2013) 37,921 (2014)	37.8	43 (2011) 37 (2012) 47 (2013) 38 (2014)	Confirmed in Ranong and Tak (2009), Kanchanaburi (2012), Ubon Ratchatani (2012)
Viet Nam	92.4	15.3* (17)	16,612 (2011) 19,638 (2012) 17,128 (2013) 15,752 (2014)	54.2	14 (2011) 8 (2012) 6 (2013) 6 (2014)	Confirmed in Binh Phuoc (2009), Gia Lai (2010), Dak Nong (2011), Quang Nam (2012), and Kon Tum and Khanh Hoa provinces (2014)

Source: World Malaria Report, 2015

* National Malaria Control Program estimates

Over the past decade, GMS countries have made tremendous progress in reducing the number of malaria cases and deaths reported through the public sector. From 2011 to 2014, the six countries have collectively reported a 77% reduction in the annual number of deaths attributed to malaria. Multiple factors have contributed to this reduction. Governments and partners have made malaria control a priority by increasing investments, successfully garnering international funding, strengthening political will, integrating malaria control efforts into national health systems, expanding access to basic malaria services, and improving cross-border collaboration. It is also likely that other factors such as environmental changes, deforestation, economic development, urbanization, demographic stabilization, greater political stability, and improved coverage of basic health services have impacted malaria morbidity and mortality in the GMS.

3. Strategic updates in the GMS

Malaria elimination in the GMS: 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 (EAS) 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 EAS 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. At the national level, Cambodia's Ministry of Health (MOH) launched in 2016 its Malaria Elimination Action Framework (MEAF) (2016-2020) – one of the first national malaria elimination strategies set out in the GMS.

Artemisinin resistance: In February 2015, the WHO expanded its definition of Tier 1 artemisinin resistance areas to include Champasack Province in southern Lao PDR, western Cambodia, as well as reclassified Bago East, Kayin, and Kayah states in Burma as Tier 1 areas (formerly categorized as Tier 2). Furthermore, molecular investigations characterizing the degree of genetic relatedness of different artemisinin-resistant strains suggest that the geographic distribution of artemisinin resistance in the Mekong likely arises out of a combination of local emergence *and* geographic spread. With the complex and evolving pattern of artemisinin resistance in the region, some countries such as Thailand and Cambodia have adopted sub-national treatment policies and regimens. In 2015, AS-MQ was re-introduced as first-line treatment in select provinces in Cambodia, since the proportion of *falciparum* strains with multiple *Pfmdr1* copy numbers (which confer MQ resistance) is currently minimal in these areas. DHA-Pip remains the first-line treatment in the rest of the country. In contrast, with the increasing failure rates of AS-MQ most likely due to MQ resistance, Thailand has begun to introduce DHA-Pip as the first-line treatment for uncomplicated *falciparum* malaria in seven provinces bordering Cambodia.

4. Integration, collaboration, and coordination

Funding

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. However, recent allocations to Thailand and Cambodia through the New Funding Model (NFM) will not maintain the same levels of support as prior grants. In fact, Thailand, as an upper middle-income country, will no longer qualify for Global Fund grants and has developed a transition plan to mobilize domestic resources to support malaria elimination activities. 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-2016 period is uncertain. Many of the Global Fund grants in the GMS (including the country NFM and Regional Artemisinin Initiative (RAI) grants) are expected to end in 2016, although extensions are being negotiated. 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	Total Budget in \$ (Funds Disbursed)	Duration	Key Implementing Partners	Key Activities
ADB	4,500,000	Oct 2015- Jun 2017	MOH/CDC of Cambodia, Laos, 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 Laos), and regional coordination
DFAT	5,000,000	2013-2015	WHO	WHO regional Emergency Response to Artemisinin Resistance (ERAR) hub
BMGF	10,000,000			
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
BMGF	29,000,000	NA	CHAI	Malaria elimination efforts in Southern Africa and the GMS
DFAT	16,300,000	2014 - 2017	ADB (Secretariat)	Regional malaria and other communicable disease threats trust fund
DFID	19,400,000			

* Costed extension through 2017 currently negotiated

Sources: World Malaria Report 2014; www.theglobalfund.org; www.gatesfoundation.org; www.3df.org; www.3mdg.org; www.adb.org

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; ERAR: Emergency Response for Artemisinin Resistance; GMS: Greater Mekong Sub-region; RAI: Regional Artemisinin Resistance; 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

Regional initiatives

Emergency Response to Artemisinin Resistance (2013-2015)

Following the Joint Assessment of the Response to Artemisinin Resistance in the GMS in 2011 supported by international development partners, WHO's Emergency Response to Artemisinin Resistance (ERAR) framework was developed. Funded by DFAT (\$5 million) and the BMGF (\$10 million), the ERAR Framework under the stewardship of WHO established a regional hub in Phnom Penh to coordinate and manage its activities.

This regional framework highlights key action areas in which progress is urgently needed to address artemisinin resistance and to move towards elimination of malaria in the GMS. The overarching goal of the framework is to protect ACTs as an effective treatment for *P. falciparum* malaria. The framework seeks to do this by advocating for stakeholders to scale-up and tailor interventions to address artemisinin resistance.

The ERAR framework draws attention to four priority action areas and urges partners to work in a coordinated manner to achieve: 1) Full coverage with high-quality interventions in priority areas; 2) Tighter coordination and management of field operations; 3) Better information for artemisinin resistance containment; and 4) Regional oversight and support. The ERAR Regional Hub oversees activities in Burma, Cambodia, Thailand, Lao PDR, and Viet Nam (the only country with funding for field activities), with a focus on increasing access to mobile and migrant populations (MMPs), and OR.

Recently, WHO has indicated that they will be phasing out the ERAR Hub and will instead strengthen technical assistance capacity in WHO country offices in the GMS.

Regional Artemisinin Initiative (RAI) (2014-2016)

In support of the ERAR Framework to respond in a coordinated manner to artemisinin resistance, the Global Fund's RAI was developed to support the implementation of this framework. This grant of \$100 million over three years to the five countries in the GMS includes \$15 million for a regional inter-country component. Funds are channeled through a regional Principal Recipient, United Nations Office for Project Services (UNOPS), to sub-recipients at country level. Oversight of the inter-country component is coordinated by the Regional Steering Committee, which has prioritized cross-border activities to reach MMPs, including surveillance, mapping, information-sharing, and cross-border communication and collaboration. Furthermore, screening and presumptive treatment approaches (including mass drug administration) is being evaluated initially in difficult-to-reach areas along the Thai-Burma border and will be expanded to other areas if shown to be effective.

The objectives of the RAI include:

1. Trans-border activities, reaching migrants and mobile populations, including surveillance, mapping and information, communication and information-sharing, diagnosis, treatment and follow-up, strengthening cross border communication and collaboration.
2. Monitoring impact, including cross-sectional point prevalence surveys in areas of focused interventions.
3. Integration of data sets from country data systems (in collaboration with the ERAR Hub).
4. Independent monitoring and evaluation.

5. ACT efficacy studies in areas with failing efficacy of first-line treatments, supplementing or adding to the WHO-coordinated therapeutic efficacy monitoring. (See footnote for funding sources¹).
6. Eliminating oral artemisinin monotherapy in the private sector.
7. Setting up a collection system for filter paper blood spots for resistance tracking. (This activity is funded from sources other than the RAI).

In 2015, an external review of the RAI was commissioned to evaluate the governance arrangements, implementation, and achievements to date of the regional grant. Despite some implementation delays, particularly in Cambodia, the RAI was noted to have contributed to the regional effort to eliminate *falciparum* malaria. Representing 29% of the overall Global Fund investments in the region over the past decade, the RAI has been able to support national programs to expand their coverage and the range of their interventions including the introduction of active case detection (ACD), directly-observed treatment (DOT), the expansion of the village malaria worker (VMW) networks, establishing malaria posts to serve mobile and remote populations, and innovative approaches to work with private companies employing migrant workers. However, the review noted that multiple Global Fund funding streams for malaria at country level have led to inefficiencies in management and complexity in planning and reporting.

Asia-Pacific Leaders Malaria Alliance (APLMA)

Established at the 2013 East Asia Summit, 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. They recently released a roadmap for malaria elimination in the Asia-Pacific² 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. Further work is underway to adapt the model to the GMS specifically.

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

¹ USAID and PMI have funded the majority of therapeutic efficacy monitoring in the GMS since 2000 and 2011, respectively.

² http://aplma.org/upload/resource/files/APLMA_Roadmap_final_EAS_2015.pdf

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 (including all of the countries in the GMS), multilateral and bilateral partners, and research groups. 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 support from the BMGF.

Asian Development Bank Regional Malaria Trust Fund (RMTF)

In 2013, the ADB established a health financing facility which 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, Laos, and Vietnam, 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.

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 impacted national treatment guidelines.

Since 2011, PMI has partnered with Peace Corps to expand malaria prevention activities throughout Africa and provide Peace Corps Volunteers with the best resources on malaria prevention. In Asia, a total of 182 Peace Corps Volunteers currently work in Cambodia (health and education sectors) and Thailand (youth development and education). In Burma, Peace Corps is setting up a program and placement of new Peace Corps Volunteers is planned in 2016. PMI/Burma and PMI/Cambodia will look at the possibility of partnering with Peace Corps in the future.

5. 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.³

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

³ http://whqlibdoc.who.int/publications/2007/9789241596084_eng.pdf

- Proportion receiving an ACT among children under five years old with fever in the last two weeks who received any antimalarial drugs

6. Progress on coverage/impact indicators to date in the GMS

Although some of the standard indicators adopted in the GMS differ from those in Africa, several indicators, mostly measuring ITN ownership and use, remain applicable to this Sub-region. Table 4 shows the most recent figures for the standard indicators being used by PMI, where survey data are available:

Table 4: National and sub-national survey data for the GMS countries

Indicator	Burma		Cambodia			Thailand			Lao PDR	Viet Nam	
	MARC (2011-2012)	MIS (2015) *	CMS (2007)	CMS (2010)	CMS (2013)	Migrant RDS, Ranong (2012)	TMS (2012)	KAP Survey (2015)	LSIS (2012)	MICS (2006)	MICS (2011)
Malaria prevalence (%)	0.5	TBD	2.6	0.9	0.1 (slide) 1.5 (PCR)	0	0.1 (PCR)	-	-	-	-
Households with at least one net (%)	97.4	95.2	100	99.4	99.7	83-94	92.2	90.1	94	99	95.5
Households with at least one ITN (%)	35.1	40.3	42.6	74.7	89.5	-	46.5	51.0	50	19	9.5
Persons who slept under an ITN the previous night (%)	15.9	24.9	25.3	52.6	59.9	1-2	28.7	38.5	-	-	-
Children under five years old who slept under an ITN the previous night (%)	19.4	TBD	28.0	56.3	63.3	-	32.5	56.4	43.2	5	9.4
Pregnant women who slept under an ITN the previous night (%)	20.3	TBD	28.1	59.1	61.5	-	36.2	-	43.2	-	11.3

* Preliminary results

MARC: Myanmar (Burma) Artemisinin Resistance Containment Project; MIS: Malaria Indicator Survey; CMS: Cambodia Malaria Survey; TMS: Thailand Malaria Survey; KAP: Knowledge, Attitudes, and Practices; ITN: insecticide-treated net; MICS: Multiple Indicator Cluster Survey; RDS: Respondent-driven sampling; LSIS: Lao Social Indicator Survey

Most of the GMS countries have relied primarily on routine health management information system (HMIS) data for planning and monitoring their malaria activities, but continue to use nationally-representative cross-sectional surveys such as the Demographic Health Survey (DHS), Malaria Indicator Survey (MIS), and Multiple Indicator Cluster Survey (MICS) to measure outcome and impact. Cambodia has conducted national malaria surveys in 2004, 2007, 2010, and 2013 as well as a Demographic and Health Survey (DHS) in 2010 per their national monitoring and evaluation (M&E) plan. Burma conducted a survey in containment zones 1 and 2 that sampled households, health facilities, and drug outlets in late 2011 as part of the Myanmar

(Burma) Artemisinin Resistance Containment (MARC) Project. In 2015, Burma conducted a MIS and preliminary results were shared at the time of the FY 2017 MOP planning process. The surveys conducted to date for Thailand, Cambodia, and Burma are described in more detail in their individual country sections.

In general, large-scale surveys have been used to obtain ITN ownership and use data (e.g. in Lao PDR's Social Indicator Survey in 2012 and Viet Nam's Multiple Indicator Cluster Survey in 2011). Although Thailand has a robust malaria surveillance system, biomarkers were included in the 2012 malaria survey to assess the usefulness of polymerase chain reaction (PCR) and serology to assess malaria burden. The PCR prevalence in Thailand was found to be 0.1% (7/10,834) which confirms the limited utility of national prevalence surveys for very low transmission settings.

The Thailand and MARC surveys were largely designed and harmonized with the Cambodian surveys. Overall, these surveys from the Sub-region show high levels of conventional bed net ownership with low levels of ITN and LLIN ownership and use. Malaria prevalence estimates from Cambodia, Thailand, and Burma show very low levels at <1%; however, Burma's MARC was sampled after the peak transmission season. The official malaria prevalence results based on RDT and PCR from the recent Burma MIS are pending. According to preliminary results, the RDTs have detected a very low prevalence of 0.07% (10/13,591), questioning also in this case the suitability of nationwide surveys for the estimation of malaria prevalence in highly heterogeneous and low transmission settings. Migrant surveys using a respondent-driven sampling methodology to generate a representative estimate show lower levels of ITN ownership and use compared to the resident populations both in Cambodia at the Thai border and in Thailand at the southern Burmese border. Lao PDR completed a DHS with a malaria module in 2011-12 showing relatively high ITN coverage, but lower use of appropriate diagnostics and treatment.

Malaria surveillance systems vary greatly amongst the GMS countries. Thailand's surveillance system is probably most comprehensive; whereas the systems in countries such as Burma and Lao PDR are relatively fragmented, and will require further strengthening. Much of the malaria data from the HMIS and malaria information systems currently remain focused on morbidity and mortality (Table 2). In addition, the HMIS would probably not be able to capture LLIN coverage and use as well as care-seeking indicators relevant for the malaria program. Implementing some targeted household surveys to capture these monitoring indicators may still be useful and needed to complement the routine data. The results from Burma's 2015 MIS are pending and will help to improve our understanding of the burden of malaria and more importantly coverage of interventions in the country. Lao PDR is currently planning to conduct a follow-on national Social Indicator Survey in 2016 to provide estimates to monitor nutritional status, reproductive health needs, and prevention of infectious diseases including malaria.

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 NGOs, with presumably no malaria treatment in the private sector. Most routine surveillance systems in the region are not comprehensive and currently are limited to the public sector only – although Cambodia's malaria information system is beginning to incorporate data from the private sector as well as the military. 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. PMI's support for the private sector is primarily focused on surveillance, drug quality monitoring, and strengthening of drug quality testing capacity in public and private facilities in Thailand and Laos.

III. THAILAND and REGIONAL

(A) Strategy

1. Introduction

Initially with United States Agency for International Development (USAID)/ Regional Development Mission Asia (RDMA) and then PMI funding in 2011, the USG has led efforts in the fight against drug-resistant malaria in the GMS. Through scale up and increasing coverage and use of proven effective interventions, PMI's strategy aims to drive the burden of malaria down towards malaria elimination. Although Burma and Cambodia USAID Missions now receive direct funding for malaria, regional programming continues to play a critical role in supporting and coordinating activities across the region. In support of the bilateral USAID Missions, the role of USAID/RDMA focuses on three key areas: 1) connecting GMS countries and USAID Missions; 2) providing technical assistance through a regional service-centered approach; and 3) designing, procuring, and/or managing projects for non-presence and/or non-bilateral countries. In addition to this, technical support is provided through the interagency collaboration to GMS countries in the region.

PMI supports the multi-country therapeutic efficacy monitoring network for antimalarial drug resistance surveillance, support for regional capacity building and training through the Asian Collaborative Training Network for Malaria (ACTMalaria), and strengthening national drug authorities to detect and remove substandard or counterfeit malaria medicines. Furthermore, limited direct support for some malaria control activities in non-presence countries through the regional platform has been provided, including support in Lao PDR to respond to commodity gaps during a malaria outbreak.

Despite the expansion of PMI's bilateral programs in Burma and Cambodia, specialized malaria technical expertise remains available through the RDMA regional platform to assist NMCPs and partners, including those in non-presence countries, as needed, to address cross-cutting, trans-boundary issues that affect all GMS countries. In addition, capacity building at the regional level for NMCPs to address adequately complex technical as well as programmatic challenges remains a critical need. Building technical and programmatic capacity in the region is not only consistent with PMI's new strategy, but a necessity as programs scale up and transition to elimination.

Outlined in the new PMI Strategy (2015-2020), USG funds support working with national malaria programs and partners to further reduce malaria deaths and substantially decrease malaria morbidity towards the long-term goal of elimination. PMI provides technical support to Thailand and Lao PDR as the countries develop their plans towards achieving malaria elimination and sub-national 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.

This FY 2017 Malaria Operational Plan (MOP) presents the implementation plan for PMI's regional program in support of the strategies of PMI and relevant National Malaria Control Programs (NMCP). Developed in consultation with the 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 and 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 2017 funding.

2. Malaria situation in Thailand / Regional

Thailand

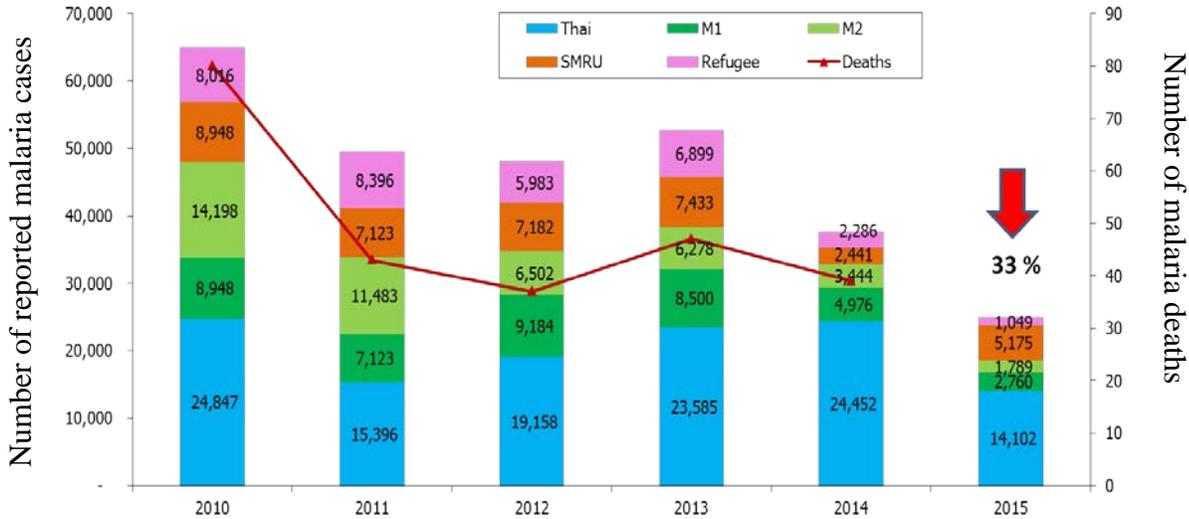
Malaria cases mainly occur in provinces bordering Burma and Cambodia. The groups at risk for malaria in Thailand consist of refugees in camps, workers in rubber plantations and fruit orchards, people who spend the night in the forest (including the military), and ethnic minority groups living along the 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.

Due to labor shortages, Thailand has been drawing large numbers of migrant workers from Burma and Cambodia. 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. The situation poses a risk for transporting malaria from place to place. 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 indigenous Thais and migrants residing in Thailand for six months or longer (M1) and cases among migrants living less than six months in Thailand (M2). In 2015, the total number of malaria cases was 24,875, down from 37,921 cases the previous year (a 34% reduction). The Annual Parasite Incidence (API) decreased from 0.49 to 0.38 per 1,000 population, and the proportion of *P. falciparum* cases declined from 41% to 32% of the malaria cases reported. These cases included those who crossed the border and sought treatment at malaria posts and health facilities in Thailand.

Compared to the other countries in the GMS, Thailand's malaria surveillance data is the most comprehensive, which allows the NMCP to update village-level malaria risk on an annual basis. In 2014, the NMCP determined that local malaria transmission was still occurring in 46 out of 77 provinces; 155 out of 930 districts; and 5,502 out of 74,956 villages. The NMCP has been able to demonstrate a continual decline in the number of villages with local transmission thus far – from 5,502 in 2014 to 4,512 in 2016.

Figure 2: Trend of malaria morbidity and mortality in Thailand among Thais, M1, M2, and refugees (FY 2010-2015) (Source: BVBD)



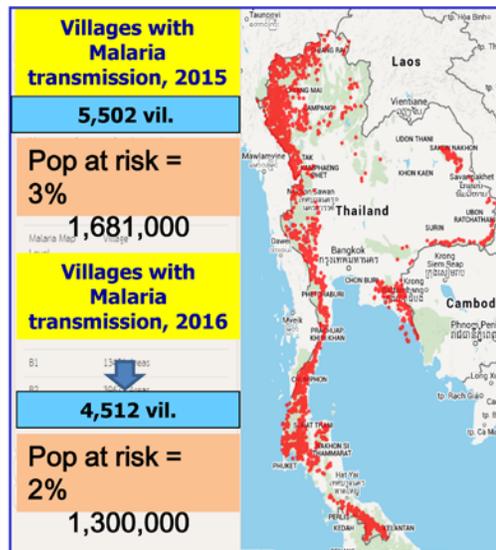
* SMRU (Shoklo Malaria Research Unit); M1 (migrants residing in Thailand for six months or longer); M2 (migrants residing in Thailand for less than 6 months)

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. Despite the decrease in malaria cases since 2013, surveillance data suggest that malaria transmission is occurring in villages which previously did not have transmission particularly along the international borders with Lao PDR, Cambodia, and Burma. The increase in the number of villages in Thailand with malaria transmission was largely due to the malaria outbreak in Lao PDR which started in Attapeu (late 2011) and spread to four other southern provinces, most notably Champasack. Champasack Province borders Thailand and these border provinces have detected increases in malaria cases in 2013 and 2014 on both sides of the Lao-Thailand border. Figure 3 shows villages with local malaria transmission in 2015 and 2016, demonstrating 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)

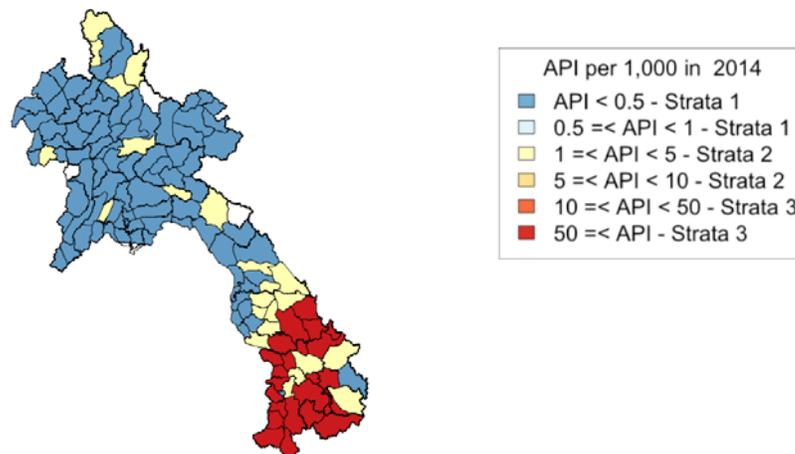


Note: Light green color represents forested areas and red dots indicate villages with malaria transmission. Population at risk estimates are those populations in A1 and A2 villages.

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. Groups at greatest risk include ethnic minorities, forest-related and agricultural workers, and miners.

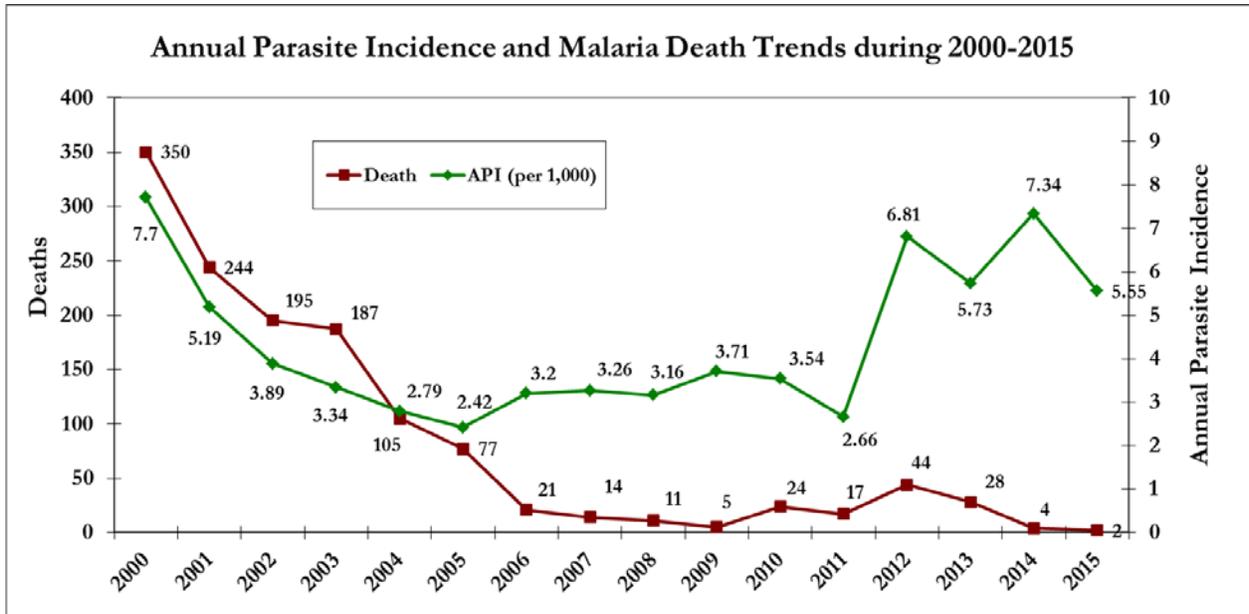
Figure 4: Stratification of districts by annual parasite incidence (API) in Lao PDR (2014)
(Source: CMPE)



Significant reductions in malaria transmission have been reported since the large-scale introduction of ACTs and ITNs, in conjunction with socioeconomic and environmental changes due to 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). Through Global Fund Round 4 support, Coartem® (Artemether+ Lumefantrine) was introduced in 2004. Since the introduction and expansion of ITNs/LLINs, ACT and RDTs, there has been remarkable reduction of malaria cases as well as severe malaria including deaths due to *P.falciparum* malaria.

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 low-strata villages were in the north, whereas high-strata 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 (2000-2015) (Source: CMPE)

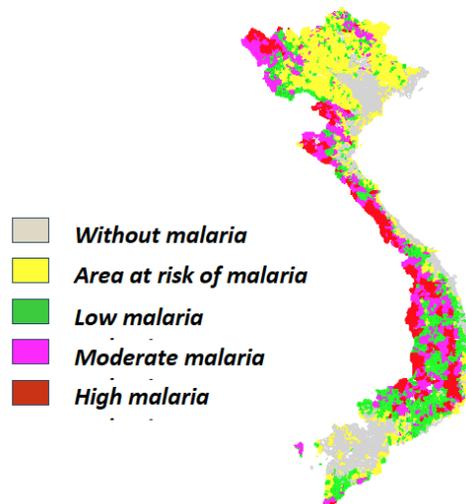


Viet Nam

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 NMCP. 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, the NMCP 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.

According to their National Strategic Plan 2011-2020, malaria risk is stratified into the following strata: "high malaria" refers to API >10/1000; "moderate malaria" refers to API 5-10/1,000; "low malaria" refers to areas that have API <5/1,000; "Area at risk of malaria" refers to areas with no indigenous cases within 5 years.

Figure 6: Malaria risk stratification in Viet Nam, 2009 (Source: NIMPE)

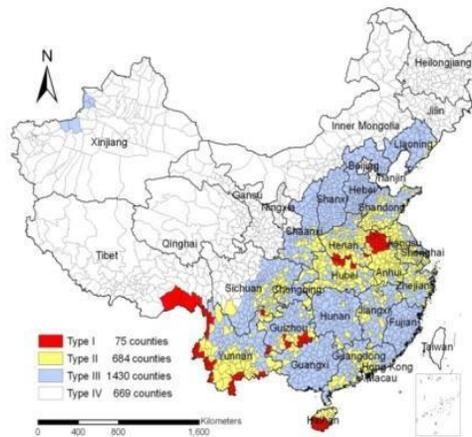


China

The People's Republic of China is mainly affected by *P. vivax*; *P. falciparum* is endemic in only Yunnan Province. Because Yunnan Province shares borders with Burma, Laos, and Viet Nam, it is the province in China of greatest concern for malaria and, as such, is included in regional GMS malaria control strategies. The Bureau of Disease Control located within the MOH is responsible for managing malaria control activities while the Provincial Health and County Health Bureaus manage the provincial- and county-level efforts. The new 2010–2020 National Malaria Strategy aims to eliminate malaria from all provinces by 2020 with an intermediate goal of elimination from all areas except the borders of Yunnan Province by 2015.⁴ In China, counties are classified by type I-IV (Figure 7). In Yunnan, Type I counties are concentrated along the Burma border where malaria is particularly problematic among people crossing the border and ethnic minority groups. Although China has demonstrated tremendous progress with only 21 indigenous cases reported in 2015, elimination efforts are threatened by the continuous influx of migrants from Burma as well as Chinese migrant workers returning from abroad.

⁴From Malaria Control to Elimination: A Revised National Malaria Strategy 2010-2015. The People's Republic of China.

Figure 7: Malaria risk stratification in China by county (Source: MOH)



- Type I represents the counties in China with confirmed local case(s) in the last 3 years, with at least one year having an annual incidence $\geq 1/10,000$
- Type II represents counties with confirmed local case(s) in the last 3 years, annual incidence $< 1/10,000$.
- Type III represents counties with no local case for at least 3 years, only imported cases.
- Type IV represents counties with no history of any locally transmitted cases, only imported cases.

The Chinese treatment policy calls for use of ACTs, primarily DHA-Pip. The strategy for vector control is based on epidemiologic stratification. In the high-risk areas with vector presence, the program aims to achieve 100% LLIN coverage and uses IRS in focal transmission areas. Additionally, the program designs specific interventions for special populations such as forest workers and migrant populations.

Beyond technical support for the therapeutic efficacy monitoring network, PMI does not provide direct implementation support in Viet Nam or in China at this time. The subsequent sections of the Thailand/Regional MOP will focus on Thailand and Lao PDR. However, the importance of continued engagement with Viet Nam and China is recognized, particularly on drug resistance, drug quality monitoring, and more recently, on regional malaria elimination efforts.

3. Country health system delivery structure and MOH organization

Thailand

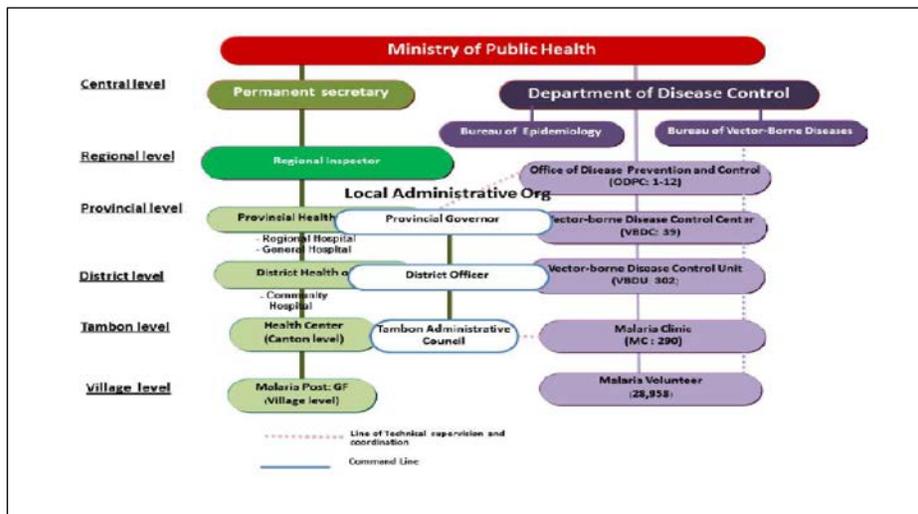
The Thai Malaria Control Program has been a vertical program from its inception in 1949 until 1996. In 1996, it was partially merged with other vector-borne disease programs (dengue fever and filariasis). It is now called the BVBD within the Department of Disease Control (DDC) in the Ministry of Public 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 malaria 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 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. The malaria information system currently managed by the BVBD will also be transitioned to the MOPH's Bureau of Epidemiology 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 underutilized, 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 17 Provincial Anti-Malaria Stations. Under the Provincial Anti-Malaria Stations, there are 140 District Malaria Nuclei and Provincial Hospitals, including military hospitals. There are approximately 850 health centers in the country which cover nearly 2,000 malaria-endemic villages.

4. National malaria control and elimination strategy

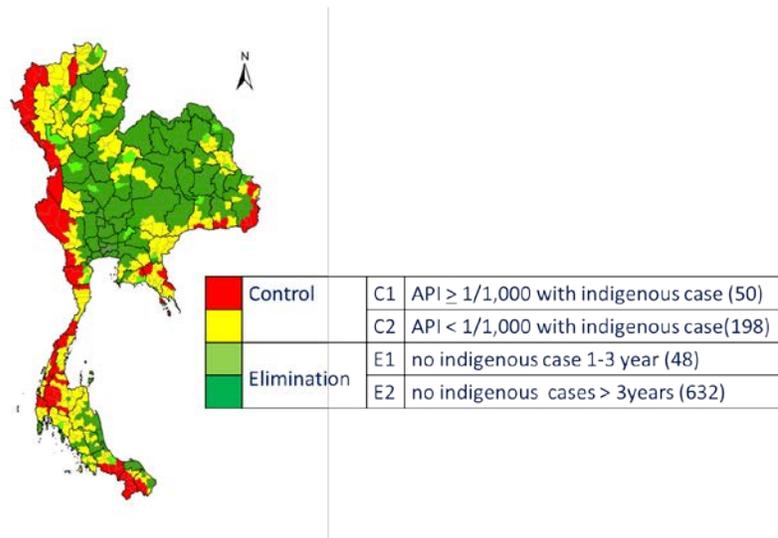
Thailand

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, Thailand, 2014 (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 target malaria control and prevention activities along these border provinces. However, after 2016, Thailand will no longer qualify for Global Fund grants and have developed a transition and advocacy plan to mobilize domestic resources for malaria. Without Global Fund resources, there may be a potential gap in malaria services, particularly for at-risk MMPs in Thailand.

Lao PDR

Lao PDR has recently finalized their new Malaria National Strategic Plan (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 (IEC) 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.

5. Updates in the strategy section

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 Bureau of Epidemiology, and mobilization of response teams (e.g., Surveillance and Rapid Response Teams) to conduct case investigations and response will need to be addressed as Thailand re-orientates its malaria program towards elimination.
- In 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 submitted to the Permanent Secretary for approval.
- In 2016, Thailand launched a new five-year NSP for Malaria Elimination (2016-2021) that seeks to increase the number of districts without malaria transmission up to at least 95% (baseline: 83%), and to reduce API to less than 0.20 per 1,000 population (baseline: 0.51 per 1,000). The goal of the Thailand NSP is that the majority of people are not at risk of malaria infection by 2021, and Thailand is free from malaria by 2024. The BVBD also plans to integrate malaria services into local primary health services. In endemic provinces a number of health promotion hospitals have been trained to provide malaria services; these hospitals previously only provided health education and referral to malaria clinics.
- After 2017 (post no-cost extension of the current SSF grant and costed extension of the RAI grant), Thailand will no longer qualify for Global Fund grants for HIV, TB, and

malaria. As a result, the BVBD in consultation with the Thailand Country Coordinating Mechanism has developed a transition plan which prioritizes key activities and resources for all three diseases and will require domestic support.

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 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 roll-out 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 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

Funding

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). Negotiations are currently underway 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 will also address cross-border areas, initially between Thailand and Burma. In addition, LLINs for short-term, non-Thai residents (M2) will be provided when the person presents at a clinic with fever. Long-lasting insecticide-treated hammock nets (LLIHNS) and repellents will also be provided to special at-risk populations. In the event of a documented local focus of infection, the NMCP plans to conduct limited IRS in the areas near the index cases.

Beginning in 2013, a government-to-government (G2G) agreement with Thailand's BVBD supported malaria services through 33 village-based malaria posts (peripheral malaria service delivery points) which improved access to malaria diagnosis and treatment among migrant workers and ethnic minorities living in forest fringe. In FY 2015, the support for these malaria posts and border malaria posts was negotiated and transitioned to the Global Fund and the Thai government as capacity to manage these sites for malaria service delivery was strengthened. The G2G also supported efficacy monitoring for first-line antimalarial drugs in seven sentinel sites throughout the country. This resulted in the updating of Thailand's malaria treatment policy to include a more effective first-line antimalarial drug, DHA-Pip, to be implemented in the seven border provinces with documented delayed parasite clearance. The G2G mechanism will be phased out by the end of 2016, and support for therapeutic efficacy monitoring implementation will be managed through WHO under the regional Consolidated Grant.

Lao PDR

The CMPE has in the past received funds from various donors which include the World Bank, Japan International Cooperation Agency (JICA), the European Union, and WHO. Commencing in 2004, the Global Fund has been the sole source of external funding for the program which 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. The uncertainty of continued funding through the Global Fund after 2016 raises concerns about maintaining malaria control and prevention activities in Lao PDR. 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.

Table 5: Non-PMI funding landscape in Thailand, Lao PDR, Viet Nam, and China

Country	Funding Source	Total Budget in \$ (Funds Disbursed)	Duration	Key Implementing Partners	Key Activities
Thailand	Domestic*	5,893,255			Treatment services for Thai citizens (2013 funding)
	Global Fund SSF	29,203,469 (16,347,131)	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
Lao PDR	Domestic*	1,122,915			Treatment services for Lao citizens
	Global Fund Transitional Funding Mechanism	7,039,151	2013 –2015	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	2014-2016	CMPE, HPA, DCDC (PR)	Artemisinin resistance containment
Viet Nam	Domestic*	4,523,810			Treatment services for Vietnamese citizens
	Global Fund Transitional Funding Mechanism	31,906,939 (28,711,982)	2013 - 2015	NIMPE (PR)	Community-based targeting the remaining endemic areas and mobile populations
	Global Fund Health Systems Strengthening	65,289,265 (41,862,214)	2012 - 2016	MOH (PR)	Targeting 15 project provinces plus patients suffering from HIV, TB and malaria; national pharmacovigilance system and strengthening the drug quality control network
	DFAT/BMGF	2,000,000	2013 - 2015	WHO (ERAR)	Targeting migrant populations
	Global Fund RAI	15,000,000	2014-2016	NIMPE (PR)	Artemisinin resistance containment
China	Domestic*	16,812,725			2013 domestic funding for malaria

Sources: World Malaria Report 2014; www.theglobalfund.org; www.gatesfoundation.org; www.adb.org; Figures in parentheses are disbursed amounts; *Funding per year

7. Progress on coverage/impact indicators to date

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 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 Thai National Malaria Program conducted a 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.

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 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 late 2016.

(B) Operational Plan

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, *An. dirus*, 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 are shifting 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 their programs to pre-elimination, the 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 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, especially in rural Burma and Cambodia.

Malaria transmission occurs both indoors and outdoors, and LLINs will have greater or lesser impact depending upon the extent to which biting occurs outside. Much of the malaria

transmission in the GMS occurs in forested and forest fringe areas, and plantations and farms where workers sleep in the open or under temporary shelters. Some reports indicate that up to 60% of infective bites occur either outdoors, or during the evening or early morning hours when people are not sleeping. The consensus of 2012 and 2013 meetings of the RBM Vector Control Working Group on outdoor malaria transmission was that LLINs/LLIHNs are effective in the GMS and wide coverage of vulnerable populations should remain a goal, with high priority given for the development and evaluation of methods to interrupt outdoor transmission. In a summary of ten publications on the efficacy of ITNs in South East Asia, eight studies reported broad effectiveness; one study reported effectiveness against one vector species but not others, and one found no measurable effectiveness against any host mosquitoes. (Efficacy of insecticide-treated nets in South East Asia: Annotated Bibliography by Anna Hoskin, Malaria Consortium report, Sept 2010). This conclusion is consistent with the early Cochrane review of Lengeler (2004) which concluded that ITNs were broadly effective across Asia.

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 head lamp 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. There is an urgent need to identify and test new, efficacious personal protection measures for vulnerable groups, but because of the heterogeneity of such groups and low levels of malaria incidence, efficacy in reducing biting rates of malaria vectors is the most appropriate outcome.

The Thai BVBD's 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.

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 RBM, PMI continues assisting with coordination of personnel and resources to strengthen entomological monitoring in the region. PMI continues to engage with JICA, Mahidol University, Institute of Tropical Medicine Antwerp, and AFRIMS to strengthen entomological capacity in the region.

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 mobile and migrant populations. The profile of risk in these populations is better understood: ‘mobile and migrant’ are not in themselves risk factors for malaria infection, but are rather correlates of increased exposure to forest malaria, social marginalization, and poor access to health services. Service delivery is challenging due to lack of formal infrastructure to reach people working outside of formal employment structures. 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.

In Thailand, PMI supported the NMCP through a Government-to-Government mechanism to conduct entomological and epidemiological surveillance in Tak Province along the Thai-Burma border. Malaria cases are consistently reported in this area, and with PMI support, entomological surveillance data along with community mobilization and investigation helped to identify risk behaviors (e.g., young children and adults watching television during peak biting hours) and provide targeted SBCC.

Plans and justification

To better target populations to reduce outdoor malaria transmission, PMI will coordinate with BMGF and its modeling unit to better understand what gaps in knowledge exists so as to allow rapid evaluation and deployment of interventions to reduce transmission. Given the sparse populations affected and the low level of malaria transmission, the traditional gold standard of a randomized trial with malaria incidence as the outcome is likely not feasible. Studies to measure reduction in biting are much cheaper and feasible, and these data, when combined with good models, may allow us to decide which forms of outdoor vector control tools may be most suitable. Operational research on different methods for treatment of uniforms with permethrin and use of ivermectin in conjunction with MDA to reduce mosquito survival is currently being carried out by Department of Defense personnel (with funding from the Department of Defense) in the Entomology Branch within the U.S. Centers for Disease Control and Prevention (CDC); information from these studies will inform PMI’s discussion with the BMGF and other partners.

Over the past year, two interns funded by APMEN worked for six weeks in the CDC’s entomology branch to learn how to carry out intensity assays for insecticide resistance. These assays have several advantages over the traditional WHO tube test: 1. Supply bottlenecks and delays associated with insecticide treated papers via WHO are avoided; 2. Insecticide resistance can be titrated, allowing a quantitative understanding of the intensity of resistance, and 3. Via

strategic application with synergists, mechanisms of resistance can be ascertained. PMI will support building entomology capacity around resistance intensity monitoring within Thailand's BVBD.

Coordination efforts both across countries and across partners will be emphasized. PMI aims to assist with regional coordination of entomological activities through direct engagement of CDC entomology branch staff in discussions with NMCPs to ensure rational implementation of entomological surveys related to transmission, insecticide resistance, and LLIN durability; through regional networks such as APMEN, which coordinates information-sharing and training related to insecticide resistance in the region; and through ACTMalaria, which will assist in organization of regional entomological capacity trainings.

Proposed activities with FY 2017 funding: (\$54,000)

- **Training in insecticide resistance intensity bioassays.** Two staff from the Thai NMCP will be trained in resistance monitoring methodologies at the CDC. (\$25,000)
- **Technical support for entomology.** Two TDYs from CDC entomologist are planned to provide technical assistance to Thailand and the region and will emphasize regional planning and coordination. (\$29,000)

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.

With FY 2012 funds, 110,000 LLINs were provided to Thailand to cover migrants in 26 provinces, with the majority distributed in Tak and Ranong provinces bordering Burma and Chanthaburi and Sa Kaeo provinces bordering Cambodia. PMI also supported delivery costs of LLINs through mass distribution to reach households, IEC/SBCC to promote use of LLINs and treated material/hammock nets in the focus areas. PMI supports an integrated SBCC approach targeting mobile and migrant populations through the use of migrant volunteers (MVs) and Thai village health volunteers (VHVs) who provide health education through multiple interpersonal communication (IPC) channels in PMI project areas, and in particular provide SBCC messaging on the care and use of LLINs.

Support for Lao PDR has been in response to the outbreaks in the five southern provinces. With FY 2012 funds 30,000 LLINs and an additional 7,000 LLINs have been delivered and distributed.

In Thailand, 60,000 LLINs have been procured with FY 2013 funds for distribution among migrant workers mostly in farms and plantations in border provinces both through PMI-supported malaria control projects and through local malaria clinics.

As southern provinces of Lao PDR continued to report high number of malaria cases, PMI procured 156,100 LLINs with FY 2013 funds for distribution by district and local health centers in the five southern affected provinces (Saravane, Savannakhet, Champasack, Sekong, and Attapeu) where malaria incidence remains relatively high. Supervisors for net distribution reported that polyester LLINs made with softer materials provided by PMI were appropriate for local preference and were well received by the communities.

Progress during the last 12-18 months

To cover distribution gaps in the Southern provinces of Lao PDR, 140,000 LLINs have been procured with FY 2014 funds to support the CMPE. An additional 175,000 LLINs and LLIHNs are being procured with FY 2015 funds to fill gaps and replace old and failed nets.

Table 6: ITN Gap Analysis -Thailand

Calendar Year	2016	2017	2018
Total Targeted Population*	1,227,030	1,148,377	1,075,229
Continuous Distribution Needs			
<i>Estimated Total Need for Continuous</i>	0	185,168***	176,229***
Mass Distribution Needs			
[2016] mass distribution campaign	681,683	0	0
<i>Estimated Total Need for Campaigns**</i>	681,683	0	0
Total ITN Need: Routine and Campaign	681,683	185,168	176,229
Partner Contributions			
ITNs carried over from previous year	320,000	110,267	0
ITNs from MOH	0	0	0
ITNs from Global Fund (SSF)	420,000	0	0
ITNs from Global Fund (RAI)	51,950	28,800	28,800
ITNs planned with PMI funding	0	40,000	60,000
Total ITNs Available	791,950	179,067	88,800
Total ITN Surplus (Gap)	110,267	(6,101)	(87,429)
* Target population (Thais, M1, and refugees) in 27 malaria-endemic provinces			
** Calculated at 1.8 LLIN per target population			
*** Number of LLINs for populations needing new LLINs (replacement)			
Data source: BVBD			

Table 7: ITN Gap Analysis - Lao PDR

Calendar Year	2016	2017	2018
Total Targeted Population*	2,032,000	2,068,576	2,105,810
Continuous Distribution Needs			
<i>Estimated Total Need for Continuous</i>	0	0	0
Mass Distribution Needs			
[2016] Mass distribution campaign**	1,128,888	169,333	275,287
<i>Estimated Total Need for Campaigns</i>	1,128,888	169,333	275,287
Total ITN Need: Routine and Campaign	1,128,888	169,333	275,287
Partner Contributions			
ITNs carried over from previous year	0	199,612	150,279
ITNs from MOH	0	0	0
ITNs from Global Fund (TFM)	991,250	0	TBD
ITNs from Global Fund (RAI)	197,250	0	TBD
ITNs planned with PMI funding	140,000	120,000	100,000
Total ITNs Available	1,328,500	319,612	250,279
Total ITN Surplus (Gap)	199,612	150,279	(25,008)
*Assumes 1.8% annual population growth rate			
** Mass campaigns will be conducted in 2016 and only replacements are anticipated in 2017 and 2018 (at an annual rate of loss of 15%)			
Data source: CMPE quantification			

Plans and justification

Continued efforts are needed to increase access to LLINs/LLIHNs for hard-to-reach populations, especially mobile and migrant populations, forest-goers, and women of childbearing age. In Thailand, despite the challenges inherent with obtaining accurate population estimates of mobile workers and migrants at risk for malaria, the NMCP is giving priority to MMPs via distribution of LLIHNs. PMI's procurement of LLINs/LLIHNs for Thailand is limited and fills gaps in procurements with other sources. In the past, Thailand distributed approximately 100,000 LLINs per year to migrants who presented at health facilities with fever. With Global Fund support ending in 2016, LLINs and LLIHNs will be procured for Thailand if urgent gaps are identified and upon government request, as has been the case in previous years.

PMI will work closely with the CMPE of Lao PDR to ensure sufficient LLINs are available for those most at risk (including women of childbearing age) and can adjust quantities between countries in the region in 2017 to fill any gaps.

Proposed activities with FY 2017 funding: (\$610,000)

- **Procurement of LLINs and LLIHNS:** Thailand's Global Fund support will cease by 2017. Therefore, PMI will procure approximately 160,000 LLINs and hammock nets for Thailand (60,000 LLINs) and Lao PDR (100,000 LLINs) to fill ITN gaps, particularly for migrant, mobile workers and pregnant women, in high endemic areas. (\$460,000)
- **Community-level support for distribution of LLINs:** PMI will support transport and distribution of LLINs for communities particularly targeting mobile and migrant populations in cross-border regions for vulnerable groups. (\$150,000)

2. Malaria in pregnancy

NMCP/PMI objectives

Thailand

The 2012 Thailand Malaria Survey reported an overall 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. 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%).

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 new 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.⁵ Recent 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 percent for women and 20 percent for men), 0% of children, and 6% of pregnant women were positive.⁶ Another research study conducted by HPA in southern Laos 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 antenatal clinics 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 an 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 have ignored 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.

Progress during the last 12-18 months

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.

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

⁵ National Strategic Plan for Malaria Control and Elimination 2016---2020. Health Department of Communicable Diseases Control Centre of Malariology, Parasitology and Entomology. January 2016.

⁶ Rapid assessment of malaria in pregnancy in Lao PDR. Malaria Consortium. October 2015.

(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 antenatal care is provided) in Thailand, there are further opportunities to ensure that targeted SBCC for MIP is provided through IPC 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 and the regional program 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 are to begin with an 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 2017 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. Under the coordination of the WHO Western Pacific Regional Office and with support from PMI, malaria microscopy capacity is strengthened by maintaining a cadre of trainers/supervisors in all GMS countries. Continued attention is needed to ensure that quality microscopy skills are maintained even as malaria incidence wanes.

Thailand's network of malaria clinics and malaria posts using RDTs continues to be the bulwark of service delivery in malaria-endemic areas. Malaria clinics are staffed with well-trained microscopists while malaria posts, Thailand's equivalent of the VMW, utilize RDTs for diagnosis. Active case detection using microscopy and/or RDTs is carried out in high-risk villages and towns and in the artemisinin resistance containment zones. The BVBD, in collaboration with Provincial Health Offices, also targets hard-to-reach populations in high-risk border areas through the development of special service facilities where RDTs are available. Some non-governmental organizations (NGOs) provide primary health care services, including malaria case management to the 140,000 refugees along the Thai-Burma border.

In Thailand, loose AS and MQ tablets, combined with single-dose primaquine (without G6PD screening) had been the first-line treatment for uncomplicated *P. falciparum*. In May 2015, though, evidence of treatment failures to AS-MQ led to a change in treatment policy. The first-line treatment was changed to DHA-Pip with single-dose primaquine. This policy has since been implemented in seven provinces, Tak, Kanchanaburi, Ranong, Trat, Surin, Srisaket, and Ubonratchathani. Chloroquine and 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.

In Lao PDR, AL is the first-line treatment for *P. falciparum* and *P. vivax* malaria and remains highly efficacious despite the recent finding of 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 in 2008. Along with therapeutic efficacy monitoring sites supported by other donors (e.g., the Global Fund), 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 these sites, the network has been expanded and strengthened in the past few years to include monitoring for chloroquine-resistant *P. vivax*, using funds from other sources. In addition to monitoring clinical and parasitological outcomes, samples collected during therapeutic efficacy monitoring are being tested using other partner resources for presence of *kelch* 13 mutations that have been correlated with resistance to artemisinins. As malaria morbidity declines in the GMS, recruitment of patients for therapeutic efficacy monitoring becomes increasingly difficult – often resulting in prolonged periods of enrollment. The standard therapeutic efficacy monitoring protocols for moderate transmission settings will not be appropriate for pre-elimination settings, and alternative, more cost-effective approaches to monitor for drug resistance will be needed.

Progress since PMI was launched

A regional slide bank has been maintained with the support of PMI which is used for regional malaria microscopy training. In Thailand, with FY 2013 funds, 37 health workers at Malaria Posts and Border Malaria Posts, and 87 health workers were trained in malaria diagnosis in Tak and Ranong. Through close coordination with the Global Fund PR, PMI has transitioned support of case management activities at Malaria Posts to the Global Fund as of 2014.

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 2012, Lao PDR experienced a large malaria epidemic in Attapeu which spread to all five southern provinces. In response, PMI supported the CMPE by facilitating an emergency distribution of ACTs and RDTs to the southern provinces where malaria incidence remained high after an outbreak that peaked in 2012. The epidemic has largely resolved in four of the five provinces, with residual high burden continuing in Champasack Province.

In 2013, data from the therapeutic efficacy monitoring site in Champasack indicate 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%. With clinical therapeutic efficacy monitoring data showing that artemisinin resistance is now present in southern Lao PDR, intensified malaria control efforts will be required to address this, particularly among these highly mobile populations along the Lao-Cambodia-Viet Nam borders.

PMI also has provided support to improve the quality and standardization of methods at the therapeutic efficacy monitoring sites in Thailand, to ensure that measured efficacy rates are accurate and can be compared from one location to another.

Progress during the last 12-18 months

To assist Thailand to move forward in introducing the new malaria treatment guidelines with DHA-Pip in seven selected provinces, PMI procured 10,000 doses of DHA-Pip for Thailand and supported training of health workers in the targeted provinces.

PMI's support for therapeutic efficacy monitoring included DHA-Pip efficacy testing for *P. falciparum* at two sites in Yunnan Province and four sites in Vietnam in 2014 which showed 100% ACPR. Thailand is currently testing the efficacy of AS-MQ in six sites and DHA-Pip in two sites (Ranong and Ubon Ratchatani). Lao PDR is testing AL in three sites with preliminary

results from Sekong showing high Day 3 positives. Thailand is also conducting chloroquine efficacy testing against *P. vivax* in three sites.

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 objectives of the meeting were: 1) to review the malaria drug resistance situation in the GMS, the Pacific and South Asian countries; 2) to review and discuss implementation of the WHO therapeutic efficacy monitoring protocol; 3) to discuss the role of K13, the molecular marker for tracking artemisinin resistance, and of other molecular markers for monitoring malaria drug resistance in these regions; and 4) to develop workplans and budgets for the networks and the countries for therapeutic efficacy monitoring in 2016-2017. In consultation with WHO, the work plans developed by the NMCPs form the basis for proposed therapeutic efficacy monitoring sites in the upcoming round. The key issues highlighted pertained to recruiting adequate sample sizes for therapeutic efficacy monitoring due to the declining burden of malaria and mobility of key affected populations. Monitoring of implementation according to protocol was also highlighted as an issue and will be addressed through work planning to increase the frequency and improve the quality of monitoring visits by the study investigators, WHO staff, and in-country PMI teams. PMI also supported building molecular capacity which included K13 analysis of samples collected through the therapeutic efficacy monitoring network by training three BVBD staff in CDC, Atlanta.

Commodity gap analysis

Table 8: RDT Gap Analysis - Thailand

Calendar Year	2016	2017	2018
RDT Needs			
Total country population*	68,098,436	68,302,731	68,507,639
Population at risk for malaria	1,227,030	1,148,377	1,075,229
PMI-targeted at-risk population	1,227,030	1,148,377	1,075,229
Total number of projected fever cases**	95,330	99,040	99,040
Percent of fever cases tested with an RDT	95%	95%	95%
Total RDT Needs	90,564	94,088	94,088
Partner Contributions			
RDTs carried over from previous year	0	42,731	51,643
RDTs from Government	0	0	0
RDTs from Global Fund (SSF)	114,395	103,000	0
RDTs from Global Fund (RAI)	18,900	0	0
RDTs planned with PMI funding	0	0	100,000
Total RDTs Available	133,295	145,731	151,643
Total RDT Surplus (Gap)	42,731	51,643	57,555
* Population growth rate estimated at 0.3% per annum.			
**Estimated number of patients presenting at Malaria Posts, Health Promotion Hospitals, and camps			
Data Source: BVBD			

Table 9: RDT Gap Analysis - Lao PDR

Calendar Year	2016	2017	2018
RDT Needs			
Total country population*	6,857,505	6,980,940	7,106,597
Population at risk for malaria*	2,032,000	2,068,576	2,105,810
PMI-targeted at-risk population*	2,032,000	2,068,576	2,105,810
Total number of projected fever cases	396,222	401,967	407,795
Percent of fever cases tested with an RDT**	64%	71%	79%
Total RDT Needs	253,582	285,397	322,158
Partner Contributions			
RDTs carried over from previous year	326,575	72,993	234,844
RDTs from Government	0	0	0
RDTs from Global Fund (TFM)	00	447,248	0
RDTs from Global Fund (RAI)	0	0	0
RDTs planned with PMI funding	0	0	62,000
Total RDTs Available	326,575	520,241	296,844
Total RDT Surplus (Gap)	72,993	234,844	(25,314)
* Assumes population growth rate of 1.8% per annum			
** Increasing % of testing by RDT annually, with target of 95% of testing with RDTs by 2020			
Data Source: CMPE			

Table 10: ACT Gap Analysis – Thailand

Calendar Year	2016	2017	2018
ACT Needs			
Total country population*	68,098,436	68,302,731	68,507,639
Population at risk for malaria	1,227,030	1,148,377	1,075,229
PMI-targeted at-risk population	1,227,030	1,148,377	1,075,229
Total projected number of malaria cases**	21,887	17,510	14,008
Total ACT Needs***	24,076	19,260	15,409
Partner Contributions			
ACTs carried over from previous year	0	0	0
ACTs from Government****	24,076	19,260	15,409
ACTs from Global Fund	0	0	0
ACTs from other donors	0	0	0
ACTs planned with PMI funding	0	0	0
Total ACTs Available	24,076	19,260	15,409
Total ACT Surplus (Gap)	0	0	0
* Population growth rate estimated at 0.3% per annum. ** Baseline 2015 data with anticipated 20% reduction of malaria per year *** Includes 10% Buffer **** 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 11: ACT Gap Analysis - Lao PDR

Calendar Year	2016	2017	2018
ACT Needs			
Total country population*	6,857,505	6,980,940	7,106,597
Population at risk for malaria	2,032,000	2,068,576	2,105,810
PMI-targeted at-risk population	2,032,000	2,068,576	2,105,810
Total projected number of malaria cases**	54,086	45,973	39,077
Total ACT Needs***	64,903	55,167	46,892
Partner Contributions			
ACTs carried over from previous year	0	18,602	24,958
ACTs from Government	0	0	0
ACTs from Global Fund (TFM)	25,965	62,063	0
ACTs planned with PMI funding	57,000	0	31,500
Total ACTs Available	82,965	80,125	56,458
Total ACT Surplus (Gap)	18,062	24,958	9,566
* Assumes population growth rate of 1.8% per annum ** Assumes 15% reduction each year *** Includes 20% buffer stock needs 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. As the Global Fund is phasing out from Thailand, PMI will help procure RDTs during the transition period and replace old microscopes in selected sites. 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. PMI will continue to support refresher training of existing laboratory staff and health workers in the performance and use of malaria microscopy and RDTs – 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. In accordance with WHO recommendations, standardized and validated slide banks are required for training as well as for accrediting senior microscopists.

PMI also will continue to support the therapeutic efficacy monitoring network in all GMS countries using standardized WHO protocols. PMI will ensure support for molecular detection of K13 mutant genotypes from patients enrolled in therapeutic efficacy monitoring sites in the region which to date has been supported by WHO with non-PMI funds. It should be noted that four of the 46 therapeutic efficacy monitoring sites in the region are supported with Global Fund resources or WHO core funding.

Proposed activities with FY 2017 funding: (\$1,011,000)

- **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, particularly for migrant and mobile populations in PMI focus areas. This will include up to 162,000 RDTs as need arises in Thailand (100,000) and Lao PDR (62,000). (\$100,000)
- **Training and accreditation for microscopy:** PMI will continue support for the training and accreditation of supervisors of malaria microscopy throughout the GMS, maintenance of regional and national slide banks, and maintenance of microscopes. (\$90,000)
- **Microscopy training for provincial and district levels:** PMI will support capacity training for microscopy for provincial and district level staff, particularly at Malaria Clinics and Hospitals in Thailand. (\$100,000)
- **Procurement of antimalarials.** PMI will procure approximately 31,500 ACTs to reach migrants and to fill regional gaps and address outbreaks. (\$36,000)

- **Regional therapeutic efficacy monitoring network:** PMI will continue to support the NMCPs to conduct therapeutic efficacy monitoring in approximately 20 sites in Thailand, Lao PDR, Viet Nam, and Yunnan, China. 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 K13 molecular analysis of samples collected from therapeutic efficacy monitoring. (\$585,000)
- **Technical assistance to conduct therapeutic efficacy monitoring in Thailand:** PMI will provide technical assistance to build capacity at the BVBD for therapeutic efficacy monitoring, analysis, and treatment policy updates and to ensure that therapeutic efficacy monitoring is conducted according to WHO standard protocols. (\$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, 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 being applied, nearly expired drugs and nearly expired RDTs have been 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 the 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 the 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 in the central warehouse and selected regional warehouses.

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 are 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.

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.

Progress during the last 12-18 months

In Lao PDR, PMI provided support for a long-term consultant to work closely with CMPE staff and develop a Logistic Malaria Information System (LMIS) to strengthen reporting of malaria commodities stock from district to national levels. With FY 2015 funds, PMI provided technical assistance support 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 addition, as a short-term measure, PMI arranged "last mile delivery support" to the CMPE in late 2014 to transport ACTs and RDTs procured by PMI to district hospitals and health centers in five highly affected provinces in the south of the country.

In 2015, PMI also 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 focuses on national and provincial level coordination with other stakeholders, including the Global Fund and CHAI, and ensures that the LMIS tools are harmonized with the national information systems.

Plans and justification

PMI will continue to support strengthening pharmaceutical management and supply chain systems in the region through the procurement of supplies and strengthening the in-country systems that manage them with a focus on Lao PDR. 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 quality issues, stockouts, expiries and their destruction, product optimization, storage, and support/development of future procurement and supply chain management plans.

In FY 2017, based on the previous assessment showing the strength of the commodity management system, PMI will not support dedicated technical assistance for pharmaceutical management in Thailand. PMI will continue to work regionally to improve coordination and strengthen capacity for forecasting, quantification, management, and distribution, and be ready to respond to outbreaks or commodity gaps as required. In Lao PDR, PMI will continue to support technical assistance supply chain strengthening and coordinate this assistance with other donors, particularly the Gates Foundation which also has prioritized technical support for supply chain for Lao PDR.

Proposed activities with FY 2017 funding: (\$150,000)

- **Support for supply chain management and logistics:** PMI will provide technical assistance to the Lao CMPE for supply chain management, focusing on strengthening capacity at sub-national levels. (\$150,000)

c. Drug Quality

NMCP/PMI objectives

The use of poor quality medicines may lead to treatment failures, increased morbidity and mortality, and the development of drug resistance. 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 both in the private as well as the public sector.

Progress since PMI was launched

PMI has provided leadership in the GMS to improve the quality of antimalarial drugs. 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. Enforcement actions against violators included suspension and revocation of operation licenses, closures of medicine outlets, fines, arrests of perpetrators, delisting of products from approved registration and banning of imports, product recalls, and confiscation and disposal of non-conforming

products. PMI supported site visits to Burma, Cambodia, Lao PDR, Thailand, and Viet Nam to provide needed reagents, reference standards, standard national formularies, and other essential supplies. PMI also supported the provision of technical guidance to these countries as appropriate and follow up of any actions taken (e.g., in Lao PDR, issuing regulatory notices, and fining and educating violators).

As a result of these efforts, recent market surveys found almost no poor quality malaria treatments. PMI, therefore, began phasing out support for most of these sentinel sites in 2015 and shifting its support to building capacity and strengthening the national drug quality laboratories in the region with a focus on achieving International Organization for Standardization (ISO)-17025 laboratory accreditation. These laboratories are responsible for testing of all newly registered drugs and any samples provided for quality testing.

PMI also has worked with national Food and Drug Administrations, medicine regulatory agencies, and other authorities to develop and strengthen policies and procedures for regulating pharmaceuticals and monitoring quality. PMI also supports countries' participation in trainings from the Asian Network of Excellence in Quality Assurance of Medicines, a network of university pharmaceutical programs providing technical assistance within the region to develop national capacities for quality assurance/quality control (QA/QC), good manufacturing practices, and bioavailability testing.

Over the last two years, PMI has supported the establishment of two regional mechanisms to promote information-sharing among GMS countries. The Build Regional Expertise in Medicines Regulation and Enforcement mechanism was designed to increase regional cooperation and access to a pool of experts in medicines regulation to address the medicines quality issues and problems in the region. Through this mechanism, country medicine regulatory agencies and other law enforcement agencies have access to a regional platform through which they can share information for effective enforcement in a timely manner. The Build Regional Expertise in Medicines Regulation and Enforcement platform expands access beyond national and regional levels by working in partnership with WHO (Southeast Asia and Western Pacific Regional Offices), INTERPOL, the Association of Southeast Asian Nations (ASEAN), and national authorities. The second mechanism is the Asia-Pacific Network of Official Medicines Control Laboratories, which assists with QA/QC laboratories in the region to support regulatory authorities in controlling the quality of antimalarial medications available on the market. This network parallels other successful Official Medicines Control Laboratories networks worldwide.

PMI continues to support provision of technical assistance to the National Health Products Quality Control Center's laboratories in Thailand and Laos through advanced analytical trainings, provision of equipment and supplies, and ongoing good laboratory practices assistance to attain accreditation by the ISO.

PMI supported a regional drug quality assessment in March 2014, to take a closer look at what has been 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 provided technical assistance to the Food and Drug Quality Control Laboratory Center toward re-establishing its ISO 17025 accreditation, which had lapsed. In Thailand, PMI is supporting Chulalongkorn University's Pharmaceutical Technology Service Center toward receiving WHO Prequalification, which will enable it to become a regional reference center for drug quality testing. With PMI support, the Viet Nam National Institute of Drug Quality Control and the Thailand Bureau of Drug and Narcotics laboratories have achieved WHO prequalification status. PMI's current support for sentinel sites is now limited to three sites in Lao PDR and four sites in Thailand.

Plans and justification

Although post-market surveillance has indicated that the availability of poor quality drugs has decreased in recent years, a recent report from Thailand found substandard antimalarials in public service sites in Thailand including all (10/10) artesunate samples failing drug quality testing. To continue to monitor this situation, PMI will resume supporting limited post-market surveillance in Thailand and Lao PDR and will continue working with the national pharmaceutical reference laboratories to strengthen their capacity to conduct the necessary laboratory analyses for national drug quality monitoring.

Proposed activities with FY 2017 funding: (\$120,000)

- **Drug quality assurance:** PMI will support post-market surveillance in Thailand and Lao PDR and strengthen capacity of national quality control laboratories by supporting technical assistance to the national pharmaceutical reference laboratory in Lao PDR in order to maintain ISO 17025 certification. (\$120,000)

4. Health system strengthening and capacity building

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

NMCP/PMI objectives

As the malaria burden continues to decline, national malaria programs in GMS countries 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.

Progress since PMI was launched

PMI has provided long-standing support to strengthen regional technical and programmatic capacity of NMCPs through ACTMalaria. ACTMalaria is an inter-country training and communication network which 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. 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. ACTMalaria is also a key partner in capacity building within the Asian Pacific Malaria Elimination Network (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. It should be noted that Integrated Vector Management training is organized by the Ministry of Health, Malaysia; however, ACTMalaria, through support from PMI, provides technical assistance and supports some participants to attend this regional training which focuses on methods and approaches for integrating vector control and vector management.

In 2014, 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. Technical assistance has been provided for updating and refining curricula which 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 FY 2015, PMI supported regional capacity building and trainings for participants from GMS NMCPs (i.e., Cambodia and Viet Nam) on entomology and vector control. PMI also supported the maintenance of a regional microscopy slide bank, including validation of slides, guaranteeing availability of high quality slide panels for External Competency Assessments of malaria microscopists and external quality assurance program for malaria laboratories. Furthermore, PMI supported a refresher training for microscopy in Thailand and an external quality assessment of microscopy in Lao PDR. (See Case management section for further details)

In mid-2016, PMI will support a national MMFO training course for provincial and district level staff in Lao PDR to improve basic skills in malaria epidemiology, program management,

monitoring, and supervision. The national MMFO training will be adapted from the international MMFO training curriculum to the local Lao context and capacity.

Plans and justification

Strengthening national program capacity is a critical area of strategic focus within the PMI strategy. 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. Support for improving data quality and use of strategic information in Lao PDR will be emphasized. PMI-supported trainings strive to be performance-based, tailored to the needs of the participants, and led by NMCPs.

Proposed activities with FY 2017 funding: (\$195,000)

- **Strengthen NMCP capacity:** PMI will support coordination and facilitation of an annual national MMFO training tailored for provincial and district level staff in Lao PDR. (\$75,000)
- **Support for strategic information:** PMI will support strengthening the CMPE's capacity for data management and use, surveillance, and using epidemiological data to inform forecasting and procurement through provision of a local advisor in Lao PDR. (\$120,000)

Table 12: Health Systems Strengthening Activities

HSS Building Block	Technical Area	Description of Activity
Health Services	Case Management	Improve QA 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 Lao PDR
Health Finance	Health Systems Strengthening	Provide technical assistance to the Thai National Program to develop the business case for malaria elimination
Leadership and Governance	Health Systems Strengthening	Through the US 5% Initiative, PMI leverages technical assistance to the Lao National Program for national coordination of supply chain and logistics and training

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 the Global Fund SSF and RAI grants (2014-2016) aim 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. The BVBD developed a framework for SBCC for the Thai population that encourages

acceptance of IRS, prompt treatment-seeking behaviors, 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.

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.

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 during case investigations. Support was also provided for training of health staff and facilitators for bilingual case management.

Additionally, with FY 2013 funding, PMI and WHO jointly conducted a regional SBCC assessment focusing on border areas of Burma, Thailand, Cambodia, and Lao PDR. The assessment reviewed availability of SBCC materials, existing SBCC activities, and access to LLINs and malaria treatment among migrant and mobile populations. Results of this assessment found that migrant populations are diverse in regards to their malaria knowledge and perceptions. In some rural areas, misconceptions about the causes of malaria (such as the belief that malaria is caused by drinking unclean water or eating certain fruits) still persist. The majority of those interviewed mentioned that interpersonal communication (IPC) and health education sessions remain the most preferred, trusted, and effective communication channels. Therefore, SBCC interventions and channels for communication need to be tailored.

Plans and justification

With support for SBCC already being provided by the Global Fund and the Thai MOPH, no specific funding is allocated for SBCC. 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 2017 funding: (\$0)

PMI supports integration of SBCC activities in 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

All countries in the GMS currently have malaria elimination goals as part of their national malaria strategy. Thailand's updated National Strategic Plan for Malaria Elimination (2016-2021) sets as their target malaria elimination in 95% of districts by the year 2021 and ultimately elimination of malaria by 2024. Lao PDR's National Strategy for Malaria Control and Elimination has set the goal of reducing incidence and deaths and eliminating malaria in six provinces in the north by 2020. Countries in the GMS recognize the importance of robust surveillance systems especially in the context of malaria elimination and have placed emphasis on surveillance strengthening in their updated NSPs. For example, the recent Thailand Malaria Program Review highlighted the need to shift the national malaria surveillance system from being used merely for reporting to inform action and response.

A timely and responsive surveillance system is critical for NMCPs to move from the control to the elimination phase, and to be able to detect, investigate, and respond to every malaria case. Malaria surveillance has been integrated into the HMIS in all six GMS countries. However, the capacity of HMIS' varies widely among countries in the GMS, from paper to web-based surveillance and from passive case detection (of cases that may or may not be parasitologically confirmed) to active case detection in some places (e.g. China and Thailand). Most HMIS' in the region aggregate malaria data and do not capture individual-level information required for malaria elimination, and will likely require linkages to complementary case-based malaria information or reporting systems. A number of countries in the region are in the process of updating their HMIS' to take advantage of recent advances in database software capable of utilizing internet connectivity. DHIS-2 systems are being piloted in Lao PDR, Cambodia (private providers), and Burma, and currently used in Viet Nam. Although DHIS-2 based HMIS' have many advantages, the needs of NMCPs in the GMS must be carefully considered to ensure that data necessary for malaria control and elimination are available at all levels to the national control programs for timely response and action.

The 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 surveillance system that incorporates both data from public and private sectors. Although fairly limited through the Private-Public Mix strategy in Lao PDR, some data from registered private providers are captured in the national surveillance system.

Limitations of current surveillance systems in the GMS include delays and incompleteness of reports. Most programs struggle to collect timely data from peripheral settings, such as from community-level volunteers, the private sector, the military, and migrants. Routine surveillance challenges in the region include a lack of adequate feedback and supervision, poor information

technology infrastructures limiting timely reporting of data, and weak capacity for data management and analysis, especially at the periphery. Often the data are not disaggregated by factors that are epidemiologically relevant (e.g. age, gender, pregnancy status, ethnicity, migrant status, or occupation). These weaknesses were highlighted during the delayed identification of malaria outbreaks in the southern provinces of Lao PDR, where caseloads were four to eight times the previous year's levels, and the outbreaks appeared to have spread to neighboring Thailand and Cambodia.

Progress since PMI was launched

There have been various attempts to harmonize and streamline M&E efforts within country programs, as well as for the GMS as a whole. In 2011, a Bi-Regional Malaria Indicator Framework was developed in an attempt to develop a key set of harmonized indicators for malaria control and elimination in the GMS countries. Although endorsed by NMCPs in both Western Pacific and Southeast Asia WHO regions, the ability for member states to modify their national M&E plan and systems to include these indicators was a challenge, particularly in countries reporting performance indicators to the Global Fund.

In 2013, PMI supported the Mekong Malaria III Monograph which reviewed both epidemiological and entomological data from 2000 to 2010 serving as a benchmark to measure past and future successes. The review documented the declining trend of malaria in the GMS but also included analyses on relationships with health systems, program costs and financing, community involvement, private sector engagement, and cross-border collaboration for all the countries in the GMS. This analytical review also projected regional trends in socio-economic development, migration, and other factors likely to affect malaria transmission and ultimately malaria elimination.

M&E and surveillance data from MMPs remain difficult to obtain as traditional survey methods often miss this population and the quality of routine surveillance data is variable. To address this, USAID supported an innovative respondent-driven sampling survey, a methodology used often with hidden populations, amongst Burmese migrants along the Thai borders to ascertain malaria prevention and treatment coverage which noted very low malaria prevalence and lower ITN utilization among migrants compared to Thai residents.

As countries in the GMS move towards malaria elimination with declining malaria burden, the reliance on robust surveillance systems to monitor morbidity trends becomes even more important. In countries where surveillance systems are weak, PMI has supported national, representative surveys to monitor progress. However, in the GMS, the emphasis has been to support strengthening routine surveillance systems that are relevant and appropriate for NMCPs to use and act upon.

Table 13: Surveillance, Monitoring, and Evaluation data sources

Data Source	Activities	Year								
		2010	2011	2012	2013	2014	2015	2016	2017	2018
Household surveys	Demographic Health Survey (DHS)									
	Malaria Indicator Survey (MIS)			X* (THA)						
	Multiple Indicator Cluster Surveys (MICS)		X (Lao LSIS)*			X* (VTN)		X (Lao LSIS)*		
	KAP Survey						X* (THA)			
Other surveys	Migrant surveys	X* (RDS, Thai-Cam)		X* (RDS, Thai-Burma)		Lao-VTN-CAM border screening*				
Malaria surveillance and routine system support	Support to malaria surveillance system strengthening		X (THA, LAO)	X (THA, LAO)	X (THA, LAO)	X (THA, LAO)	X (THA, LAO)	X (THA, LAO)	X (THA, LAO)	X (THA, LAO)
Therapeutic efficacy monitoring	<i>In vivo</i> efficacy testing		X (THA, LAO, VTN, CHN)	X (THA, LAO, VTN, CHN)	X (THA, LAO, VTN, CHN)	X (THA, LAO, VTN, CHN)	X (THA, LAO, VTN, CHN)			
Entomology	Entomological surveillance and resistance monitoring		X	X	X	X	X	X	X	X
Other data sources	Drug quality monitoring		X (THA, LAO)	X (THA, LAO)	X (THA, LAO)	X (THA, LAO)	X (THA, LAO)	X (THA, LAO)		

* Not PMI-supported; THA=Thailand, LAO=Lao PDR, VTN=Viet Nam, CHN=China, RDS=respondent-driven sampling

Table 14: Routine Surveillance Indicators

Indicators	Thailand	Lao PDR
Total number of reported malaria cases (2015) Data sources: BVBD and CMPE	27,359	36,059
Total diagnostically confirmed cases	27,359	36,059
Total clinical/presumed/unconfirmed cases	N/A	N/A
<i>If available, report separately for outpatients and inpatients</i>		
Outpatient number of reported malaria cases	27,359	36,059
Diagnostically confirmed (Pf + mix)	9,983	15,247
Diagnostically confirmed (Pv)	17,376	20,812
Inpatient number of reported malaria cases	N/A	N/A
Diagnostically confirmed	N/A	N/A
Clinical/presumed/unconfirmed	N/A	N/A
Total number of reported malaria deaths Data source: BOE and CMPE	33	2
Diagnostically confirmed	N/A	N/A
Clinical/presumed/unconfirmed	N/A	N/A
Malaria test positivity rate (outpatients) Data source:	N/A	N/A
Numerator: Number of outpatient confirmed malaria cases	N/A	N/A
Denominator: Number of outpatients receiving a diagnostic test for malaria (RDT or microscopy)	N/A	N/A
Completeness of monthly health facility reporting Data source: BVBD	100%	N/A
Numerator: Number of monthly reports received from health facilities	302 VBDUs	N/A
Denominator: Number of health facility reports expected (i.e., number of facilities expected to report multiplied by the number of months considered)	302 VBDUs	879 health facilities

Progress during the last 12-18 months

In 2015, WHO ERAR commissioned a regional assessment of surveillance systems for each country in the GMS. This work focused on assessing the surveillance, monitoring, and evaluation capacities in the GMS for the emergency response to artemisinin resistance and malaria elimination. Given that country surveillance situations are dynamic and are at different stages, the purpose of the assessment was to serve as a ‘baseline’ or starting point from which countries can be best assisted to transition their surveillance from malaria control into an elimination setting.

With the phasing out of the Global Fund in Thailand, the BVBD’s malaria online system will be transitioned to be managed by the Ministry of Public Health’s Bureau of Epidemiology (BOE) as

part of the General Health Services system. PMI contributed to the recent External Malaria Program Review, which highlighted that this transition will help to consolidate and integrate malaria reporting in the country. However, gaps in data management, analysis, and response to malaria data exist within BOE and need to be strengthened.

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.

Plans and justification

Given the increased attention on malaria surveillance in the region, there is a need for more coordination amongst partners and donors. PMI will focus on provision of technical assistance in the following areas for monitoring, evaluation, and surveillance: 1) ensuring the collection and use of quality, standardized routine data that feeds into comprehensive national surveillance systems, particularly from the private sector, the military, and other non-health sectors; 2) technical assistance for the development and operationalization of national M&E plans; and 3) strengthening national and sub-national M&E and surveillance capacity. Countries in the region have malaria surveillance systems of variable quality and require a more tailored approach which focuses more on technical assistance. With the relatively low malaria prevalence and goals of malaria elimination in the region, PMI will emphasize strengthening routine surveillance systems and rely less on large national surveys. In particular, incorporation of private sector data into the routine information system is critical – especially in countries such as Laos where there is a Public-Private Mix strategy in place. Thailand has banned the sale of antimalarial drugs in the private sector. Support will be provided to strengthen SM&E at national and sub-national levels and to strengthen routine data collection and its quality at the peripheral levels. More specifically, PMI will support technical assistance to improve the NMCP's capacity to analyze and use strategic information, and to evaluate malaria elimination models and activities currently implemented in Thailand, including strengthening individual case reporting and investigation. Support for trainings and workshops are also envisioned as part of the technical assistance to build capacity of these important skills amongst NMCP staff. With support for SM&E from headquarters, the RDMA Regional Resident Advisor (RA) will provide technical inputs and guidance on SM&E issues at project level as well as direct support to NMCPs in the GMS on development and implementation of SM&E plans and other strategic documents.

Proposed activities with FY 2017 funding: (\$210,000)

- **Support for M&E and surveillance system strengthening:** Technical assistance will be provided to strengthen malaria surveillance systems particularly in Lao PDR and Thailand; technical assistance to improve M&E, data quality, and use of strategic information and

evaluation of malaria elimination models and interventions in Thailand such as case-based surveillance and response activities. (\$200,000)

- **Technical assistance on M&E:** A CDC epidemiologist will provide technical assistance support with ongoing M&E activities in the region and support NMCP's with their M&E plans. (\$10,000)

7. Operational research

NMCP/PMI objectives

Malaria elimination is now a priority for Thailand's BVBD which has identified the need to better improve its strategy and interventions to reach its MMPs in the context of achieving malaria elimination within its borders. Moreover, the BVBD seeks to develop a sustainable and resourced package of interventions to achieve malaria elimination in Thailand.

In Lao PDR, the national malaria strategy has prioritized OR in case management, particularly with regard to G6PD mapping and screening, as well as the epidemiology of malaria among mobile workers in development projects and forest-goers.

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 2017 funding but PMI will continue to keep abreast of the OR issues and needs in the region and will plan accordingly.

8. 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.

The 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 2017 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 2017**

Mechanism	Geographic Area	Activity	Budget (\$)	%
GHSC-PSM	Regional	Procurement of LLINs/LLIHNs, RDTs, ACTs to fill gaps in the region.	\$896,000	30%
Inform Asia	Regional	Technical assistance to a) strengthen malaria surveillance systems in Lao PDR and Thailand, b) support national programs to evaluate elimination models and strategies for implementation and scale-up, c) support national programs to generate and use strategic information (including TES and documentation write-ups); 4) Local TA for data management in Lao PDR.	\$545,000	18%
CDC IAA	Regional	TDYs for M&E (1) and entomology (2).	\$39,000	1%
USP/PQM	Thailand	Technical assistance to national authorities for ISO accreditation.	\$120,000	4%
WHO Consolidated Grant	Regional	a) Conduct TES in Thailand, Viet Nam, Lao PDR, and China; b) Support for microscopy training and accreditation in the region and maintenance of regional and national slide banks; c) Coordinate and facilitate regional training courses.	\$750,000	25%
USAID	Regional	Staffing and administration costs.	\$650,000	22%
Total			\$3,000,000	100%

Table 2: Budget Breakdown by Activity

**President's Malaria Initiative – Thailand/Regional
Planned Malaria Obligations for FY 2017**

Proposed Activity	Mechanism	Budget (\$)				Geographic Area	Description
		Thailand + Regional		Thailand	Regional		
		Total	Commodity	Total	Total		
PREVENTIVE ACTIVITIES							
VECTOR MONITORING AND CONTROL							
Entomological Monitoring and insecticide resistance management							
Entomology training	Inform Asia	\$25,000		\$25,000		Regional	Two trainees to Atlanta for CDC bottle bioassays.
Technical assistance for entomology	CDC IAA	\$29,000		\$14,500	\$14,500	Thailand/Regional	Two CDC TDYs.
SUBTOTAL Entomological Monitoring		\$54,000	\$0	\$39,500	\$14,500		
Insecticide-treated Nets							
LLIN/LLIHN procurement and distribution	GHSC-PSM	\$460,000	\$460,000	\$0	\$460,000	Regional	Support for ~160,000 LLINs and LLIHNs for focus areas and to fill gaps in the region.
Distribution costs	GHSC-PSM	\$150,000		\$0	\$150,000	Regional	Distribution costs for LLINs/LLIHNs in the region.
SUBTOTAL ITNs		\$610,000	\$460,000	\$0	\$610,000		
Indoor Residual Spraying							
SUBTOTAL IRS		\$0	\$0	\$0	\$0		

SUBTOTAL VECTOR MONITORING AND CONTROL		\$664,000	\$460,000	\$39,500	\$624,500		
Malaria in Pregnancy							
Subtotal Malaria in Pregnancy		\$0	\$0	\$0	\$0		
SUBTOTAL PREVENTIVE		\$664,000	\$460,000	\$39,500	\$624,500		
CASE MANAGEMENT							
Diagnosis and Treatment							
Procurement of RDTs, microscopes, and reagents	GHSC-PSM	\$100,000	\$100,000		\$100,000	Regional	Procure ~162,000 RDTs/microscopy supplies to reach migrants and to fill regional gaps and outbreaks; microscopes for Thailand MCs.
Training and accreditation for microscopy	WHO Consolidated Grant / ACTMalaria	\$90,000		\$0	\$90,000	Regional	Support for microscopy training and accreditation in the region and maintenance of regional and national slide banks; training of trainers for microscopy.
Microscopy training for provincial and district level (MCs and hospitals)	Inform Asia	\$100,000		\$100,000		Thailand	Provide microscopy training for MCs and hospitals.

Procurement of ACTs	GHSC-PSM	\$36,000	\$36,000	\$0	\$36,000	Regional	Procure ~31,500 antimalarials to reach migrants and to fill regional gaps and outbreaks.
Therapeutic efficacy surveillance network	WHO Consolidated Grant	\$585,000		\$150,000	\$435,000	Regional	Conducting TES studies in four countries (Thailand, Laos, Viet Nam, China); technical assistance and monitoring visits by WHO PI to all six GMS countries; support for drug policy review; convening of annual meetings; monitoring of K13 markers.
Technical assistance support for TES in Thailand	Inform Asia	\$100,000		\$100,000		Thailand	Technical assistance support for TES.
Subtotal Diagnosis and Treatment		\$1,011,000	\$136,000	\$350,000	\$661,000	\$0	
Pharmaceutical Management							
Strengthening supply chain management	GHSC-PSM	\$150,000			\$150,000	Laos	Provide technical assistance to CMPE for supply chain management, particularly at sub-national level.
Drug quality assurance	USP/PQM	\$120,000		\$40,000	\$80,000	Regional	Postmarket surveillance in Thailand and Laos; ISO accreditation for Lao FDD.

Subtotal Pharmaceutical Management		\$270,000	\$0	\$40,000	\$230,000		
SUBTOTAL CASE MANAGEMENT		\$1,281,000	\$136,000	\$390,000	\$891,000		
HEALTH SYSTEM STRENGTHENING / CAPACITY BUILDING							
Strengthen NMCP capacity	WHO Consolidated Grant / ACTMalaria	\$75,000			\$75,000	Laos	National MMFO for Laos.
Support for strategic information	Inform Asia	\$120,000			\$120,000	Laos	Local resident technical assistance support for epidemiology in Laos.
SUBTOTAL HSS & CAPACITY BUILDING		\$195,000	\$0	\$0	\$195,000		
SOCIAL AND BEHAVIOR CHANGE COMMUNICATION							
SUBTOTAL SBCC		\$0	\$0	\$0	\$0		
SURVEILLANCE, MONITORING AND EVALUATION							
M&E and surveillance strengthening	Inform Asia	\$200,000		\$100,000	\$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 revising national strategic plans as well as updating national

							M&E plans.
CDC technical assistance for M&E	CDC IAA	\$10,000			\$10,000	Regional	One CDC TDY.
SUBTOTAL SM&E		\$210,000	\$0	\$100,000	\$110,000		
OPERATIONS RESEARCH							
SUBTOTAL OR		\$0	\$0	\$0	\$0		
IN-COUNTRY STAFFING AND ADMINISTRATION							
USAID Resident Advisor and FSN	USAID	\$590,000			\$590,000	Regional	Support for USAID Resident Advisor, PMI Malaria FSN in Bangkok; administrative costs.
Travel costs	USAID	\$60,000			\$60,000	Regional	Regional travel for RDMA PMI staff.
SUBTOTAL IN-COUNTRY STAFFING		\$650,000	\$0	\$0	\$650,000		
GRAND TOTAL		\$3,000,000	\$596,000	\$529,500	\$2,470,500		

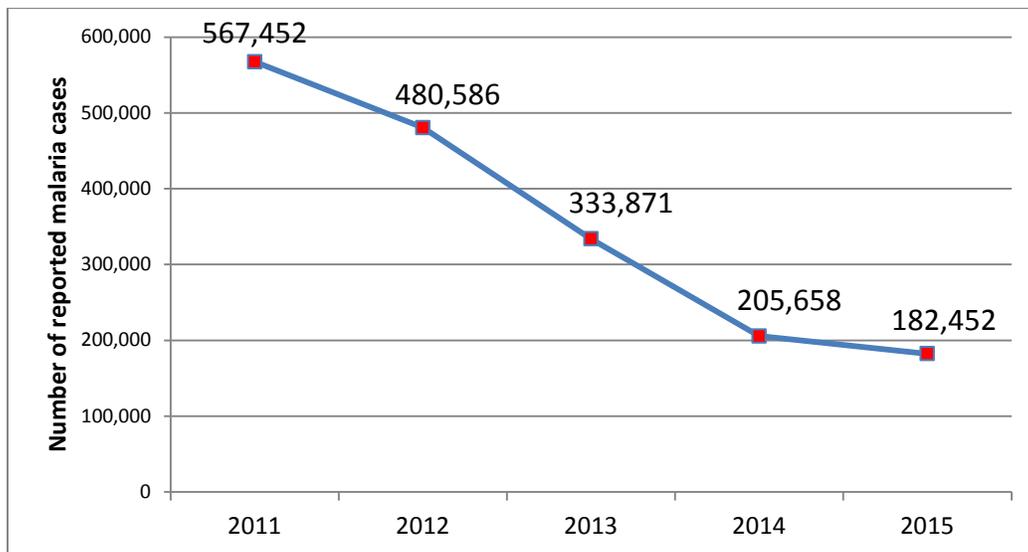
IV. BURMA

(A) Strategy

1. Malaria situation in Burma

Although significant progress has been made in recent years, the malaria burden in Burma remains the highest among the six countries of the GMS. The NMCP reported 567,452 malaria cases in 2011; 480,586 cases in 2012; 333,871 in 2013, which represents 75% of the total malaria cases (447,827) in the GMS in the same year; 205,658 in 2014 and 182,452 in 2015, which represents a 68% reduction from 2011 (Figure 10).

Figure 10: Malaria cases reported in Burma from 2011 to 2015 (Source: NMCP)



The number of deaths attributed to malaria has progressively fallen in the past ten years from 1,261 in 2007, 788 in 2010, 236 in 2013, 96 in 2014 and 37 in 2015.

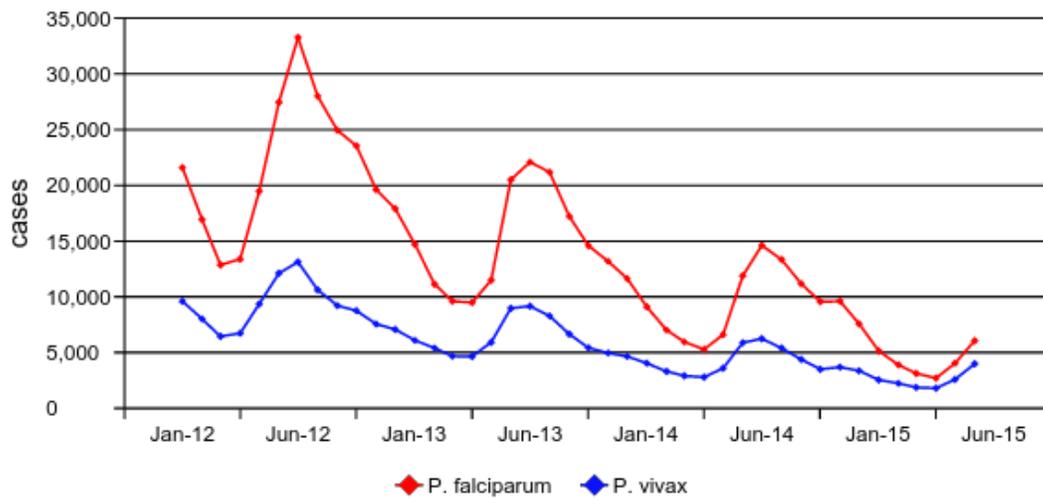
The reported cases represent only the public sector and do not include those using self-treatment or seeking care in the private sector, which are estimated to represent more than 50% of the total. The estimate of total malaria morbidity and mortality that is under-reported in Burma is uncertain. Several malaria-endemic areas, particularly in the non-state actor areas and those bordering Thailand and China, have limited accessibility by government health services and international organizations, which further contributes to under-reporting.

The NMCP estimates that 284 out of the total 330 townships are located in malaria-endemic areas, and that approximately 43% of the population lives in areas where malaria transmission

occurs (7% in high transmission, 12% in moderate transmission and 24% in low transmission areas), according to the 2015 stratification⁷.

P. falciparum and *P. vivax* are the major species, with occasional reports of *P. malariae* and *P. ovale*. *P. falciparum* has shown a slight decline in its occurrence over the past decade, and in 2014 it accounted for 67% of cases, non-*P. falciparum* for 30%, and mixed infections for 3%. Recent trends of the *P. falciparum* and *P. vivax* caseload in Burma are reported in Figure 11.

Figure 11: Trends of the *P. falciparum* and *P. vivax* cases from January 2012 to April 2015 (Source: NMCP)

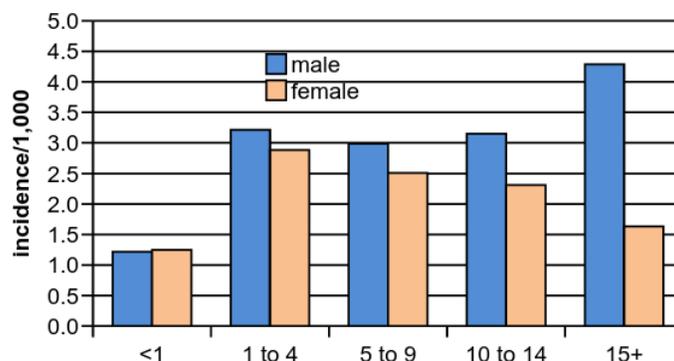


Out of 37 species of *Anopheles* recorded in the country, ten species are malaria vectors and have been classified as primary vectors (*An. dirus s.l.* and *An. minimus*) and secondary vectors (*An. aconitus*, *An. annularis*, *An. philippinensis*, *An. Sundaicus s.l.*, *An. culicifacies*, *An. maculatus*, and to a lesser extent *An. sinensis* and *An. jeyporiensis*). The peak malaria transmission period is generally between July through October for the majority of the country and rainfall peaks between June and August.

Analysis of the age and sex distribution of national reported cases in 2014 (see Figure 12 below) indicates an over-representation of adult males, reflecting the risk attributed to occupations such as mining, forest-related activities, rubber tapping, construction, etc.

⁷ Draft of the National Strategic Plan for Intensifying Malaria Control and Accelerating Progress towards Malaria Elimination 2016-2020. Department of Public Health, Ministry of Health, Republic of the Union of Myanmar

Figure 12: Incidence of malaria in Burma in 2014, by age group and sex



Areas of concern for artemisinin resistance have been identified within Burma through ongoing drug resistance monitoring. In 2009-2010, the early signs of *P. falciparum* resistance to artemisinins characterized by prolonged parasite clearance time were reported in at least three states/regions (Mon, Tanintharyi, and Bago-East); and evidence of suspected artemisinin resistance was reported in Kachin, Kayah, and Kayin States.

As an emergency response, a strategic framework to contain artemisinin-resistant *P. falciparum* was developed and endorsed in 2011. The MARC Project was started in mid-2011 with support from the Three Disease Fund (3DF). Following the principles outlined by the WHO's Global Plan for Artemisinin Resistance Containment, the MARC framework aimed to halt the spread of artemisinin resistance from eastern Burma to the western part of the country and beyond. However, these containment efforts were unable to stop the spread of resistant parasites beyond the containment areas. Furthermore, recent studies⁸ based on multi-country analysis of the genetic mutations associated with artemisinin resistance have suggested that these mutations originated independently in multiple locations of Southeast Asia. More recently, a survey⁹ conducted in Burma from January 2013 to September 2014 in ten states/regions and along the Thailand and Bangladesh borders found K13 mutations in 371 of 940 (39%) malaria patients tested. Therefore containment or elimination efforts in one small area will likely have limited or no effect on preventing the emergence of resistance in other areas. In September 2014, the WHO declared that elimination of *P. falciparum* malaria from the GMS is technically feasible and should be the recommended response to address the challenge of artemisinin resistance. The MOH of Burma has been closely monitoring these events and in November 2014, during the Ninth East Asia Summit, the Government of Burma adopted the goal of malaria elimination by 2030 along with the rest of the Asia-Pacific Region. To support this long-term endeavor the MOH established in August 2015 a new "Malaria Elimination Committee" with the task of

⁸ Independent emergence of artemisinin resistance mutations among *P. falciparum* in Southeast Asia. *The Journal of Infectious Diseases* 2015; 211: 670–9

⁹ Spread of artemisinin-resistant *Plasmodium falciparum* in Myanmar (Burma): a cross-sectional survey of the K13 molecular marker. *Lancet Infectious Disease*, 2015. Published Online, February 20, 2015.

providing the necessary institutional, technical, and financial support needed to achieve this historical goal.

2. Country health system delivery structure and MOH organization

According to the last census, conducted in 2014, the total population of Burma is estimated at 51,486,253. The 2015 mid-year population estimate is 52,006,261 as referenced in the NSP. The country is divided administratively into Nay Pyi Taw Territory, the capital city, and 14 states and regions (Figure 13), and comprises 74 districts, 330 townships, and 64,134 villages.

Figure 13: Administrative States and Regions of the Republic of the Union of Myanmar



Burma's health system has a pluralistic mix of public and private services. The MOH is taking the responsibility of ensuring comprehensive health care services covering activities for promoting health, preventing diseases, providing effective treatment, and rehabilitation. Some ministries (e.g. Ministry of Defense) also provide limited health care services, mainly curative, for their employees and families. The private for-profit sector is fragmented in different delivery channels, ranging from traditional healers to general practitioners, mainly providing ambulatory care, and private clinics, mostly in some large cities. The private not-for-profit sector is mostly run by community or religious-based organizations supporting institutional care and social health protection.

The MOH structure was recently reorganized in April 2015 into six different departments: Public Health, Medical Care, Medical Research, Health Professional Development and Management, Food and Drug Administration, and Traditional Medicine. Three task forces have been established for financial management, human resources development, and health sector development. Burma aspires to achieve Universal Health Coverage as part of its Vision 2030 for

a healthier and more productive population. With rapid development and change, it is promising that Burma has significantly increased its national budget for health from 1% of the total national budget in 2010 to 3.4% in 2015, and has made human resource capacity strengthening one of its priorities. For example, in April 2015, the government nearly doubled the salary of government employees.

Malaria control activities are led by the Vector-Borne Disease Control (VBDC) program and housed in the newly established Department of Public Health, with the collaboration of partners from public and private sectors. At central level, the VBDC is mandated to formulate national strategies, policies, standards, and norms related to malaria control, provide training, conduct OR, control outbreaks, and provide consultative and advisory services to implementing agencies.

3. National malaria control strategy

A new five-year, 2016-2020, National Strategic Plan for Intensifying Malaria Control and Accelerating Progress towards Malaria Elimination has been in preparation since September 2015 and the final version is expected in the fall of 2016. The ultimate goal of the new NSP is to eliminate *P. falciparum* malaria by 2025 and all forms of malaria from Burma by 2030.

The NSP has four intermediate objectives:

1. To reduce reported incidence of malaria to less than 1 case per 1,000 population in all states/regions by 2020.
2. To interrupt transmission of *P. falciparum* malaria in at least five states/regions by 2020 (Bago, Magway, Mandalay, Mon, Yangon).
3. To prevent the emergence of multi-ACT resistant *P. falciparum*.
4. To prevent the re-establishment of malaria in areas where transmission has been interrupted.

The NSP identifies three key intervention areas with priority activities:

1. Case detection and effective management:

- Providing universal coverage for diagnosis and treatment in health facilities and at community level;
- Reducing the parasite reservoir through effective radical treatment of all cases;
- Focusing on detecting, protecting and providing access to diagnosis and treatment for priority population groups (e.g. mobile and migrant populations)
- Detection and treatment of asymptomatic parasite carriers by screening appropriate populations using rapid and highly sensitive diagnostic tools;
- Reinforcing and scaling up quality microscopy and access to quality assured RDTs;
- Strengthening malaria program management, to ensure that it is operating optimally at all levels of the health system;
- Engaging formal and informal private sectors to improve the availability of quality-assured products;
- Strengthening drug regulatory agency functions to eliminate artemisinin monotherapy and prevent the sale of substandard and falsified drugs;

2. Disease prevention:

- Universal coverage of at-risk populations with LLINs or IRS and supplementary vector control measures where appropriate;
- Delivering preventive measures appropriate to local vector biology, transmission settings, and population characteristics to accelerate the impact on transmission;
- Empowering at-risk populations by ensuring they understand the disease through culturally-appropriate and gender-sensitive communication;
- Ensuring participation of at-risk communities and population groups in malaria prevention activities.

3. Malaria case and entomological surveillance

- Strengthening the malaria case surveillance system as a core intervention to efficiently gather, use, and disseminate data;
- Rapid detection and full treatment of cases through intensified surveillance and response;
- Maintaining adequate epidemiological and entomological capabilities with an effective OR component, to determine risk and underlying causes of transmission;
- Establishing an early warning system to monitor malaria risk factors in terms of vulnerability and receptivity in order to predict and prevent re-establishment of malaria transmission.

Implementation of the NSP is guided by the new epidemiological stratification, no longer relying on socio-ecologic risk factors, but rather based primarily on level of transmission and API. Additionally, the order number has been reversed, with stratum 1 being a malaria-free area, stratum 2 having potential transmission, and 3a, 3b, and 3c strata reflecting high, moderate, and low levels of malaria transmission, respectively. Table 15 summarizes a breakdown of the Burmese population by strata based on the new stratification criteria.

Table 15: Breakdown of Burma’s population (2015) by transmission level strata (Source: VBDC)

Stratum	Transmission level	Criteria	Population by strata (%)
1	Malaria free	API: 0 No transmission	8.1 million (16%)
2	Potential transmission	API: 0 Possibility of vector presence, receptivity and vulnerability	21.4 million (41%)
3a	High transmission	API: >5	3.5 million (7%)
3b	Moderate transmission	API: 1-5	6.3 million (12%)
3c	Low transmission	API: <1	12.7 million (24%)
Total			52.0 million

Two main phases are identified on the path to malaria elimination:

- The transmission-reduction phase, where a combination of interventions is applied in all endemic areas to bring malaria incidence down to a level at which elimination can be considered (below 1 case per 1,000 people at risk per year);
- The elimination phase, where these measures are targeted to remaining foci and surveillance intensified with measures to rapidly detect and cure every case.

PMI supports the NMCP’s strategy, contributing support both at national and peripheral level. At national level, PMI provides support for capacity building, particularly in the field of entomology and epidemiology, monitoring therapeutic efficacy of antimalarial drugs, strengthening malaria surveillance, antimalarial drug quality assurance systems, and supply chain management for health commodities, and quality assurance for malaria diagnosis.

At peripheral level, PMI supports comprehensive, community-based malaria services for at-risk populations with vector control and case management interventions, involving public and private sectors. Presently, PMI implementing partners reach more than 1,400 villages with over one million residents in 29 townships of five states/regions. With additional resources, PMI will consolidate geographic focus and expand geographic coverage within target areas over the next five years to reach over three million people in all 33 townships of three states/regions, including expansion to 10 new townships in Rakhine. The proposed geographic focus of PMI with FY 2017 funding will consolidate geographic areas and ensure a comprehensive coverage in well-defined administrative areas; and prioritize areas with high malaria burden, such as Rakhine which has the highest caseload (36,826 cases) and the second highest incidence (11.5/1,000) in 2014. This approach will allow PMI to concentrate the interventions in priority areas and to provide comprehensive assistance at all levels of the health system, as well as expand coverage to more remote communities.

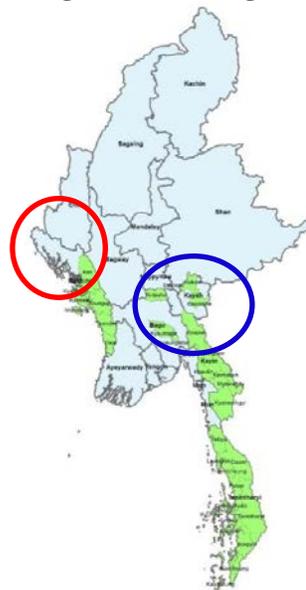
Figure 14: Present coverage and proposed future coverage of PMI target areas

Present coverage by PMI

1. Tanintharyi: 10 TSPs
 2. Rakhine South: 7 TSPs
 3. Kayin: 6 TSPs
 4. Kayah: 3 TSPs
 5. Bago East: 3 TSPs
- TOTAL : 29 TSPs**
Beneficiaries: one million people

Proposed FY 2017 coverage by PMI

1. Tanintharyi: 10 TSPs
 2. Rakhine South & North: 7+10 TSPs
 3. Kayin: 6 TSPs
- TOTAL : 33 TSPs**
Beneficiaries: three million people



Note: **Blue ring**: 6 townships to transition out; **Red ring**: 10 new townships to add

4. Updates in the strategy section

- ***Restructuring of Ministry of Health.*** In early 2015, the Ministry of Health underwent restructuring which created a Department of Medical Services and Department of Public Health. The NMCP now falls under the Department of Public Health which oversees activities on communicable diseases, nutrition, school health, environmental health, and other public health initiatives. It is anticipated new staff will be recruited to fill these new positions within the new MOH structure and departments.
- ***New National Strategic Plan, 2016-2020.*** A new five-year, 2016-2020, NSP for Intensifying Malaria Control and Accelerating Progress towards Malaria Elimination has been in preparation since September 2015 and the final version is expected at the end of April 2016.
- ***Revision of the three tier levels of artemisinin resistance.*** Based on recent molecular findings, the distribution of the genetic biomarker associated with delayed parasite clearance appeared more widely distributed than previously thought. In December 2014, the NMCP revisited the designation of tiers used for the stratification of resistance risk and containment activities. All 48 townships in Mon, Kayin, Tanintharyi, Kayah and East-Bago states/regions were classified as Tier 1 (confirmed/ suspected resistance) and the rest of the country as Tier 2. The Tier 3 category was dropped.
- ***Political commitment to malaria elimination.*** Burma, together with the other 17 countries attending the Ninth East Asia Summit in November 2014, adopted the historical goal of malaria elimination from the entire Asia-Pacific Region by 2030. This unanimous and enthusiastic commitment of high-level political leaders represents a strong stimulus for all national malaria programs and the international donor community to further mobilize resources and scientific attention to this ambitious but technically achievable goal.
- ***New President, new Government, and new Ministry of Health.*** Following the historic parliamentary elections of November 2015, with Aung San Su Kyi's National League for Democracy winning 78% of the seats, a new President of the Republic of the Union of Myanmar was selected on March 30, 2016, and a new civilian-led government, with a new Ministry of Health, announced on April 1, 2016.

5. Integration, collaboration, and coordination

Funding

In recent years, Burma has seen a dramatic increase in both external and domestic funding for health. Following the initial withdrawal of the Global Fund in Burma in 2005, the 3DF (2006-2011) provided \$25 million for malaria and was one of the first consortia of donors to support

malaria control as well as the response to artemisinin resistance through the MARC framework. Since then, Burma has received funding support namely from the following:

- Global Fund¹⁰: Round 9 (\$33 million for malaria for the period 2011-2012), New Funding Model (\$74.7 million for malaria for the period 2013-2016, with a no-cost extension approved through 2017), and the RAI (\$40 million for the period of 2014-2016, with a cost extension until December 2017);
- Three Millennium Development Goals (3MDG) Fund is a \$300 million initiative primarily focused on strengthening the national health system and improving maternal and child health services, but has also funding allocated for malaria (\$16.1 million for the period 2014-2016, with a costed extension anticipated through 2017);
- The Artemisinin Monotherapy Replacement Project, funded with £11.3 million from the UK's Department for International Development, \$1 million from Good Ventures, and other funds from the BMGF, is implemented by Population Services International (PSI) and is working to replace artemisinin monotherapy and other substandard antimalarial drugs available in the informal private market sector with subsidized quality-assured ACTs;
- The Japan International Cooperation Agency's 10-year project, which has provided funding for health and malaria programs, ended in March 2015. A new five-year malaria project focusing on elimination in Bago Region started in January 2016.
- Other regional donors supporting malaria activities that impact Burma are Australia's Department of Foreign Affairs and Trade and the BMGF which jointly support the WHO's regional ERAR hub, 2013-2015, based in Phnom Penh.
- The Asian Development Bank is providing multi-year funding in 2016 for malaria surveillance, laboratory quality assurance, and malaria services for mobile and migrant populations.

Coordination

The NMCP coordinates its activities and those implemented by over 25 different international and national organizations through a technical and strategic group (TSG) for malaria. The malaria TSG comprises technical experts from the MOH, United Nations agencies, national and international NGOs, and donors, including PMI. As the Secretariat for the TSG, WHO organizes periodic meetings for improved coordination and discussion of technical topics on an *ad hoc* basis. There are two sub-working groups (M&E and Program Implementation) established under the TSG.

Private Sector

In Burma, PSI supports the "Sun Quality Health Network," a franchise of licensed general practitioners serving low-income populations. As mentioned above, PSI is also implementing the

¹⁰ Global Fund grants resumed in Burma in 2011 after initial withdrawal in 2005.

Artemisinin Monotherapy Replacement Project which provides quality-assured ACTs to the private market sector.

Similarly, the Myanmar Medical Association (MMA), with support from Global Fund, 3MDG, USAID, and WHO, has a network of private general practitioners under its project “Quality Diagnosis and Standard Treatment of Malaria.” The private general practitioners receive training and logistics support to deliver quality-assured diagnostics and treatment of malaria. Approximately 330 private providers in 113 townships and 360 Village Health Volunteers in 12 fixed and mobile clinics are part of the network.

Growing support for malaria control activities is also provided by the corporate private sector:

- 28 Burmese companies, members of Myanmar Health & Development Consortium and Myanmar Business Coalition on AIDS, have signed a corporate commitment to provide education on malaria testing, diagnosis, and treatment;
- Total Exploration and Production supports a comprehensive malaria program in 33 villages (population 38,000) surrounding their pipeline in Tanintharyi Region, in addition to collaboration with NGOs on outreach activities;
- Shwe Taung Group ensures health insurance and malaria prevention program to all its 3,304 employees;
- Dagon International provides testing and treatment for 100 permanent staff and 500 seasonal laborers on their palm oil plantation;
- South Dagon and Yuzana provide assistance to health facilities and malaria programs at their plantations in Tanintharyi.

Other USG

PMI is collaborating with USAID/Burma’s “Project for Local Empowerment” (PLE) by providing technical assistance in the training of ethnic group volunteers and distributing ACTs, RDTs and LLINs. The PLE Project is funded by USAID for the period 2011-2017 (\$8-\$10 million per year) and covers six Thai provinces on the Thai-Burma border, including nine Burmese refugee camps.

Another example of USG collaboration is the “Shae Thot Project”, which is funded by USAID and implemented by a consortium of international NGOs in the central dry-zone of Burma. This is a comprehensive community development project, which also includes health and malaria control components.

US Peace Corps plans to start programs in Burma in 2016, and PMI will explore opportunities for collaboration to strengthen malaria control and prevention activities in communities supported by both organizations.

6. Progress on coverage/impact indicators to date

There have been demographic surveys jointly conducted every five years by the Department of Population and United Nations Population Fund since 1991. In the past, Multiple Indicator

Cluster Surveys have been jointly conducted by the Ministry of National Planning and Economic Development, the Ministry of Health, and UNICEF. These surveys primarily assessed the situation of women and children and also included data collection on nutrition.

For malaria, more recently there was a baseline household prevalence survey conducted in the MARC areas (Tier 1 and Tier 2) along the Thai-Burma border in 2011-2012. Due to funding and approval delays, this survey was carried out towards the tail end of the malaria transmission season and noted very low malaria prevalence.

For the first time in the history of the country, both a Demographic Health Survey (DHS) and a MIS were conducted in 2015. A PMI implementing partner carried out the MIS fieldwork, in collaboration with the NMCP, during a period of 11 weeks, from August 17 to October 31, 2015. In total, 4,371 households from 145 clusters were interviewed, 13,484 blood samples were collected for PCR and serology analysis, and 13,591 people were tested for malaria with RDTs. Preliminary results are expected in May 2016. The DHS data collection started in December 2015 and its completion is expected in June 2016.

Table 16: Evolution of Key Malaria Indicators in Burma from 2012 to 2015

Indicator	2012 Baseline MARC survey	2013 CAP-Malaria Tanintharyi, Rakhine, Kayin	2012-13-14 Global Fund Implementing Partners	2013-2014 CAP-Malaria Project	2015 MIS (preliminary data)
% Households with at least one net of any type	97.4%	82%	2013:99.3% 2014:97.2%		95.2.0%
% Households with at least one LLIN/ITN	35.1%	37.8%	2013:68%	2013:97.6% 2014:97.3%	40.3%
% Household members who slept under an ITN the previous night	15.9%	20.7%	2013:86% 2014:62.7%	2013:61% 2014:82%	24.9%
% Children under five who slept under an ITN the previous night	19.4%		2013: 58.5% 2014: 44.6%		TBD
% Pregnant women who slept under an ITN the previous night	20.3%		2013: 56.5% 2014: 42.4%		TBD
% Children under five years old with fever in the last two weeks for whom advice or treatment was sought			2013:11.6% 2014: 7.5%		
Test Positivity Rate*			2012:23.4% 2013:19.1% 2014: 8.1%	2013:7.5% 2014:4.7%	

* Based on both symptomatic and asymptomatic cases

(B) Operational Plan

1. Vector monitoring and control

NMCP/PMI objectives

The new NSP (2016-2020) aims to achieve universal coverage of at-risk populations with LLINs or IRS and supplementary measures, where appropriate, and is guided by an eco-epidemiological stratification informed by malaria case and entomological surveillance data. The implementation of these measures will occur within the framework of integrated vector management to ensure optimal use of resources. The NSP also considers the deployment of new promising transmission reduction tools, such as spatial repellents, insecticide-treated clothing, and toxic sugar baits. Several updates to the NMCP's vector control strategy are noted below:

The NSP recommends multiple delivery strategies to maximize coverage of LLINs in all townships including in strata 3a and 3b, with the objective of providing one LLIN per 1.8 people (as per international guidelines). Targeting will be based on the most up-to-date stratification of malaria risk available. As the quality of surveillance improves, the stratification will evolve to distinguish between endemic villages and villages where all cases are imported. Endemic villages will continue to receive periodic mass distributions but in villages where all cases are imported, LLINs will be provided only to forest-goers. The strategy will thus move away from blanket coverage towards increased focus to maximize cost-effectiveness and sustainability. Distribution of LLINs will be coupled with locally-appropriate and gender-sensitive IEC/SBCC to ensure community mobilization and high and correct LLIN usage. PMI will continue to target LLINs in project areas to address gaps in coverage and reach the most vulnerable populations including migrant and mobile populations.

The NMCP supports the provision of free LLINs to cover the entire population residing in established settlements in target communities. These LLINs will be delivered through regular mass distributions every three years (or depending on the expected lifespan of the net procured). Where appropriate, the NMCP will provide additional LLINs for use in forests/forest farms through routine mass distributions (targeting traditional farming communities and informal sector forest workers e.g. small-scale gem/gold miners, people gathering forest products). Village Malaria Workers and Village Health Volunteers will monitor and support continuous distribution of LLINs to address any LLIN attrition in-between mass distributions. Additional LLINs may be given to pregnant women in communities targeted for mass LLIN distribution and delivered through antenatal care (ANC) services.

According to the NSP, focal responsive IRS is recommended in the event of outbreaks and confirmed transmission foci. The NMCP also recommends that IRS may also be applied as a mass preventive measure in epidemic-prone areas that, for some reason, do not have LLINs (e.g. new development project sites and new settlements). While IRS appears in the NMCP strategy document, at the present time, PMI will not fund IRS implementation in Burma.

Furthermore, the NSP considers larval source management where vector-breeding sites are few, fixed, and findable. The focus will be on villages where wells are identified as a significant source of *An. dirus* and in disused shrimp farms and coastal lagoons associated with generating high densities of *An. sundaicus*. PMI does not currently fund larval source management in project areas but would consider operational research where an established comprehensive surveillance system exists and high coverage of LLINs has been prioritized and achieved.

A recent WHO review concluded that the weak entomological capacity in the NMCP is a key gap in Burma's malaria control program. WHO presented a comprehensive and ambitious plan for strengthening national entomological capacity. PMI, working closely with JICA and in coordination with WHO and the much stronger Thai entomology program, aims to strengthen both laboratory and field capacity for basic entomological monitoring, building on the WHO recommendations. PMI will work with the NMCP and partners to analyze and publish the results of entomological monitoring efforts to inform programmatic decisions and operations. PMI will work to ensure that appropriate entomological surveillance and monitoring guidelines are put in place. PMI will support development of basic entomological capacity at central level, including basic techniques for field collections, proper mosquito rearing methods in the insectary, and bioassay methods for insecticide activity linked to LLIN durability monitoring. These activities will require frequent support from CDC entomologists in Atlanta, who are in close communication with WHO and JICA.

a. Entomological monitoring and insecticide resistance management

Progress since PMI was launched

From December 2012 until November 2015, PMI supported entomological monitoring in 16 sentinel sites (villages) in eight townships of three states/regions, as summarized in Table 17.

Table 17: Summary of entomological monitoring activities carried out in Burma since 2012

Period	State/Region	Township	# of sites	# of <i>Anopheles malaria</i> vectors collected
October 2014-October 2015	Tanintharyi	Myitta (Dawei)	2	2,228 of 7 species: <i>An. minimus</i> , <i>An. maculatus</i> , <i>An. dirus</i> , <i>An. kochi</i> , <i>An. culicifacies</i> , <i>An. vagus</i> , <i>An. annularis</i>
October 2014-October 2015	Tanintharyi	Thayetchaung	2	389 of 6 species: <i>An. maculatus</i> , <i>An. minimus</i> , <i>An. aconitus</i> , <i>An. annularis</i> , <i>An. dirus</i> , <i>An. kochi</i>
October 2014-October 2015	South Rakhine	Ann	2	1,069 of 7 species: <i>An. maculatus</i> , <i>An. minimus</i> , <i>An. kochi</i> , <i>An. culicifacies</i> , <i>An. annularis</i> , <i>An. epiroticus</i> , <i>An. aconitus</i>
October 2014-November 2015	South Rakhine	Toungup	2	656 of 7 species: <i>An. maculatus</i> , <i>An. minimus</i> , <i>An. culicifacies</i> , <i>An. epiroticus</i> , <i>An. kochi</i> , <i>An. aconitus</i> , <i>An. annularis</i>
January to November 2013	Tanintharyi	Bokpyin	2	1,564 of 7 species: <i>An. aconitus</i> , <i>An. maculatus</i> , <i>An. kochi</i> , <i>An. dirus</i> , <i>An. minimus</i> , <i>An. annularis</i> , <i>An. epiroticus</i>
January to November 2013	Tanintharyi	Kawthaung	2	801 of 7 species: <i>An. kochi</i> , <i>An. aconitus</i> , <i>An. maculatus</i> , <i>An. dirus</i> , <i>An. annularis</i> , <i>An. minimus</i> , <i>An. epiroticus</i>
December 2012-October 2013	Tanintharyi	Kyunsu (Island)	2	943 of 6 species: <i>An. maculatus</i> , <i>An. annularis</i> , <i>An. dirus</i> , <i>An. kochi</i> , <i>An. aconitus</i> , <i>An. epiroticus</i>
December 2012-October 2013	Kayin	Myawaddy	2	643 of 5 species: <i>An. minimus</i> , <i>An. annularis</i> , <i>An. culicifacies</i> , <i>An. aconitus</i> , <i>An. maculatus</i>

Data have been compiled into a report, but little progress has been made to translate the results into an actionable format for the NMCP. Insecticide susceptibility tests conducted indicate that most populations remain broadly susceptible to pyrethroids, as shown in the table below.

Progress during the last 12-18 months

PMI continued to support entomological monitoring and surveillance in target areas. Data from the most recent studies are noted in Table 18 below.

Table 18: Data from recent entomological monitoring in Kayin, Rakhine, and Tanintharyi, Burma

Insecticide	<i>Anopheles</i> species tested	No. of specimens tested	Susceptibility status
0.05% Lambda-cyhalothrin	<i>An. minimus</i> , <i>An. jamesii</i> , <i>An. maculatus</i> ,	118	100% susceptible
0.05% Deltamethrin	<i>An. minimus</i> , <i>An. aconitus</i> , <i>An. culicifacies</i> , <i>An. annularis</i> , <i>An. jamesii</i> , <i>An. maculatus</i> , <i>An. philippinensis</i> , <i>An. jeyporiensis candidiensis</i>	220	100% susceptible
0.15% Cyfluthrin	<i>An. jamesii</i> , <i>An. maculatus</i> ,	55	100% susceptible
0.5% Etofenprox	<i>An. jamesii</i> , <i>An. maculatus</i> ,	85	100% susceptible
0.75% Permethrin	<i>An. jamesii</i> , <i>An. maculatus</i> , <i>An. minimus</i> , <i>An. annularis</i> , <i>An. aconitus</i>	223	100% susceptible

In consultation with the NMCP, JICA, and other stakeholders, a medium-term capacity development plan for public health entomology and vector control was developed early in 2015. This plan reviewed the current policies for entomology and vector control, identified training needs and gaps, and potential partnerships and coordination for the next five years. These plans were inserted into the NSP for malaria recently finalized by the MOH.

In February 2016, PMI supported a workshop convening various partners to discuss how to best fill gaps in entomological monitoring in the context of highly heterogeneous transmission. The workshop yielded internal consensus within the MOH and local partners on the best approach for monitoring guided by epidemiological needs. The crucial need is for the entomological data to be of practical use to the NMCP.

On-the job training for ELISA was carried out in December 2015. The two-week training highlighted some of the basic infrastructural needs for entomology that remain – stable electricity and water supply, and a dedicated staff to maintain the insectary. Assurances have

been made by JICA and the NMCP that additional staff and infrastructural needs will be met, with additional training scheduled for 2016.

Plans and justification

PMI will continue with a two-pronged approach to supporting the VBDC entomological section. First, data will be analyzed, packaged, and provided to the NMCP in a manner that is useful and informative. PMI will continue to engage with the NMCP to advocate for increased support for entomology, particularly for personnel. Second, PMI will support basic training in the field and laboratory methods for key VBDC staff via TDY from CDC entomologists.

Additionally, PMI will continue to support entomological monitoring at sentinel sites in the targeted townships, including Northern Rakhine State. PMI will discuss possible other sentinel sites with the VBDC based upon malaria endemicity as determined by the revised stratification data.

PMI is supporting development of guidelines for entomological monitoring and surveillance which will provide details for: 1) Longitudinal sentinel site monitoring, 2) Monitoring in the context of residual foci investigation, 3) Outbreak investigation, and 4) Insecticide resistance surveillance. These guidelines will be supported by PMI and are aligned with NMCP priorities.

Proposed activities with FY 2017 funding: (\$148,000)

- **Support for entomological surveillance (basic package):** PMI will continue to support entomological monitoring in the targeted townships and the insectary in Yangon. In these targeted areas, basic entomological testing will occur at sentinel sites in collaboration with JICA and the VBDC. (\$90,000)
- **Technical support for entomological studies and training, data analysis and publication.** Four CDC TDYs by two experienced entomologists will be provided to build capacity and provide technical assistance on entomological studies and durability monitoring of LLINs. (\$58,000)

b. Insecticide-treated nets

Progress since PMI was launched

As with other countries in the region, Burma has a “net culture” with a high rate of conventional net use. According to the 2010–2016 National Strategic Plan for Malaria Control, many families in Burma already use mosquito nets, but usage rates are highly variable and many nets are untreated. A 2008 survey by the Myanmar (Burma) Council of Churches conducted in 160 malaria-endemic and hard-to-reach villages in Chin State, Kachin State, and Sagaing Division showed that 91% of households own any type of mosquito net (treated and untreated) with an average of two nets per household. However, coverage of insecticide-treated nets (e.g., ITNs or

LLINs) is very low, with only an estimated 5.6% of the total population protected by any ITN. Similarly, the MARC survey (2011-12) found household ownership of nets was 97%, but ITN and LLIN use was only 35% and 18%, respectively.

A post-campaign rapid survey in Northern Shan State in 2015 showed that only about half of households were using their LLINs, preferring to use untreated nets. In contrast, data from a PMI implementing partner operating in Rakhine State showed overall high use of LLINs. Unpublished data from the 2015 MIS conducted in 145 villages across Burma during the high transmission season show an uneven level of use of LLINs: preliminary results showed high rates of net ownership among households – 96% of households owned any type of net and 52% of households owned at least one LLIN. The MIS also found that 83% of households had sufficient nets (one net per two people) but only 26% of households had sufficient LLINs (one LLIN per two people). Although 95% of households in endemic areas reported sleeping under a net the previous night, only 26% reported sleeping under an LLIN. Among respondents in hard-to-reach areas, who are considered especially vulnerable, 61% reported having slept under any net the previous night, of which 40% slept under an LLIN.

Burma's LLIN needs are met primarily through the Global Fund NFM and the RAI grants which cover 14 of the 17 states and regions, with most of the targeted townships in the eastern and southern part of the country. In 2011 and 2012, 1.3 million LLINs were distributed and 2.5 million conventional nets retreated using all sources of support, including the Global Fund. In 2013, the Global Fund, JICA, 3MDG, and PMI contributed 1.9 million LLINs, and in 2014 their contribution amounted to 1,082,626 LLINs.

Progress during the last 12-18 months

With FY 2015 funding, PMI procured a total of 793,500 LLINs. Of these, 553,500 LLINs were used to fill gaps identified by the NMCP in moderate-risk areas (old strata 1b) located outside of PMI's target areas. PMI supported the shipment, warehousing at central level, transport at peripheral level, and distribution of these nets to 47 townships in 11 states/regions, in collaboration with the NMCP. The distribution was successfully accomplished from July to December 2015. The additional 240,000 LLINs were distributed in PMI target areas to resident populations, migrant and mobile populations, and communities in non-state actor areas.

With FY 2014 and FY 2015 funds, PMI is supporting an LLIN durability monitoring assessment of LLIN survivorship, attrition, physical durability, and insecticidal activity. This assessment is especially important for LLIN need projections as the current NSP is based on replacement after three years. In December 2015, PMI distributed 14,000 LLINs in Tamu Township for the three-year monitoring and durability assessment. The NMCP participated in the protocol development and selection of the study sites.

Commodity gap analysis

Table 19: LLIN Gap Analysis for Burma

Calendar Year	2016	2017	2018
Total targeted population ¹	22,535,825	22,763,437	22,993,348
Continuous Distribution Needs			
<i>Estimated Total Need for Continuous</i>	-	-	-
Mass Distribution Needs			
<i>Estimated Total Need for Campaigns²</i>	3,256,674	6,582,901	6,460,000
Total ITN Need	3,256,674	6,582,901	6,460,000
Partner Contributions			
ITNs from Global Fund: NFM and RAI	2,712,615	1,913,901	-
ITNs from 3MDG	-	2,000,000	-
ITNs planned with PMI funding	300,000	456,000	456,000
Total ITNs Available	3,012,615	4,369,901	456,000
Total ITN Surplus (Gap)	(244,059)	(2,213,000)	(6,004,000)
<p>Note: 3MDG and Global Fund's RAI have been extended through 2017, and Global Fund's NFM will end in December 2016. It is anticipated that the additional LLINs required to fill the current gaps will be supported by a new four-year Global Fund grant, whose Concept Note has been already submitted for approval and is expected to start in January 2017.</p> <p>¹ Risk population is based on the census conducted in 2014 and the micro-stratification data estimated by NMCP in 2015 (see details in Table 15). Targeted population includes at-risk population in strata 3a, 3b, and 3c. Annual population growth rate (1.01%).</p> <p>² Total distribution need calculated as (population at risk / 1.8) – (# of nets previously distributed to target areas). Global Fund targets areas in strata 3a, 3b, 3c, and 10% of the rural population in stratum 2; PMI targets strata 3a, 3b, and 3c in three target states/regions (Rakhine, Tanintharyi, and Kayin).</p>			

Plans and justification

Although Burma has funding from the various donors in specific areas, there remain gaps in LLIN coverage in the country. PMI will procure approximately 456,000 LLINs in FY 2017 to

fill LLIN gaps at the household level in endemic areas, targeting villages and Townships in the cross-border areas and those that are not supported under the current Global Fund agreement (e.g., Rakhine State, with expansion to new Northern Townships and continuing to maintain coverage in Southern Townships, and non-state areas particularly in Tanintharyi and Kayin), including reaching migrant and mobile populations with LLINs. The primary channel for LLIN distribution in Burma is through geographically focused, sub-national mass campaigns implemented on a rolling basis. PMI coordinates annually with the MOH and Global Fund on net quantities and distributes PMI LLINs in PMI-supported project areas to resident populations as well as migrant and mobile populations living in these areas. PMI estimates LLINs based on prior year's consumption and the quantities distributed by implementing partners who are working with marginalized populations mainly through workplace and outreach distribution channels. In addition, PMI will continue to monitor LLIN survivorship, attrition, and physical integrity monitoring in project areas.

Proposed activities with FY 2017 funding: (\$1,950,000)

- **Procurement of LLINs:** PMI will procure approximately 456,000 nets to fill LLIN gaps at the household level in endemic areas, targeting villages and Townships in the PMI implementation areas and those that are not supported under the current Global Fund agreement (e.g., southern Rakhine Townships and expansion to northern Rakhine Townships, non-state areas, potential expansion to new areas), including reaching migrant and mobile populations with LLINs. (\$1,500,000)
- **Community-level support for distribution, promotion, and use of LLINs:** PMI will support distribution and delivery of LLINs through mass distribution to reach households and migrant populations, SBCC to promote use of LLINs through trained village malaria volunteers. PMI will target ITN distribution to Townships in project areas depending on existing gaps and PMI resources. (\$450,000)
- **Net durability assessment:** PMI will continue to support the assessment of LLIN survivorship, attrition, physical integrity, and insecticidal activity monitoring in project areas. The assessment follows the basic PMI Guidance for Routine Monitoring of LLINs, with modifications to meet the specific needs of Burma. (no FY 2017 funding is allocated as this activity is forward funded for three years with previous years' funds)

2. Malaria in pregnancy

PMI supports a two-pronged approach to reduce the burden of malaria infection among pregnant women including provision of LLINs and effective case management of malaria, especially amongst the most vulnerable populations including migrant workers, refugees, and other hard-to-reach populations. Because of the low prevalence of malaria as measured nationally, IPTp is not part of any national strategy in the GMS, including Burma. However, since malaria transmission in Burma is highly heterogeneous, there are likely pockets of medium to high prevalence of malaria in pregnant women mirroring similar prevalence in adults. The NMCP strategy supports

free distribution of LLINs to all households in areas of high and moderate risk. Although LLINs have not traditionally been distributed through ANC in Burma, the new national strategic plan mentions ANC as a possible strategy for continuous distribution in order to improve access and ensure high LLIN coverage. According to the 2011-12 MARC survey conducted in the Tier 1 areas, the percentage of households with at least one ITN in Burma is 35% and LLIN use among pregnant women is 20%. In Burma, most pregnant women attend ANC at least once (80%) and most pregnant women complete the recommended four visits (73%).

Burma's national malaria treatment policies for pregnant women follow WHO recommendations: quinine is used in the first trimester (which may be combined with clindamycin) and ACTs in the second and third trimester (as stated in the national treatment guidelines). Treatment for severe malaria is with IV or IM artesunate. *P. vivax*-infected women should receive weekly chloroquine during pregnancy and radical cure after delivery. Given the existence of G6PD deficiency in Burma, the treatment policy recommends that when G6PD status is unknown and testing is not available, the treatment decision be based on assessment of risks and benefits of adding primaquine. There is no policy on screening asymptomatic pregnant women for malaria at ANC; only women displaying symptoms of malaria are routinely tested.

Data on the burden of MIP in the region is limited. A 2002 review of 17 studies on malaria during pregnancy in Burma reported a low prevalence of clinically suspected malaria among pregnant women (1-2% of total outpatient and inpatient burden). A separate 2005 study found that 11% of pregnant women attending ANC and 12% of all women delivering in Eastern Shan State and Mon State were infected with malaria. Data on the critical outcomes of maternal anemia, placental parasitemia, and low birth weight associated with malaria infection in pregnancy are not available for Burma. The states/regions reporting the highest incidence are Rakhine, Kachin, and Kayah. Wide variations in prevalence of malaria parasitemia in women attending ANC services were reported, ranging from 3% in Tanintharyi Division to 37% elsewhere along the Thai-Burma border, where the majority of women were asymptomatic and infected with *P. falciparum*. The role of female migrants may also be underestimated in the region; small studies conducted by PMI partners in Burma found that more than 50% of migrants in their catchment areas are women.

Progress since PMI was launched

With FY 2013 funding, PMI assisted the NMCP to update its policies especially for areas with confirmed artemisinin resistance, ensuring integration of MIP guidelines across relevant national programs (e.g. Maternal Health Program). With FY 2014 funding, PMI supported the development of a malaria module which addresses MIP as part of the national training for auxiliary midwives. PMI also supported the development of ethnically appropriate SBCC materials and messages directed to the prevention and early treatment-seeking for suspected cases of MIP for use by village malaria volunteers at the community level and nurse midwives at Rural Health Units.

A total of 4,008 pregnant women attending ANC services from October 2014 to September 2015 were tested with an RDT by a PMI implementing partner; of those, only three were malaria-

positive. However, when the same partner tested with an RDT over 230,317 people in the same period through its mobile outreach and community mobilization activities in project areas, including remote villages, it found a 6% prevalence among pregnant women (total tested was 1,382 of which 83 were positive for malaria) as compared to 2.2% prevalence among non-pregnant women of reproductive age (15-49 years, total women tested was 26,063 of which 585 were positive). It was concluded that screening through routine ANC was not an appropriate approach for detecting malaria infection among pregnant women, and that focusing instead on improved case finding and management by VMWs and enhanced surveillance by mobile outreach teams is a better approach.

Progress during the last 12-18 months

With FY 2015 funding, PMI supported an observational assessment of ANC services at 18 facilities in Yangon Region, Mon State and Kayin State to better understand what ANC services are offered and the extent to which MIP is addressed. Field data collection was completed and a draft report is pending review. Initial observations reported that midwives and ANC facility staff are not always consistently following correct case management practices for malaria during pregnancy.

The recommendations include support of a systematic approach to focused ANC with emphasis on history taking, physical examination and counselling as well as the need for additional training, both in-service training for midwives serving in medium to high endemic areas and pre-service training as part of a revised midwifery curriculum. To better understand malaria treatment-seeking practices and barriers to seeking antenatal care, PMI is also supporting a qualitative assessment among women of childbearing age (including pregnant women) in malaria-endemic villages among PMI target areas. An exploration of this issue will be conducted for women in both stable and migrant populations and will focus on differential malaria burden among pregnant women who do and do not seek care through ANC services.

Plans and justification

PMI will continue to support MIP activities in Burma to ensure that malaria and maternal health programs implement coordinated strategies and their guidelines, and supervision and training activities are consistent among both malaria and maternal health programs. With the MOH working to update existing policies and guidelines for all health services, this is also an opportunity to re-emphasize the partnership between NMCP and the Reproductive Health/Maternal and Child Health programs and ensure completeness and consistency among all policies and guidelines, and proper implementation of case management guidelines by midwives. PMI will also explore the feasibility of distributing LLINs through ANC with the NMCP including setting aside a portion of the LLINs procured with FY 2017 funds for ANC distribution in PMI-targeted areas (costs would be covered under the LLIN section).

Proposed activities with FY 2017 funding: (\$50,000)

- **Support for MIP coordination between Reproductive Health/Maternal and Child Health programs and the NMCP:** PMI will continue to support MIP efforts in Burma by ensuring coordination between Reproductive Health/Maternal and Child Health programs and the NMCP on policies and guidelines related to prevention and control of malaria during pregnancy. PMI will support efforts to coordinate with the national nurse and midwives association to ensure updated guidelines as well as pre-service and in-service training materials with correct case management guidelines are available and disseminated widely. Based on findings from the qualitative and quantitative assessments conducted at health facilities and in selected malaria-endemic villages, PMI will also support any recommendations, including measures to improve case detection and follow-up and ensure consistency in programming approaches between malaria and maternal health programs. (\$50,000)
- **Strengthen case management of malaria in pregnancy:** Support for training of facility health workers and VMWs in malaria diagnosis and treatment, including specific guidance on the treatment of malaria during pregnancy. (see Case Management section)

3. Case management

a. Diagnosis and treatment

NMCP/PMI objectives

The national malaria treatment policy, which was developed since 2002, was later updated in February 2008 with further revision in 2011. In April 2015, a workshop was convened to produce an updated version of the guidelines¹¹. Three ACTs, AL, DHA-Pip, and AS-MQ, are currently recommended for the treatment of *P. falciparum* cases along with a single dose of primaquine (0.75 mg/kg) prescribed on the first day without a prior G6PD deficiency test. The higher primaquine dose was national policy before the more recent WHO recommendation of the lower 0.25 mg/kg dose.

Artemisinin monotherapy use in both formal and informal sectors is strictly prohibited and has been banned. Adherence to the national malaria treatment policy among health care providers is not uniform in part due to approximately 50-60% of suspected malaria patients receiving treatment from the private sector¹². Treatment for *P. vivax* is chloroquine and primaquine for radical cure; however, there is a reluctance to use primaquine especially in the private sector, as well as poor adherence to the 14-day regimen. For severe malaria, parenteral artesunate is recommended. In addition, Burma is piloting in some areas DOT and enhanced follow-up to determine the proportion of patients with persistent parasitemia on Day 3.

¹¹ Guidelines for Malaria Diagnosis and Treatment in Myanmar. NMCP, Department of Public Health, MOH of Myanmar

¹² Preliminary results of the national Malaria Indicator Survey carried out in 2015

The national diagnostic policy is confirmatory testing with either microscopy or RDT before treatment for malaria is prescribed. In hospitals and higher-level health facilities, microscopy is the preferred diagnostic method. RDTs are being scaled up in lower-level facilities and at the community level through VMWs. Microscopy availability is limited primarily to townships. Records indicate that presently there are about 1,000 malaria microscopy centers nationwide, 330 of them located in township hospital laboratories: however, it is estimated that only about 60% are fully functional and their quality needs further strengthening.

Although diagnosis and treatment of malaria is free in the public sector, a significant proportion of persons with malaria-like symptoms first seek treatment from private sector providers, where diagnostic testing may not be available or may be of poor quality. DFID and other donors have supported the subsidized monotherapy replacement project that has been successful in reducing artemisinin monotherapy from many retail outlets. Rapid replacement of oral artemisinin monotherapy with Supa Arte®, a quality-assured and subsidized ACT, has occurred in the informal private sector with 1 million courses of Supa Arte® sold from January to October 2014.

Progress since PMI was launched

PMI has invested in improving diagnostic capacity through strengthening microscopy services as well as equipping and training community-level volunteers to utilize RDTs for parasitological confirmation. A diagnostic quality assurance system was updated in 2009, with training and technical support provided by WHO and ACTMalaria, but the quality of current microscopy testing is still inadequate.

Since the launch of PMI, 838,500 RDTs and 129,000 ACTs have been procured and distributed. PMI began supporting community-level malaria case management in 2011 in Tanintharyi and Kayin and since then has expanded to a total of 29 townships to also include villages in South Rakhine, Bago, and Kayah. To date, 1,264 VMWs are operational in 1,456 villages and work sites, providing free malaria case management services, including diagnostic testing.

In non-state actor areas, Back Pack Health Worker Teams have promoted increased access to health services for vulnerable populations in South-East Burma. Through mobile health teams, Back Pack Health Worker Teams provide primary health care including malaria diagnosis with RDTs and treatment with ACTs and community health education and prevention for internally-displaced persons and other vulnerable populations in conflict-affected and rural areas of Burma.

In the private sector, the Sun Quality Health Network operates a private sector social franchise of clinics and shops which has now scaled up to 863 general practitioners and over 2,057 primary health providers ensuring malaria diagnosis and treatment services in 193 and 87 townships, respectively. In 2014, approximately 400,000 RDTs and 35,000 ACTs were distributed through this network. In total, 325,034 suspected malaria cases were tested with RDTs and 15,571 were treated with ACTs. PMI supports 314 health providers in 17 township with training and supervision within this network.

Progress during the last 12-18 months

From October 2014 to September 2015, 572 VMWs and 725 health staff and laboratory technicians were trained/retrained in malaria diagnostics (RDT or microscopy), and 572 VMWs and 682 Basic Health Staff were trained/retrained in malaria case management. Through this large network of health providers, a total of 230,317 people were tested for malaria through different approaches (VMWs, screening points, mobile clinics, and intensified case detection), of which 7,843 people were found positive for malaria, 7,792 cases were treated, and 86 cases were referred to hospitals.

As part of PMI's support to quality assurance of malaria microscopy, a national five-day refresher training of 15 microscopists, led by a WHO-accredited microscopist, was organized in December 2015. Also in December 2015, a one-day workshop was organized with representatives from WHO, the NMCP, JICA, PMI and the CAP-Malaria project to discuss and coordinate the initiatives in support of malaria diagnosis quality assurance.

In 2015, PMI expanded support of the Sun Quality Health Network from 11 townships in Chin, Magway, South Shan, and Kayah to 17 townships in Chin, Magway, South-North-East Shan, Kayah, Sagaing, and Kachin, and an additional 20 doctors and 265 rural health workers were recruited and trained. From July 2014 to December 2015, 30,383 people were tested with RDTs and 522 cases were found positive for malaria. These confirmed malaria cases were treated according to the national malaria treatment guideline.

Commodity gap analysis

Table 20: RDT Gap Analysis

Calendar Year	2016	2017	2018
RDT Needs			
Total country population	52,452,950	52,977,480	53,507,255
Population at risk for malaria ¹	22,535,825	22,763,437	22,993,348
PMI-targeted at-risk population ²	1,000,000	1,500,000	3,000,000
Total number of projected fever cases ³	3,018,058	2,951,058	2,884,878
Percent of fever cases tested with an RDT	98%	98%	98%
Total RDT Needs	2,957,697	2,892,037	2,827,180
Partner Contributions (to PMI target population if not entire area at risk)			
RDTs carried over from previous year	0	40,215	0
RDTs from Government	0	0	0
RDTs from Global Fund	2,298,071	306,000	0
RDTs from other donors (3MDG, JICA)	399,841	398,582	27,735
RDTs planned with PMI funding	300,000	270,000	445,000
Total RDTs Available	2,997,912	1,014,797	472,735
Total RDT Surplus (Gap)	40,215	(1,877,240)	(2,354,445)
<p>Note: 3MDG and Global Fund's RAI have been extended through 2017, and Global Fund's NFM will end in December 2016. It is anticipated that the additional RDTs required to fill the current gaps will be contributed by a new four-year Global Fund grant, whose Concept Note has been already submitted for approval and is expected to start in January 2017.</p> <p>¹ Risk population is based on the census conducted in 2014 and the micro-stratification data estimated by NMCP in 2015 (see details in Table 15). Targeted population includes at-risk population in strata 3a, 3b, and 3c. Annual population growth rate (1.01%).</p> <p>² The yearly increase of the at-risk population targeted by PMI results from the gradual extension of the coverage to new areas, in particular 10 townships in North Rakhine.</p> <p>³ The estimation of fever cases is based on the fever case data provided by public health facilities, community-based services and collaborating private providers.</p>			

Table 21: ACT Gap Analysis

Calendar Year	2016	2017	2018
ACT Needs			
Total country population	52,452,950	52,977,480	53,507,255
Population at risk for malaria ¹	22,535,825	22,763,437	22,993,348
PMI-targeted at-risk population ²	1,000,000	1,500,000	3,000,000
Total projected number of malaria cases ³	136,839	102,630	76,973
Total ACT Needs⁴	91,423	73,397	54,997
Partner Contributions (to PMI target population if not entire area at risk)*			
ACTs carried over from previous year	0	17,040	0
ACTs from Government	0	0	0
ACTs from Global Fund	58,049	0	0
ACTs from other donors (3 MDG)	10,414	17,143	4,125
ACTs planned with PMI funding	40,000	20,000	40,000
Total ACTs Available	108,463	54,183	44,125
Total ACT Surplus (Gap)	17,040	(19,214)	(10,872)
<p>Note: 3MDG and Global Fund's RAI have been extended through 2017, and Global Fund's NFM will end in December 2016. It is anticipated that the additional ACTs required to fill the current gaps will be supported by a new four-year Global Fund grant, whose Concept Note has been already submitted for approval and is expected to start in January 2017.</p> <p>¹ Risk population is based on the census conducted in 2014 and the micro-stratification data estimated by NMCP in 2015 (see details in Table 15). Targeted population includes at-risk population in strata 3a, 3b, and 3c. Annual population growth rate (1.01%).</p> <p>² The yearly increase of the at-risk population targeted by PMI results from the gradual extension of the coverage to new areas, in particular 10 Townships in North Rakhine.</p> <p>³ 182,452 malaria cases were reported in 2015, and an average annual decrease of 25% is expected in the following years.</p> <p>⁴ It is assumed that on average 70% of malaria cases are <i>P. falciparum</i> and mixed infections requiring ACT treatment.</p>			

Plans and justification

Ensuring the availability of quality-assured diagnostics and antimalarials is critical to PMI programming. PMI will continue supporting scale-up of diagnostic testing and treatment at community and primary care levels, in the private sector, and in non-state areas through the provision of commodities, refresher training of existing laboratory staff and health workers in the

performance and use of malaria microscopy and RDTs, case management, and strengthening quality assurance systems in PMI-targeted areas.

Based on available consumption data from prior years of implementation in 29 townships and currently reported overstock of RDTs and ACTs at the national level due to overestimation of malaria burden, PMI will scale down the procurement of RDTs and antimalarials in these townships, but will remain vigilant and ready to fill critical gaps when supply chain or financial lapses impede their availability. As the malaria burden will eventually decline in many parts of Burma, PMI will assess feasible ways of integrating delivery of malaria services at community and health facility levels.

On the other hand, PMI is expecting to expand coverage to an additional ten townships with high malaria transmission in North Rakhine, resulting in an increased need for diagnostic and treatment commodities. Considering this heterogeneous and evolving epidemiological situation and variable impact of control efforts, a flexible approach tailored to the local context will be needed.

Proposed activities with FY 2017 funding: (\$4,212,000)

- **Procure RDTs and microscopy supplies.** PMI will procure approximately 445,000 RDTs and microscopy supplies for use by health facility and community based service providers. (\$330,000)
- **Procure antimalarials:** PMI will procure approximately 40,000 ACTs and other antimalarials for use by health facility and community-based service providers. (\$45,600)
- **Support strengthening of national diagnostics QA/QC system:** In coordination with other donors, PMI will provide technical assistance and training of key staff to improve the malaria diagnostic capacity at the central level and in PMI-targeted areas. (\$50,000)
- **Private sector quality assurance:** PMI will continue to strengthen diagnosis and case management among private providers identified in targeted areas as well as improve data reporting from the private sector. (\$250,000)
- **Enhance technical and operational capacity, promote community engagement, and ensure training and supervision of case management activities at facility and community levels in PMI-targeted areas:** Training and supervision of malaria case management through VMWs, rural health center staff, and auxiliary midwives, including delivery of integrated community case management, where appropriate. (\$3,536,400)

b. Therapeutic Efficacy Monitoring

NMCP/PMI objectives

Since 2012, the number of therapeutic efficacy monitoring sites in Burma has increased to eight (from three in 2009) and these are mainly focused in border areas. Therapeutic efficacy monitoring sites in Burma are assessing the efficacy of AL, DHA-Pip, and AS-MQ for the treatment of uncomplicated *P. falciparum* infections and of CQ for the treatment of *P. vivax* infections in eight sentinel sites on a rotating basis with half of the sites reporting results every two years, as well as monitoring for Day 3 parasitemia.

In 2014, new molecular methods were introduced into the routine monitoring of drug resistance, in addition to therapeutic efficacy monitoring. As a result, studies on the prevalence of mutations in the K13 propeller region of the *P. falciparum* genome were conducted in Burma.

Progress since PMI was launched

Cure rates with an ACPR ranging from 93% to 100% were seen in all therapeutic efficacy monitoring sites against *P. falciparum* with AL, DHA-Pip, and AS-MQ in the last seven years, as summarized in Table 22. Therapeutic efficacy monitoring results also show that CQ, the first-line treatment for *P. vivax* infection, is currently still effective, except in Kawthaung (Tanintharyi Region) where ACPR was only 70% in 2013.

Progress during the last 12-18 months

Recent studies¹³ based on multi-country analysis of the genetic mutations associated with artemisinin resistance have suggested that these mutations originated independently in multiple locations of Southeast Asia. Although these studies have detected a high prevalence of K13 mutants along both the China–Burma¹⁴ and the India–Burma¹⁵ borders, therapeutic efficacy monitoring results from both China and Burma do not show a clinical correlation between K13 mutations and treatment failures, and ACT efficacy remains high (Table 22).

¹³ Independent emergence of artemisinin resistance mutations among *P. falciparum* in Southeast Asia. *The Journal of Infectious Diseases* 2015; 211: 670–9

¹⁴ Artemisinin Resistance at the China-Myanmar Border and Association with 2 Mutations in the K13-propeller Gene. *Antimicrob. Agents Chemother.* Published Online 31 August 2015

¹⁵ Spread of artemisinin-resistant *Plasmodium falciparum* in Myanmar: a cross-sectional survey of the K13 molecular marker. *Lancet Infectious Disease*, 2015. Published Online 20 February 2015.

Table 22: PCR-corrected therapeutic efficacy results by drug, site, and year of study

Dihydroartemisinin-Piperaquine				
Year	Sentinel site (State-Region)	Cases enrolled	42-day ACPR	Day 3 Parasitemia
2009	Kawthaung (Tanintharyi)	79	97%	19.0%
	Shwe Kyin (Bago)	72	100%	4.0%
	Bago Region	72	100%	4.0%
2010	Rakhine State	80	100%	0.0%
	Mon State	75	99%	23.0%
	Myitkyina (Kachin)	57	98%	3.5%
	East-Shan State	51	100%	2.0%
2011	Kawthaung (Tanintharyi)	57	95%	23.0%
2012	Myawaddy (Kayin)	73	95%	8.0%
	Shwe Kyin (Bago)	40	98%	14.0%
2014	Tha Beik Kyin (Mandalay)	75	100%	0.0%
	Tamu (Sagaing)	75	95.8%	4.0%
	Buthidaung (Rakhine)	70	100%	0.0%
2015	Myawaddy (Kayin)	28	100%	21.0%
	Myitkyina (Kachin)	56	100%	0.0%
	Kyauk Me (North-Shan)	60	100%	0.0%
Artemether-Lumefantrine				
Year	Sentinel site (State-Region)	Cases enrolled	42-day ACPR	Day 3 Parasitemia
2009	Shwe Kyin (Bago)	86	98.8%	10.2%
	Kawthaung (Tanintharyi)	80	93.8%	6.3%
	Tamu (Sagaing)	73	98.6%	0.0%
2010 2011	Kawthaung (Tanintharyi)	84	94%	8.3%
	Myawaddy (Kayin)	66	97%	5.0%
	Rakhine State	70	100%	0.0%
	Myitkyina (Kachin)	59	100%	2.0%
	Kyaing Ton (East-Shan)	50	100%	2.0%
2012	Kalay-Tamu (Sagaing)	74	97.2%	5.4%
	Muse (North-Shan)	55	100%	7.3%
	Bamaw (Kachin State)	52	98%	3.9%
	Loikaw (Kayah)	51	96%	14.0%
	Myawaddy (Kayin)	59	97%	14.0%
	Shwekyin (Bago)	51	94%	6.0%
	Kawthaung (Tanintharyi)	58	100%	12.0%
2014	Buthidaung (Rakhine State)	72	100%	0.0%
	Tha Beik Kyin (Mandalay)	75	97.1%	2.6%
2015	Mawthaung (Tanintharyi)	28	93%	0.0%
	Myitkyina (Kachin)	54	96.3%	2.0%
	Kyauk Me (North-Shan)	58	96.5%	2.0%

Artesunate-Mefloquine				
Year	Sentinel site (State-Region)	Cases enrolled	42-day ACPR	Day 3 Parasitemia
2012	Kalay-Tamu (Sagaing)	74	98.6%	0.0%
	Muse (North-Shan)	45	100%	2.2%
	Bamaw (Kachin)	16	100%	0.0%
	Loikaw (Kayah)	16	98%	25.0%
	Kawthaung (Tanintharyi)	48	98%	9.0%

Plans and justification

The therapeutic efficacy monitoring network for monitoring antimalarial drug resistance has proved to be a successful and well-appreciated initiative in assisting national programs to update their national treatment policies and guidelines. PMI plans to continue support of therapeutic efficacy monitoring in Burma using standardized WHO protocols. Since 2016, the new ACT, artesunate-pyronaridine, has been included in the efficacy monitoring.

Proposed activities with FY 2017 funding: (\$220,000)

- **Support to therapeutic efficacy monitoring in Burma:** PMI will continue to support five in-country designated therapeutic efficacy monitoring sites (on a rotational basis), technical assistance from WHO TES Coordinator in Bangkok to support monitoring, and annual therapeutic efficacy monitoring meetings. (\$220,000)

c. Pharmaceutical management

NMCP/PMI objectives

Ensuring the availability and use of antimalarial medicines, diagnostics and preventive commodities is a high priority for the NMCP and PMI. Malaria health commodities are procured and distributed in Burma in three ways: through the VBDC; the Central Medical Store Depot (CMSD); and the various implementing partners.

The VBDC distributes laboratory supplies and antimalarial drugs to township hospitals and health departments throughout Burma. Additionally, it supplies sub-national VBDC teams located in states and regions. Township health departments then are responsible for the distribution to the station hospitals, rural health centers, and sub-rural health centers. The second system managed by the CMSD is within the Medical Care Services of the Department of Health. The CMSD purchases antimalarial drugs using government funds in consultation with the VBDC and then distributes them to all township hospitals and health departments.

Since 2002, UNICEF has supported Supply System Management Officers whose duty it is to strengthen the supply and logistics systems within the MOH. The USAID Mission is currently supporting a strategic review and assessment of the national supply chain system with the MOH and working at the national level to develop strategies for improved coordination among the

NMCP, Supply Chain Management Systems, donor agencies, NGOs and United Nations agencies on commodities management and logistics, but specifically focusing on HIV/AIDS products. PMI will coordinate with USAID's broader efforts while focusing on strengthening systems for malaria commodities. Coordination of commodities management among donors and partners is a critical area of support that is needed in Burma with vertical programs and projects.

The Global Fund grants (NFM and RAI) cover procurement and distribution of ACTs, RDTs, and other malaria medicines for the 284 malaria-endemic townships. VBDC provides malaria services in all 284 townships with support from other partners. Procurement for ACTs and other malaria medicines under the Global Fund is handled by the two Principal Recipients (Save the Children and UNOPS) for their sub-recipients. Initially, the 3MDG Fund imported malaria commodities on behalf of implementing partners; however, it scaled down this activity when the Global Fund expanded its support for malaria commodities.

Progress since PMI was launched

PMI support for pharmaceutical management and commodities to Burma primarily consists of monitoring availability of commodities (medicines, diagnostics, and LLINs) supplied through the Global Fund; facilitating procurement and distribution of PMI-funded commodities to fill gaps not addressed by the Global Fund grant; and providing commodities, targeted technical assistance, micro-planning, and/or logistics support as needed to support full coverage of malaria interventions in the target areas of Tanintharyi, Kayin, Rakhine, Kayah, and Bago.

Progress during the last 12-18 months

In FY 2014, following a national quantification exercise, the NMCP identified a large gap in moderate-risk areas (old strata 1b) under the Global Fund NFM. In response, PMI was able to procure 553,500 LLINs and assisted with the microplanning and distribution in 47 townships, which was successfully completed from July to December 2015. PMI recruited a supply chain consultant to assist with the lengthy importation process and coordinate with the NMCP, UNOPS, and other stakeholders for storage and coordination with freight forwarders in-country.

PMI also has been coordinating with the Supply Chain Management System and other supply chain partners in Burma through quarterly LMIS harmonization workshops to ensure standardization of forms and reporting. In addition, PMI participates in the quarterly partner's meetings on supply chain forecasting and planning exercises with the NMCP, UNOPS, WHO, and other stakeholders.

Plans and justification

To ensure availability of key commodities in PMI implementation areas as well as to respond to urgent requests from other areas, PMI will monitor and address potential bottlenecks in procurement and distribution of malaria commodities (including Global Fund-financed commodities). As with any transition period, there is potential for significant commodity gaps when the Global Fund's NFM and RAI come to an end in 2016. PMI will monitor the situation

closely and will be prepared to mobilize commodities as needed. Special attention will be paid to support community-level logistics to target cross-border migrants through the development of simple inventory tools, storage and transport boxes, etc. Due to the relatively nascent supply chain system in Burma, PMI will support a local technical advisor to work closely with the NMCP, MOH, and other stakeholders to address these critical supply chain issues.

Proposed activities with FY 2017 funding: (\$200,000)

- **Support for pharmaceutical management and logistics:** Technical assistance in supply chain management will be provided to Burma's MOH to strengthen coordination for malaria commodities (including pharmaceutical management systems, forecasting, quantification, management, and distribution of pharmaceuticals and RDTs). (\$200,000)

d. Drug quality

NMCP/PMI objectives

Given the large quantities and varieties of antimalarials available in the private sector and the high malaria burden in the country, Burma is considered to be vulnerable to the introduction and sale of counterfeit and substandard antimalarial drugs and artemisinin monotherapies. In 2009, WHO and United States Pharmacopeia found that most of the staff that had been trained to conduct drug quality testing were no longer present, nor were there adequate equipment and reagents. In addition, the national reference laboratory at the Food and Drug Administration (FDA) had only one high performance liquid chromatography machine and one refurbished dissolution machine; and it had no standards for registration of malaria medicines. The assessment also found that there was a severe need for equipment, supplies, and training at the national reference laboratory.

One of the specific objectives of the National Malaria Strategic Plan is to address counterfeit or substandard drugs and ban oral artemisinin monotherapy. The FDA is a key player in fulfilling this objective. The FDA takes responsibility in monitoring drug quality, banning monotherapy as well as upgrading its quality assurance laboratory and capacity building of inspectors. As FDA has stopped registration and renewal of any licenses of artemisinin monotherapy, all existing licenses of artemisinin monotherapy expired on December 2012. Furthermore, with support from the DFID-funded Artemisinin Monotherapy Replacement project, the availability of artemisinin monotherapies has significantly reduced and these products appear to have been withdrawn/phased out from markets. The FDA will reinforce its regulatory action to ensure monitoring for artesunate monotherapy as well as substandard and counterfeit antimalarials.

The FDA recently announced that it will strengthen its efforts to protect the country from substandard imported food, medicines, and cosmetics, and that it will also improve the standards of locally produced goods. The FDA currently has offices in Nay Pyi Taw, Yangon, and Mandalay with six other branch offices. With the increase in budget and staff, the FDA plans to establish branch offices in 14 districts and to set up laboratories at 14 more border trade zones

over the next three years. Moreover, FDA procured high-level drug quality testing equipment for central-level laboratory and Minilabs® for the state/regional offices.

Similar to the vision of the FDA, PMI has a focus on monitoring quality of antimalarial drugs in Burma. When PMI expanded its commitment to Mekong countries in 2011, PMI supported monitoring the quality of antimalarial drugs and building country capacity to curtail the availability of substandard or counterfeit drugs. In support of the NSP, PMI works closely with the NMCP, FDA, and other key stakeholders to implement this effectively.

Progress since PMI was launched

PMI is supporting efforts in Burma to collect information on the country's medicine QA/QC systems that are intended to ensure quality of antimalarial medications passing through the public and private supply chain. Sentinel survey protocols were developed and trainings were held on the use of the Minilabs® for field-based testing of medicines collected from a wide variety of venues. Additional staff from the national FDA laboratories in Nay Pyi Taw and Mandalay were trained on compendia testing methods so that they could conduct confirmatory testing of medicines suspected of being falsified. PMI has supported efforts to build capacity in-country through training and provision of technical assistance and has supported the establishment of five sentinel sites for drug quality testing. In addition, PMI has procured essential equipment including a dissolution tester, a high performance liquid chromatography system, and other necessary laboratory and personal safety supplies for use by the FDA laboratories.

Progress during the last 12-18 months

With FY 2015 and FY 2016 funding, PMI is supporting technical assistance to the national FDA laboratory in Nay Pyi Taw; this support ranges from the introduction of safety equipment, conducting advanced analytical training, implementing a quality assurance framework, and completing an assessment of the laboratory encompassing standards of the ISO/IEC 17025.

Plans and justification

PMI is supporting efforts to establish a proper and functioning quality management system in the national FDA laboratory and strengthen technical capacity through advanced analytical training. With these components in place, PMI will support the FDA's participation in proficiency testing and in identifying the accreditation body for ISO/IEC 17025.

With FDA having no experience in designing and configuring the layout of laboratories suitable to achieve ISO 17025 status, PMI's support will be highly beneficial for FDA as it also pursues ISO 17025 accreditation of the Yangon and Mandalay laboratories after the accreditation of the Nay Pyi Taw laboratory.

Proposed activities with FY 2017 funding: (\$200,000)

- **Drug quality assurance:** Technical assistance will be provided to the national FDA laboratory to meet international standards of practices, to attain ISO 17025 accreditation by 2017, and to maintain the certification status. (\$200,000)

4. Health system strengthening and capacity building

NMCP/PMI objectives

The new NSP strategy focuses on rebuilding the NMCP's health workforce with different skill sets to improve management at various levels of field operations. Additionally, it aims to improve health staff capacity in 284 malaria-endemic townships on planning, implementation, and M&E of malaria control activities. These efforts will be supplemented with a strengthened HMIS, evidence-based planning, research and policy development, and increasing access to malaria commodities such as LLINs, quality drugs, and diagnostics.

The Government of Burma recently created a Department of Public Health under the Ministry of Health which will require an increased public health workforce with additional skills over the coming years. The International Field Epidemiology Training Program (IFETP) in Thailand has graduated a number of trainees from Burma, and is appreciated by both the NMCP as well as the MOH's Department of Epidemiology. This success has led to the MOH specifically requesting for a national FETP course, which will also help strengthen epidemiological skills across diseases. There is a high level of interest and need for this type of in-country capacity building support as the MOH has committed to increasing the number of public health staff, and PMI will aim to continue to strengthen this collaboration.

The NMCP has taken a leadership role in improving key components of the health system with the collaborative support of development partners. As part of the effort to improve the technical capability and quality of health services, the NMCP has set up a series of trainings on malaria prevention, case management, commodities management, program planning and development, and community mobilization. Over the years, the NMCP has trained its key staff at different levels including basic health staff, microscopists, and health care personnel from hospitals, general practitioners and volunteers with the financial and technical support of UNICEF, JICA, and WHO. Later, these efforts were scaled up with the support of PMI, 3DF, 3MDG Fund, and the Global Fund. PMI collaborates closely with NMCP leadership to achieve the goals of a stronger health workforce, strengthened quality health services, reliable health information, and continuous availability of essential medical products.

Progress to strengthen the malaria surveillance system is underway. The NMCP has standardized case report forms and made an effort to improve data collection at all levels. Systematic data collection and data transmission have been reinforced over the year through training of NMCP staff as well as basic health staff and provision of computers. Based on the findings of a PMI-supported assessment on the country's surveillance situation in 2013, an implementation plan

was drafted to improve the malaria surveillance system. In consultation with the NMCP, PMI supported the development of an electronic database management system and a field test to generate quality and comprehensive data for better planning of malaria control activities. To date, this database system has been scaled up to 106 target townships.

Progress since PMI was launched

Since 2012, PMI has supported training and capacity building for NMCP staff on specific technical areas on an annual basis such as field epidemiology, malaria field operations management, quality assurance for laboratory diagnostic services, and drug quality testing.

Progress during the last 12-18 months

PMI continues to support participation of NMCP staff in the IFETP, which began with FY 2013 funding and continued in subsequent fiscal years. Two NMCP staff have completed the IFETP training in 2015, with one staff returning to Burma and the other pursuing a MPH degree expected to complete in 2016. Three additional NMCP staff have participated in IFETP training since 2014 (2 in 2014 and 1 in 2015), for a total of five IFETP trainees since FY 2013.

In FY 2014, PMI provided technical assistance to the Department of Health on the development of an in-country six-month FETP training course to support long-term capacity building, targeted at different levels of field staff to strengthen capacity on data collection and epidemiological analysis. In FY 2015, PMI provided training assistance by sending two CDC Atlanta epidemiologists to lead a two-week course.

The PMI-supported routine monitoring of antimalarial drug efficacy has served as a platform for strengthening in-country research capacity. The NMCP has updated the “National Malaria Treatment Guideline” based on the results of these efforts. Moreover, the information gathered from therapeutic efficacy monitoring contributed to resource prioritization for effective malaria interventions.

Plans and justification

Recognizing that human capacity is lacking in Burma and well-trained staff are critical for successful malaria control and eventual elimination, PMI will continue to support Burma NMCP staff to participate in the IFETP. In addition, PMI will continue to support the building of in-country capacity for data collection and epidemiology by training NMCP staff responsible for malaria control activities in the field through short technical training courses. In order to build more malaria management and field operations capacity, PMI will adapt the regional MMFO course to the local needs and develop an in-country course.

Proposed activities with FY 2017 funding: (\$340,000)

- **International Field Epidemiology Training Program (IFETP):** PMI will support two Burmese fellows to participate in the IFETP in Bangkok, Thailand. (\$150,000)

- **In-country FETP:** PMI will support building epidemiology and surveillance capacity for state and regional level NMCP staff through participation in a six-month in-country FETP course. (\$100,000)
- **Technical assistance for in-country FETP:** PMI will provide technical assistance through CDC TDYs for the curriculum development and on-site support for the in-country FETP course. (\$40,000)
- **In-country MMFO course:** The regional MMFO training course coordinated by ACTMalaria will be adapted for mid-level managers from selected regions/states and townships. It will focus on malaria program management skills and basic malariology for the cadre of new Township malaria managers. (\$50,000)

Table 23: Health Systems Strengthening Activities

HSS Building Block	Technical Area	Description of Activity
Health Services	Case Management, Behavior Change Communication	PMI supports training and supervision of malaria case management to improve malaria services provided by VMWs, community health workers, rural health center staff, and auxiliary midwives. PMI has supported the development of standard operating procedures on quality assurance of diagnostics and will continue to support the implementation of these procedures as well as field practices, training and accreditation of malaria microscopists, and establishment of a national slide bank. PMI is also supporting health systems strengthening by expanding coverage and availability of malaria commodities, and creating demand for services through community health education, SBCC, and VMW networks in hard-to-reach areas and to reach at-risk, vulnerable mobile/migrant populations.
Health Workforce	Health Systems, Capacity Building	The Ministry of Health has recently created a Department of Public Health, where the NMCP is housed, to provide focused leadership and technical guidance on public health activities in the country. PMI will support the Ministry of Health in building the capacity of its technical staff and health workforce on program management and development. This includes support of two-year long-term international fellowships and a six-month in-country short course on field epidemiology for key NMCP central- and field-level staff. The training

		will help improve epidemiology skills and capacities at different levels of program management staff for malaria control. PMI will also support the development of an in-country malaria managers field operations training course adapted from the regional course for mid-level managers from selected regions/states and townships.
Health Information	Monitoring & Evaluation, Surveillance, Operational Research	PMI supports strengthening the health information management system through strengthening the malaria surveillance system. PMI will provide technical assistance to the NMCP and supporting surveillance systems in all sectors (public, private, community). The implementation plan will include scaling up an electronic database system; supporting NMCP capacity for data management and use; and supporting national M&E plan development. These processes will enable the NMCP to transition its implementation from malaria control to elimination in the future. PMI is also contributing towards building in-country research capacity through routine monitoring of the efficacy of antimalarial drugs in ten sentinel sites and through the recent study to evaluate the acceptability and feasibility of using insecticide-treated clothing in Mon State.
Essential Medical Products, Vaccines, and Technologies	Pharmaceutical Management & Logistics, Case Management	PMI will provide technical assistance in supply chain management to the NMCP and strengthen coordination of malaria commodities (including the pharmaceutical management system, forecasting, quantification, management, and distribution of pharmaceuticals and RDTs). PMI is also strengthening the national quality control laboratories for malaria in order to improve the quality of health services and build the capacity of health laboratory workforce.
Leadership and Governance	Health Systems Strengthening, Capacity Building	PMI will continue to support the coordination among NMCP and development partners to harmonize the strategic efforts in responding to artemisinin resistance in Burma, including participation and technical support for the malaria Technical Steering Group and its technical workstreams. PMI's technical assistance to the NMCP will closely align with national strategies and national responses.

5. Social and behavior change communication

NMCP/PMI objectives

The NMCP, in collaboration with WHO and in consultation with agencies working in malaria control, previously developed a “Communication and Social Mobilization for Malaria Prevention and Control in Burma.” This document has served as the framework for SBCC activities since 2007. The current NMCP Strategy (2010-2016) recognizes the need for a malaria communication and social mobilization plan with a budget, human resource requirements, and implementation strategies. The new draft NSP (2016-2020), aiming to intensify malaria control and accelerate progress towards elimination, calls for “empowering at-risk populations by ensuring they understand the disease through culturally-appropriate and gender-sensitive communication” and “creating mass awareness through IEC/SBCC,” as key activities in its strategy.

Burma’s NSP places priority on educating and raising awareness of the target population for malaria prevention and control. With the increased availability of LLINs, RDTs, and ACTs at the health facility and community levels, SBCC activities are relied on to motivate targeted at-risk populations to access and utilize these interventions. A cadre of VMWs supports IPCs on prevention and promotion activities as well as treatment compliance counseling at the community level (at least one VMW per village). Special high-risk populations targeted with SBCC messages include local forest dweller residents, new settlers, internal and external migrant workers, and people crossing national border areas. Key behaviors to target include use of ITNs, prompt diagnosis and treatment of fever, adherence to treatments, and avoidance of monotherapies and counterfeit drugs. One of the challenges for SBCC activities is the more than 135 ethnic groups speaking more than 100 languages and dialects, traditional beliefs related to causes of and remedies for malaria, and mobility of key target groups. A formal SBCC workgroup has not yet been established at the national level; however, SBCC efforts are discussed in the TSG within the Program Implementation working group. SBCC activities implemented through PMI partners are aligned with the national strategy, and support efforts at the national, as well as the township and community levels.

Progress since PMI was launched

During the last two decades, the MOH and partners have trained about 40,000 community health workers in Burma. It is estimated that 50% of these community health workers are still active. They are volunteers and are trained in health education; they treat minor illnesses and assist in the control of various infectious diseases. Among these volunteers are auxiliary midwives who are trained for deliveries and VMWs who are the mainstay of malaria control activities at the village level. PMI supports SBCC efforts through 1,264 VMWs based in 29 townships in Tanintharyi, Kayin, and southern Rakhine regions. PMI conducted advocacy meetings to sensitize the health and administrative officials from state, township, and village levels on the malaria situation and project plans.

In Kayin State, local Karen ethnic groups benefitted from established community-based malaria interventions and community health worker networks that are integrated within the existing local health structure. These Community Health Groups support the work of trained VMWs. Besides administering RDTs and case management, the VMWs have been trained on community mobilization strategies, education sessions, and use of communication tools.

In Tanintharyi Region, target populations included local residents as well as large and small groups of internal migrants working in agricultural plantations and at the Dawei Deep Seaport Project. Mobile malaria education and clinic teams also conduct malaria prevention outreach campaigns with screening and treatment of febrile patients. PMI partners also work with private sector employers to strengthen and improve their malaria services, provide LLINs, and promote awareness among their temporary and seasonal migrant workers.

In southern Rakhine State, PMI supported malaria control efforts in seven townships, reaching local residents in rural, remote villages with malaria interventions (LLINs, RDTs, and ACTs) through trained VMWs. A number of construction projects have attracted migrant workers from other regions and states within Burma (including non-endemic areas) who are working for extended periods of time in Rakhine and living in temporary migrant camps. PMI targets mobile malaria outreach activities to these migrant workers and their families with SBCC sessions, provides screening for malaria and treating identified cases, and distributes LLINs to new migrants.

PMI has supported the training of 1,264 VMWs in effective case management of malaria and conducting SBCC sessions. With FY 2014 funding, PMI reached 284,220 people, including 25,636 MMPs, with SBCC messages and IPC provided by trained VMWs, mobile malaria teams, and private providers.

PMI also collaborated with WHO on an SBCC assessment conducted in 2015 along the Burma-Thailand and Cambodia-Thailand borders as well as in Lao PDR to better understand progress to date and identify remaining gaps to strengthen SBCC efforts. The assessment reviewed national SBCC strategies and guidelines; the quality and availability of SBCC training and materials; existing approaches, messages, tools and job aids being disseminated and utilized on the ground by different projects, and the extent to which the target mobile/migrant populations and local residents are being reached. The report found that while the majority of respondents knew about the cause of malaria and malaria prevention methods, there was a notable difference between sites and population groups, with respondents from Burma and Lao PDR appearing to have more misconceptions regarding malaria than people in Thailand and Cambodia. Common misconceptions regarding the causes of malaria included drinking unclean or unboiled water, swimming in streams, eating unclean food or being tired. An overwhelming majority of respondents mentioned that IPC and health education sessions remain the most preferred, trusted, and effective form of communication. The majority of participants wanted to receive malaria messages through health staff, doctors, and village volunteers. The report provided recommendations on how SBCC activities can be strengthened, delivered more effectively, and messages harmonized within and among the four countries, as well as providing country-specific recommendations. For Burma, the report recommended the development of a National SBCC

Strategy to address current gaps in coverage, allow for strategic and systematic responses at operational level, define national M&E indicators, and help programs in reaching ethnic minorities and internally-displaced populations with targeted SBCC messages.

Progress during the last 12-18 months

With FY 2015 funding, PMI reached 184,944 people, including 35,822 MMPs, with SBCC messages and IPC provided by trained VMWs, mobile malaria teams, and private providers. In addition, PMI partners distributed 380,405 pamphlets and 2,134 posters with malaria prevention and control messages.

Preliminary results from the 2015 MIS conducted in 145 villages across Burma during the high transmission season, showed overall limited knowledge among the population surveyed about malaria transmission. For example, among residents and migrant populations surveyed, 59% of resident respondents named mosquitoes as a cause of malaria; however, only 34% of respondents in hard-to-reach areas correctly identified mosquitoes as the cause of malaria. Interestingly, only 4% of residents and migrants in all domains identified ITNs as a prevention method for malaria. The final MIS report will be made available in late 2016; these early results indicate a need for enhanced awareness and knowledge about malaria and prevention methods among both resident and migrant populations.

Plans and justification

PMI supports the NMCP strategy of aiming to have at least one village health worker per village in all malaria-endemic villages in Burma. Emphasis will be given to interpersonal and group communication comprising up to 70% of SBCC efforts. Support will include training and dissemination of already developed SBCC materials on malaria prevention, accurate diagnosis, and prompt and effective treatment. The costs of the distribution and LLIN promotion include SBCC activities to augment malaria prevention efforts implemented by community health/malaria volunteers in the target areas and engaging community members and networks, including employers of migrant and forest workers. PMI will also support routine LLIN monitoring post-distribution by village health workers to reinforce SBCC messages on LLIN use. Furthermore, PMI will plan to support the NMCP in updating its national SBCC strategy.

Proposed activities with FY 2017 funding: (\$200,000)

- **SBCC for malaria control and prevention interventions:** PMI will support continued efforts to standardize, harmonize, and disseminate key SBCC materials and messages at the community level and strengthen IPC approaches through VMWs and private providers. Based on the preliminary findings from the 2015 MIS, PMI will support development and implementation of effective SBCC approaches, in particular through IPCs and community engagement with VMWs. Careful consideration will be given to special and high-risk target groups using SBCC approaches focused on improving knowledge about malaria transmission, coverage and use of malaria prevention measures (e.g., LLINs), and increasing awareness of MIP, dangers of counterfeit drugs, as well as

prompt diagnosis and effective treatment. PMI will also support efforts to develop a national SBCC strategy with the NMCP and partners. (\$200,000)

6. Surveillance, monitoring, and evaluation

NMCP/PMI objectives

A new five-year, 2016-2020, National Strategic Plan for Intensifying Malaria Control and Accelerating Progress towards Malaria Elimination is currently being drafted. The ultimate goal of the new NSP is malaria elimination from Burma by 2030 and the elimination of *P. falciparum* malaria by 2025. A key intervention prioritized by the new NSP is the improvement of the malaria surveillance system, which will be adapted to the transmission-reduction and elimination phases. For this purpose, guidelines will be revised, new staff will be recruited, training will be conducted, and supervision enhanced.

The current malaria surveillance system involves basic health staff submitting monthly reports to their respective Township Health Department, which then forwards the report to the state/regional VBDC office. The state/regional VBDC team then analyzes the data on a quarterly basis and sends feedback to the township level. This system is paper-based, well designed, appropriate for the capacity of the health staff, and works well at lower levels of the health system (states/regions, townships, and villages). However, challenges arise when this large amount of data, entered in Excel® spreadsheets, needs to be managed, analyzed, and reported at the central level. In addition, since the central-level system does not capture village information for malaria cases, it is not presently possible to disaggregate malaria data below the township level. Furthermore, the current system does not effectively or routinely capture information from the private sector and NGOs.

Progress since PMI was launched

The first national census in 20 years was completed in April 2014; it has provided the sampling frame for the Demographic Health Survey (DHS). With USAID's support, this is the first DHS ever to be conducted in Burma. The collection of field data for the DHS started in December 2015 and has now been completed; preliminary results are expected by December 2016. It will provide key indicators for population, health, and nutrition, and will serve to help identify the critical needs in health for the country, as well as a nationally representative baseline to measure and monitor progress. The DHS will not collect malaria biomarkers, however, input has been provided to adapt the standard malaria module to the Burmese context.

Following an assessment of the malaria surveillance system in Burma, carried out by Malaria Consortium in May 2013 with PMI funds, an implementation plan was developed in February 2014 in consultation with the NMCP. A four-pronged approach with both short- and long-term goals was developed:

1. Improving the management, processing, and analysis of malaria data through implementation of an Access® database to replace the current system of Excel® spreadsheets;
2. Improving the information technology infrastructure in the NMCP and staff capacity at all levels to manage, secure, and share data;
3. Harmonizing VMW reporting systems to maximize data quality, coverage, and completeness through standardized volunteer reporting systems and standard operating procedures;
4. Using mHealth approaches to develop appropriate mechanisms to detect and respond to malaria cases in real-time and respond to emergency stockouts of key commodities using a suite of mHealth tools.

In recent years, attempts to improve the electronic data management system with a new, appropriate, and sustainable platform have been supported by several donors (the Global Fund, JICA, PMI, CHAI, and recently the ADB). PMI has supported work to transition away from Excel® spreadsheets towards an Access® database at the central level.

Surveillance, monitoring, and evaluation (SM&E) coordination at the national level is managed through an SM&E Working Group under the TSG. The TSG has not been convening regularly; however, the M&E Working Group has convened *ad hoc* meetings. Both PMI staff and implementing partners are active members.

Progress during the last 12-18 months

In 2015, the first-ever national MIS in Burma was carried in collaboration with the NMCP with PMI and 3MDG co-funding. The survey protocol was approved by the Ethical Review Committee in June. One hundred eighty enumerators, supervisors, and blood collectors were trained in the first two weeks of August. The survey fieldwork was carried out during 11 weeks, from August 17 to October 31: 4,371 households were interviewed (target was 4,495), 13,484 blood samples were collected for PCR and serology analysis, and 13,591 people were tested for malaria infection with an RDT. Preliminary results of the MIS are expected in May 2016.

Since March 2015, a database manager has been placed in Nay Pyi Taw to support the NMCP on data management and analysis. The national plan is to eventually migrate the content of the Access® database to a comprehensive nationwide DHIS-2 platform as the latter becomes more widely deployed, and internet connectivity more widely available. It will allow management and mapping of village-level malaria data and reduce the need for data manipulation at the higher levels. Additionally, this will empower townships to more easily analyze and use their data and to prioritize interventions.

Table 24: Surveillance, Monitoring, and Evaluation Data Sources

Data Source	Survey Activities	Year								
		2010	2011	2012	2013	2014	2015	2016	2017	2018
Household surveys	Demographic Health Survey (DHS)						X*	X*		
	Malaria Indicator Survey (MIS)			X* Sub-national MARC areas			X			
	National census					X*				
Health facility and other surveys	Health facility survey						X* SARA			
Malaria surveillance and routine system support	Support to malaria surveillance system					X	X	X	(X)	(X)
	Support to HMIS					X	X	X	(X)	(X)
Therapeutic efficacy monitoring	<i>In vivo</i> efficacy testing	X	X	X	X	X	X	X	(X)	(X)
Entomology	Entomological surveillance and resistance monitoring				X	X	X	X	(X)	(X)

*Not PMI-funded

Table 25: Routine Surveillance Indicators

Indicators	Value in 2015	Comments
Total number of reported malaria cases Data source: NMCP and Implementing Partners		
Total diagnostically confirmed cases	182,452	Only cases reported in the public sector and by volunteers supported by NMCP and implementing partners
Total clinical/presumed/unconfirmed cases	N/A	Since 2012 only confirmed cases are reported
<i>If available, report separately for outpatients and inpatients</i>		
Outpatient number of reported malaria cases	N/A	
Diagnostically confirmed	N/A	
Clinical/presumed/unconfirmed	N/A	
Inpatient number of reported malaria cases	N/A	
Diagnostically confirmed	N/A	
Clinical/presumed/ unconfirmed	N/A	
Total number of reported malaria deaths		
Diagnostically confirmed	37	
Clinical/presumed/ unconfirmed	N/A	
Malaria test positivity rate (outpatients) Data source: NMCP and implementing partners	Less than 10% nationwide	
Numerator: Number of outpatient confirmed malaria cases	170,170	
Denominator: Number of outpatients receiving a diagnostic test for malaria (RDT or microscopy)	2,957,700	
Completeness of monthly health facility reporting		
Numerator: Number of monthly reports received from health facilities	N/A	
Denominator: Number of health facility reports expected (i.e., number of facilities expected to report multiplied by the number of months considered)	N/A	

Plans and justification

Malaria SM&E in Burma remains fragmented, particularly between implementing partners and the national program. A comprehensive and responsive surveillance system will be critical as the NMCP continues to scale up activities across the country and moves towards the goal of case-based reporting, case investigation, and response.

The use of an Access® database for capturing malaria case data will need to continue to ensure uninterrupted surveillance data collection by the national program. Once the DHIS-2 platform becomes widely available, data from the Access® database can be imported to ensure complete historical malaria data. Currently DHIS-2 is functional in only a small part of the country, but the plan is for a phased roll-out based on the initial pilot experience supported by the 3MDG Fund using maternal and child health data.

PMI, in collaboration with other stakeholders, will continue to support strengthening of SM&E in Burma, particularly integration of malaria data from NGOs and the private sector, into one comprehensive national malaria information system. As described earlier (see Case Management section), PMI has supported the expansion of the Sun Quality Health Network of the private sector to provide quality malaria diagnosis and treatment services. PMI will emphasize integration of data reporting and use from these private sector health providers with the national surveillance system.

Burma's current M&E systems are not set up to provide timely and complete information from the periphery. Much of the data available at lower levels are paper-based and timely compilation is a major challenge. With the roll-out of DHIS-2 and eventual integration of malaria data into DHIS-2, high quality surveillance data need for elimination activities should be more readily available.

Proposed activities with FY 2017 funding: (\$750,000)

- **Support for M&E activities and surveillance strengthening:** Technical assistance will be provided to strengthen routine surveillance systems at national, state/region and township levels towards a comprehensive, integrated system that includes data from public, private, and community sectors. PMI will continue support of the transition to a national web-based system and ensure that malaria surveillance data are complete and timely, and historical data will be imported into the new system. PMI will continue to support the National M&E Plan development and assist in the identification of NMCP SM&E needs to move from control to elimination. Supported activities include updating data collection and reporting forms, trainings for M&E, data quality assurance, etc. There may be instances where computers and hardware might be required at small scale, but PMI does not anticipate supporting IT infrastructure. (\$300,000)
- **Surveillance, monitoring, and evaluation in PMI-targeted areas:** PMI will require a robust SM&E system to monitor progress in the PMI-targeted areas for eventual malaria elimination, specifically in the 33 townships in 3 regions (Rakhine, Tanintharyi, and Kayin) where the new bilateral project will be operating. The expansion areas for enhanced M&E will likely be Tanintharyi and possibly Kayin where PMI has been working. Northern Rakhine, where the new project is anticipated to expand to and where the burden of malaria is high, will likely require more resources and effort in terms of SM&E systems strengthening. Activities will include focus on piloting and implementing improved data collection systems, data quality audits, and use of strategic information in the PMI-targeted

areas to inform areas for program improvement. There will also be an increased focus on identifying every single case (case tracking), reactive case detection, and tracking of migrant workers in low transmission areas. Mobile phone technology will be piloted to assess its utility with real-time surveillance. However, mobile phone-based systems are not meant to replace routine surveillance systems and implementation will be targeted based on need (e.g., in areas without internet access but with mobile phone coverage) and PMI will carefully monitor the cost. (\$450,000)

7. Operational research

Table 26: PMI-funded Operational Research Studies

Completed OR Studies			
Title	Start date	End date	Budget
Preference and acceptability of permethrin insecticide-treated clothing in Mon State	February 2015	September 2015	\$127,500
Ongoing OR Studies	Start date	End date	Budget
Title			
N/A			
Planned OR Studies FY 2017			
Title	Start date (est.)	End date (est.)	Budget
N/A			

NMCP/PMI objectives

The new NSP includes the following specific OR topics: Adherence to treatment guidelines by health care providers and patients; New diagnostic technologies; New antimalarial drugs; Validation of G6PD test kit used at community level; Gender-related dynamics of treatment-seeking behavior; New vector control methods including Insecticide-treated clothing and spatial repellents; Attractive toxic sugar baits; Larval Source Management; Spatial repellents; The role of sub-patent asymptomatic parasitemia in malaria transmission; Remote sensing to assess risk for difficult-to-reach populations; Barriers to access for high-risk groups; mHealth applications (mobile apps for health). The NMCP plans to review research priorities annually and revise them as necessary.

Progress since PMI was launched

Along with other development partners, PMI has procured a significant number of LLINs in Burma. However, personal protection against outdoor transmission has not been adequately addressed by the national program. PMI has focused its OR support thus far on evaluating

additional personal protection measures to address outdoor transmission e.g. the occupational use of insecticide-treated clothing.

Progress during the last 12-18 months

Over the past 12 months, a PMI-funded study to evaluate the acceptability and feasibility of using insecticide-treated clothing amongst rubber tappers in Mon State was conducted. Preliminary findings suggest acceptability of insecticide-treated clothing was very high with no significant difference between the insecticide-treated and non-treated clothing arms. Ninety four percent of respondents in both arms reported liking the clothing overall, and perceived the clothing to reduce mosquito bites (92.1%), to provide warmth (91.6%), to be pleasant to wear for nighttime work (95.6%), to be easy to clean (92.1%), and to be comfortable (93.8%). Preliminary results suggested that protective efficacy of the used insecticide-treated clothing was lower than expected. Percentage knock-down of *An. dirus* on worn insecticide-treated clothing was 17.3% compared to 0% on worn non-treated clothing, over 28 days of high usage and washing ($p < 0.01$). Mortality was also very low (1.3% mortality of *An. dirus* for worn insecticide-treated clothing).

Plans and justification

PMI will support OR as key programmatic questions arise.

Proposed activities with FY 2017 funding: (\$0)

There are no proposed OR activities with FY 2017 funding.

8. Staffing and administration

One health professional serves as the Resident Advisor to oversee PMI in Burma, representing USAID. In addition, one FSN works as part of the PMI team. All PMI staff members are part of a single inter-agency team 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.

The 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 PMI Resident Advisor, from USAID, reports to the Senior USAID Health Officer for day-to-day leadership. The technical

expertise housed in Atlanta and Washington guides PMI programmatic efforts and thus overall technical guidance for the RA falls to the PMI staff in Bangkok, Atlanta, and Washington.

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 NMCPs 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 USG Global Malaria Coordinator.

Proposed activities with FY 2017 funding: (\$730,000)

- Support for USAID/PMI Resident Advisor (including 100% FSN and in-country support, administrative costs). (\$700,000)
- Travel cost support for RDMA staff. (\$30,000)

Table 1: Budget Breakdown by Mechanism

**President's Malaria Initiative – *Burma*
Planned Malaria Obligations for FY 2017**

Mechanism	Geographic Area	Activity	Budget (\$)	%
Global Health Supply Chain - PSM	Target areas	Procurement of LLINs, RDTs, and ACTs, supply chain strengthening.	\$2,075,600	23%
WHO Umbrella Grant	National	Conduct TES to inform treatment policy, support strengthening national/subnational QA/QC for malaria diagnosis.	\$320,000	4%
CDC IAA	National	Technical support for entomology (four TDYs) and FETP (four TDYs), support two Burmese fellows to participate in international FETP.	\$248,000	3%
Defeat Malaria	Target areas	a) case management at the community level, including implementation, training and supervision; b) strengthening national/subnational QA/QC for malaria diagnosis, c) diagnosis and case management in the private sector, d) support in-country FETP short course implementation, e) SBCC for malaria control and prevention interventions, f) surveillance and M&E strengthening at national level and target areas, g) distribution of LLINs.	\$5,426,400	60%
USP/PQM	National	Technical assistance for FDA laboratory accreditation.	\$200,000	2%
USAID	National	Salary costs for one Resident Advisor and Foreign Service National, administrative and program costs, and travel costs for RDMA-based staff.	\$730,000	8%
Total			\$9,000,000	100%

Table 2: Budget Breakdown by Activity

**President's Malaria Initiative - *Burma*
Planned Malaria Obligations for FY 2017**

Proposed Activity	Mechanism	Budget (\$)		Geographic Area	Description
		Total	Commodity		
PREVENTIVE ACTIVITIES					
VECTOR MONITORING AND CONTROL					
Entomological monitoring and insecticide resistance management					
Entomological surveillance (basic package)	Defeat Malaria Project	\$90,000		Sentinel sites	Support for entomological monitoring in selected sites in the field; insectary support in Rangoon (in collaboration with JICA/VBDC) and entomology laboratory.
Technical support for entomology	CDC IAA	\$58,000		Sentinel sites	Four TDYs for entomologic support.
SUBTOTAL ENTO MONITORING		\$148,000	\$0		
Insecticide-treated Nets					
Procurement of LLINs	GHSC- PSM	\$1,500,000	\$1,500,000	Target areas	Procure 456,000 LLIN/LLIHNs for PMI-supported areas and non-state areas including migrants and mobile populations.

Distribution of LLINs	Defeat Malaria Project	\$450,000		Target areas	LLIN distribution, promotion, and BCC in PMI target areas. Distribution will target stable populations and special populations including migrants and pregnant women.
Net durability assessment	Vectorworks	\$0		Target areas	Support assessment of LLIN survivorship, attrition, physical integrity, and insecticidal activity monitoring with FY 2014 and FY 2015 pipeline funds.
SUBTOTAL ITNs		\$1,950,000	\$1,500,000		
Indoor Residual Spraying					
SUBTOTAL IRS		\$0	\$0		
SUBTOTAL VECTOR MONITORING AND CONTROL		\$2,098,000	\$1,500,000		
Malaria in Pregnancy					
Support for MIP coordination with RHMCH and NMCP	Defeat Malaria Project	\$50,000			Continue to support MIP coordination on national policies and guidelines, and pre- and in-service training materials for national nurses and midwives association.
Strengthen case management of malaria in pregnancy	Defeat Malaria Project	\$0			See Case Management section.
Subtotal Malaria in Pregnancy		\$50,000	\$0		
SUBTOTAL PREVENTIVE		\$2,148,000	\$1,500,000		
CASE MANAGEMENT					
Diagnosis and Treatment					

Procurement of RDTs/microscopy supplies	GHSC- PSM	\$330,000	\$330,000	Target areas	Procure 445,000 RDTs/ microscopy supplies for focus areas and non-state areas for use by community level health volunteers or workers, for scale up of complete coverage in three states including all of Rhakine, Thanintaryi, and Kayin.
Procurement of antimalarials	GHSC- PSM	\$45,600	\$45,600	Target areas	Procure 40,000 ACTs and other antimalarials for use by community level health volunteers or workers in PMI-supported and non-state areas.
Support strengthening national/subnational QA/QC for malaria diagnosis	WHO Consolidated Grant / ACTMalaria	\$50,000		Nationwide	Training and accreditation of microscopists.
Support to diagnosis and case management in the private sector	Defeat Malaria Project	\$250,000		Target areas	Support diagnosis and case management among private providers identified in PMI-supported areas.
Case management at the community level, including implementation, training, and supervision	Defeat Malaria Project	\$3,536,400		Target areas	Training and supervision of malaria case management through community health workers, rural health center staff, and auxillary midwives, including integrated case management where appropriate.
Therapeutic efficacy surveillance	WHO Consolidated Grant	\$220,000		Sentinel sites	Conducting TES studies at 10 sites in Burma; technical assistance; drug policy review.
Subtotal Diagnosis and Treatment		\$4,432,000	\$375,600		
Pharmaceutical Management					

Support for supply chain management	GHSC- PSM	\$200,000		Nationwide	Technical assistance (local staff) in supply chain management to Burma MOH to strengthen coordination on malaria commodities (including pharmaceutical management systems, forecasting, quantification, management, and distribution of pharmaceuticals and RDTs).
Technical assistance for FDA laboratory accreditation	USP/PQM	\$200,000		Nationwide	Technical assistance and strengthening national FDA quality control laboratory and achievement ISO accreditation.
Subtotal Pharmaceutical Management		\$400,000	\$0		
SUBTOTAL CASE MANAGEMENT		\$4,832,000	\$375,600		
HEALTH SYSTEM STRENGTHENING / CAPACITY BUILDING					
International Field Epidemiology Training Program (IFETP)	CDC IAA	\$150,000		Nationwide	Support two Burmese fellows to participate in international FETP in Bangkok.
In-country FETP	Defeat Malaria Project	\$100,000		Nationwide	Conduct in-country FETP short-course training, and work with community health university.
Technical assistance for in-country FETP	CDC IAA	\$40,000		Nationwide	Four technical assistance TDYs for in-country FETP training.
In country malaria management field operations (MMFO) course	WHO Consolidated Grant / ACTMalaria	\$50,000		Nationwide	Strengthen in-country epidemiology and management capacity.

SUBTOTAL HSS & CAPACITY BUILDING		\$340,000	\$0		
SOCIAL AND BEHAVIOR CHANGE COMMUNICATION					
SBCC for malaria control and prevention interventions	Defeat Malaria Project	\$200,000		Target areas	Support to standardize, harmonize, and disseminate key BCC materials and messages at the community level and strengthen interpersonal communication approaches with VMWs and private providers; technical support for updating national BCC strategy.
SUBTOTAL SBCC		\$200,000	\$0		
SURVEILLANCE, MONITORING AND EVALUATION					
Surveillance and M&E strengthening at national level	Defeat Malaria Project	\$300,000		Nationwide	Strengthen routine surveillance systems at all levels (public, private, community), including scaling up of electronic database systems; support NMCP capacity for data management and use, including TA in NPT; support national M&E plan development; support NMCP M&E needs to move from control to elimination.
Surveillance and M&E strengthening in PMI target areas	Defeat Malaria Project	\$450,000		Target areas	Strengthen surveillance, monitoring and evaluation; improve data collection systems, data quality, and use at township and state levels in PMI target areas.
SUBTOTAL SM&E		\$750,000	\$0		
OPERATIONS RESEARCH					
SUBTOTAL OR		\$0	\$0		
IN-COUNTRY STAFFING AND ADMINISTRATION					

USAID	USAID	\$700,000			USAID Resident Advisor, 100% Malaria FSN Burma, in-country and regional travel, administrative costs.
RDMA TA	USAID	\$30,000			Technical assistance and TDY support from RDMA PMI staff.
SUBTOTAL IN-COUNTRY STAFFING		\$730,000	\$0		
GRAND TOTAL		\$9,000,000	\$1,875,600		

V. CAMBODIA

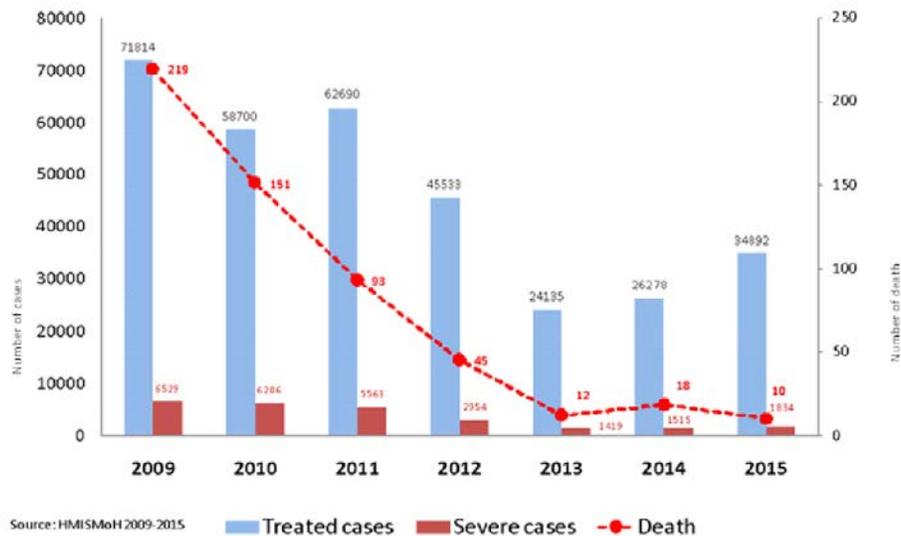
(A) Strategy

1. Malaria situation in Cambodia

Over the last decade, many of Cambodia's key health indicators have improved as the country's economy has developed. Cambodia has also made huge progress in malaria prevention and control and is poised to move from control to elimination by 2025. Malaria deaths have decreased dramatically by 95.4% from 219 deaths in 2009 to only 10 deaths in 2015. Malaria cases treated at public facilities also declined from 71,814 in 2009 to 34,892 cases in 2015 resulting in a decrease in malaria incidence reported in public sector from 5.17 cases per 1,000 population to 2.26 cases per 1,000 population, respectively.

Despite this success, artemisinin resistance and mobile populations remain challenges to reaching the national elimination goals. Currently, the most effective treatments for malaria are now taking two to three times longer to clear malaria parasitemia. As of early 2016, AS-MQ has been implemented as first-line treatment in nine provinces where there is evidence of high failure rates to the previous first-line treatment, DHA-Pip.

Figure 15: Trend of malaria treated cases and deaths in public health facilities in Cambodia (2009-2015) (Source: CNM)

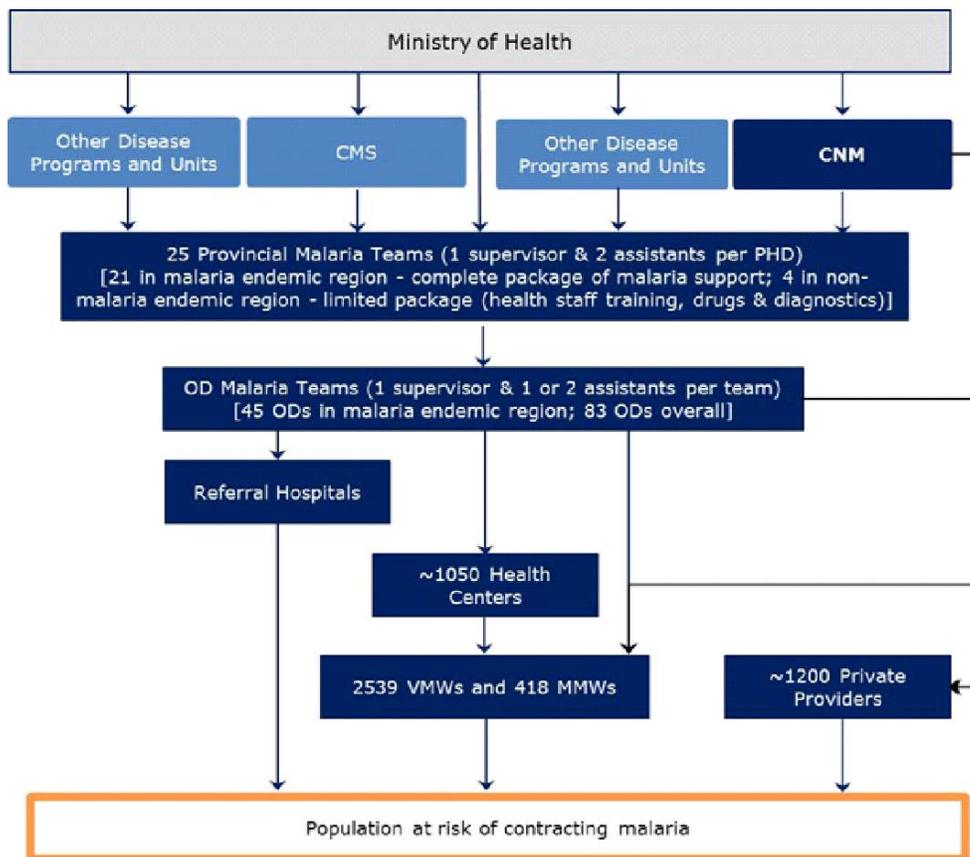


Geographically, malaria is endemic in 21 out of Cambodia's 25 provinces. The incidence is highest in the Northeastern parts of the country and lower in the Western provinces. Peak malaria transmission is between July and November which is a transition period from the hot to the rainy season. Malaria predominantly impacts males 15-49 years of age; incidence rates in adult males

2. Country health system delivery structure and MOH organization

The CNM sits within the MOH. The leadership of the malaria control activities within Cambodia rests at the central level; however, with the decentralization of the MOH, Provincial Health Department (PHD) and OD malaria supervisors are involved with planning and implementing activities. Village Health Volunteers, VMWs, Mobile Malaria Workers (MMWs), and local authorities have been deployed to improve the availability and accessibility of malaria services, including early diagnosis and treatment, LLIN distribution, and malaria health education.

Figure 17: Structure of the National Malaria Program within the Ministry of Health, Cambodia (Source: MOH/CNM)



3. National malaria control strategy

In 2011, the Prime Minister of Cambodia endorsed the National Strategic Plan for Elimination of Malaria for 2011 – 2025. This strategy, the NSP for Elimination of Malaria, is based on the following goals:

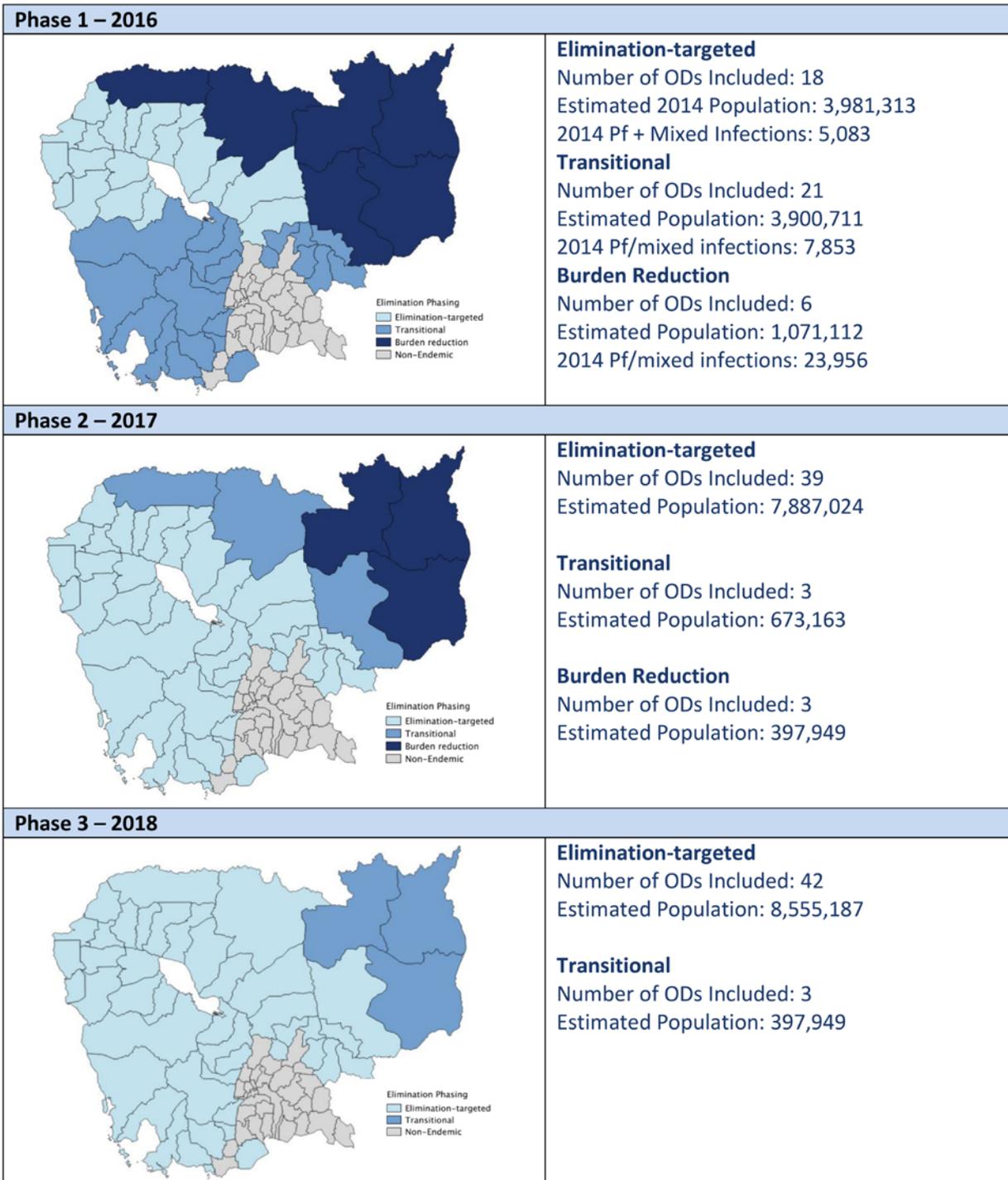
- **Short-Term (by 2015)**
To move towards pre-elimination of malaria across Cambodia with special efforts to contain artemisinin-resistant *P. falciparum* malaria.
- **Medium-Term (by 2020)**
To move towards elimination of malaria across Cambodia with an initial focus on *P. falciparum* malaria and ensure zero deaths from malaria.
- **Long-Term (by 2025)**
To achieve phased elimination of all forms of malaria in Cambodia.

In 2014, Malaria Elimination in the GMS was developed as a coordinated strategy for malaria elimination by 2030. As a result, the National Malaria Program developed the Malaria Elimination Action Framework 2016 -2020 to update national strategies within the NSP for Malaria Elimination to align it with the GMS Malaria Elimination strategy.

Under MEAF 2016 – 2020, malaria control and elimination activities are managed through three phases (Figure 18):

- **Phase 1 in 2016:** The elimination activities will be concentrated in 18 ODs in the northwest of Cambodia where surveillance activities will be intensified to follow up cases, investigate focal areas, and conduct response interventions. The National Malaria Program will develop evidence-based approaches that can be scaled up to these 18 targeting elimination ODs. Simultaneously, the NMCP will strengthen control and prevention activities in the other 21 ODs, classified as the transitional phase, to drive down malaria incidence toward the elimination phase, and 6 ODs where there is high malaria burden will aggressively use control and prevention activities.
- **Phase 2 in 2017:** The 21 transitional ODs will be included in the targeting elimination ODs and 3 out of 6 ODs with high malaria burden will move to transitional.
- **Phase 3 in 2018:** The elimination-target area will then cover 42 ODs and 3 ODs for control activities. By 2019, the entire country will be targeted for elimination strategies and ultimately to eliminate *P. falciparum* by 2020.

Figure 18: Phased approach to malaria elimination in Cambodia (Source: CNM)



During the implementation period covered by this MEAF, Cambodia will need to transition from malaria control to pre-elimination and to elimination using a feasible model to scale up in new ODs. In concert, PMI will continue to support pilot elimination approaches in one OD, Sampov

Loun, focusing on *P. falciparum* initially, and then expanding the model to additional elimination ODs, in support of the MEAF.

At the center of PMI's support for elimination in Cambodia is universal coverage with LLINs and rapid identification and treatment of all malaria infections in targeted areas. This includes rapid diagnosis and prompt effective treatment of all malaria cases at health facilities and in villages, through the network of VMWs. Because of widespread resistance to artemisinins, efforts are made to directly observe treatment and follow up patients to document clearance of infection.

In addition, all cases in targeted elimination areas are investigated to gather key information, particularly recent travel history, to help differentiate possible imported cases from cases of probable local transmission. Furthermore, investigation of household contacts and fellow travelers (for imported cases) also are conducted. The collection and analysis of these data in our pilot OD, Sampov Loun, has provided the CNM and OD health authorities with detailed information and maps indicating residual foci of transmission and areas where transmission appears to have been interrupted.

Once these activities have been scaled up in a given OD further interventions that could be considered would include vector surveys and interventions in residual and new foci, which could include IRS and larval source management. Behavioral interventions could be employed to reduce or mitigate high-risk behaviors as well as sustain malaria awareness. Approaches such as MDA also may be considered for residual foci, although the challenge with using MDA in Cambodia is the lack of an effective, well-tolerated treatment. Treatment failures to DHA-Pip are increasingly common in Cambodia especially in the west, which are the areas now being targeted for elimination.

4. Integration, collaboration, and coordination

Funding

The Global Fund has been the major donor for malaria control since 2005. The following Global Fund mechanisms are in place in Cambodia: the RAI is currently active and will end in December 2016 and the NFM will end in December 2017. UNOPs serves as the principal recipient for both the RAI and the NFM grants. PMI is the second largest donor supporting malaria control and elimination activities in Cambodia. The BMGF supports the CNM with the development of new tools to accelerate towards elimination, strategies to prevent infection and block transmission, and technical assistance and capacity building on surveillance and M&E. The main donors in Cambodia, the Global Fund, PMI, the BMGF, and the ADB, meet regularly (every two months) to coordinate activities and leverage funding to more efficiently support the NMCP's control and elimination activities.

A major concern is the uncertainty of Global Fund support to Cambodia after 2017. Although no decisions about funding will be made by the Global Fund about country allocations post-2017 until the next replenishment meeting, the new funding strategy specifically prioritizes the GMS

for some funding, particularly to address artemisinin resistance. The magnitude of that funding is uncertain. Given these uncertainties, this MOP anticipates that Global Fund support for key commodities may decrease and, therefore, planned procurements are adjusted upwards, when feasible.

Table 27: Current malaria funding in Cambodia

Funding	Total Budget in \$ (Funds Disbursed)	Duration	Key Implementing Partners	Key Activities
Domestic	3,484,029			Treatment services for Cambodian citizens (2012 Funding)
Global Fund SSF	50,953,325 (37,370,392)	2013-2015	CNM, UNOPS (PR)	Pre-elimination
Global Fund RAI	15,000,000	2014-2016	CNM, UNOPS (PR)	Artemisinin resistance containment
Global Fund NFM	30,000,000	2015-2017	UNOPS (PR)	Malaria control and prevention
ADB Grant	2 nd GMS Regional Communicable Diseases Control Project (CLV) 9.5 Million for GMS CDC2 CLV 4 Million for Cambodia	Jan 2016 – 30 June 2017	Grant to Departments of Communicable Disease Control, MOH in GMS countries and Cambodia Malaria National Program Center	Contribute to the containment of artemisinin resistance and malaria elimination in Preah Vihear Province. Strengthen and harmonize national malaria programs. Enhance regional cooperation in malaria and strengthen focal points for regional cooperation for malaria control in each MOH. Support WHO and the ministries in rolling out regional strategies for malaria control.
BMGF			WHO-ERAR AFRIM CHAI PSI UCSF MORU APLMA	Research and innovative tools to control and eliminate malaria. Support to WHO ERAR Hub and Asia-Pacific Malaria Leaders Alliance. Direct BMGF engagement in Global Fund RAI.

5. Progress on coverage/impact indicators to date

Cambodia continues to make progress against malaria by continually enhancing approaches to reach key affected populations. Mass distribution of LLINs and LLIHNs has been implemented and VMWs deployed, particularly in the western part of the country.

During 2015, 10 malaria-related deaths were reported; a drop from 219 in 2009. In 2015, the total number of malaria cases from public facilities and those treated by VMWs decreased to 51,262 cases compared to 92,769 in 2009, representing a 45% reduction. Incidence of confirmed malaria decreased from 7 per 1,000 to 2.26 per 1,000, demonstrating progress towards elimination. The provinces with the highest numbers of malaria cases are Preah Vihear, Kampong Speu, Pursat, Oddar Meanchey, Tbong Khmum, Stung Treng, Ratanakiri, and Kratie.

Since 2004, the CNM has conducted nationwide MIS' to measure the progress of the malaria program and to help the program make strategy and implementation shifts. These household and outlet surveys provide useful trend information on key malaria indicators of malaria prevalence, ITN coverage and use, as well as treatment-seeking behaviors over time.

Table 28: Key indicators from the Cambodia Malaria Surveys (2004, 2007, 2010, and 2013)

Indicator	2004	2007	2010	2013
Malaria prevalence by microscopy (%)	4.4	2.6	0.9	0.1*
Households with at least one mosquito net (%)	95	100	99.4	99.7
Households with at least one ITN (%)	35.8	42.6	74.7	89.5
Persons who slept under an ITN the previous night (%)	29.3	25.3	52.6	59.6
Children under five years old who slept under an ITN the previous night (%)	26.4	28.0	56.3	63.3
Pregnant women who slept under an ITN the previous night (%)	13	N/A	59.1	61.5

*1.5% prevalence by PCR

6. Challenges and opportunities

Challenges

Lack of efficacious first-line ACT treatments: In Cambodia, because of widespread resistance to both artemisinin and partner drugs, there remains no single ACT in widespread use which can be expected to produce cure rates at the desired WHO recommendation of >90% throughout the country. In 2015, the MOH adopted new treatment guidelines which identify different first-line regimens by province in order to ensure the best possible cure rates with the expectation that different combinations may have to be rotated periodically.

Private sector service delivery: As with many countries, self-medication and utilization of private outlets are the first choice for a sizeable proportion of the population seeking treatment for fever. To address this demand, PMI supports a “Public-Private Mix” strategy in which registered private clinicians in the private sector are supported to ensure quality case management. PMI also supports a QA system to assess and monitor these private providers’ malaria case management skills and to ensure malaria data from the private sector are incorporated into Cambodia’s Malaria Information System. USAID/Cambodia also supports a program to facilitate registration of private providers. Under the new 2016-2020 MEAF, the NMCP will manage all registered private health providers in ODs with evidence of artemisinin resistance (formerly known as Tier 1). In elimination areas, private health providers are allowed only to test for malaria diagnosis but need to refer patients to public health facilities or village malaria workers for treatment. In other areas, access to diagnosis and treatment will be extended among all licensed private health providers in each endemic area and with support of NGOs up until 2018. From 2018 onward, the NMCP will be solely responsible for the private sector. Some concerns have been raised about this transition which has been delayed, such as capacity of central and provincial staff to conduct routine supervision visits, enter malaria data from the private sector into current malaria information system, and maintain quality of health care services.

Limited malaria service delivery: Although some improvement has been made in the health care system, Cambodia still faces many challenges, such as decentralization and integration of malaria control into existing health care services, which places additional management burden on the provincial and district levels. Low salaries of government health staff result in high turnover and limited public services. Village malaria workers who provide front-line services in communities for early detection and treatment of malaria are covering many malaria-endemic parts of the country, but some lack supplies of RDTs and drugs, and receive insufficient support from district and provincial management.

Mobile and migrant populations: Cambodians pursuing economic opportunities in rice-cultivating areas and farming development projects often transit between low and high risk zones, unwittingly creating the potential for importation of malaria between them. These high-risk populations tend to be difficult to reach with health services. Increasingly, men (typically the occupational breadwinner) are moving with their spouse and their children to plantations, farms, development sites, and forested areas where access to public health facilities is limited. Hence, such populations may seek health care from private providers or pharmacies.

Integrating programs and limited human resources: Although the resource allocation for health from the Cambodian national budget has been increasing slowly, many infectious disease programs (such as malaria, TB, and HIV/AIDS) remain vertical and largely funded by external donors. Cambodia faces two issues: (1) sustainability and merging these vertical programs into the existing health system and (2) limited human resources and capacity in the health system. Particularly at district and health facility levels, there is a shortage of skilled health professionals. Increased skills in key areas such as planning, implementation, and M&E will be critical as Cambodia moves from control to elimination.

Opportunities

Economic growth: Cambodia continues to enjoy rapid economic expansion with a 7% increase in gross domestic product in 2015; the country was ranked as the third among ASEAN countries for contribution to gross domestic product from tourism (Sources: World Bank; Travel and Tourism Economic Impact 2015). Cambodia achieved the Millennium Development Goal of halving poverty from 53% in 2004 to 20.5% in 2011 and is moving toward becoming a lower middle-income country. Furthermore, the domestic budget has also seen an increase for the health sector.

Improving antenatal care and child health: Cambodia has made good strides in improving maternal and child health. The under-five mortality rate decreased from 124 per 100,000 live births in 2000 to 35 in 2014; and 95 percent of pregnant women who gave birth in the last five years received ANC at least once from a health professional (Cambodian DHS 2014).

Licensing and regulation of the private sector: In response to a 2014 HIV outbreak linked to unsafe injections and infusions delivered by an unlicensed provider, a new “Law on Regulation of Health Practitioners” was formulated that required all private providers to register with professional councils. Once the law is enacted and enforced, providers will need to meet defined qualification standards to receive a license to provide health care services.

(B) Operational Plan

1. Vector monitoring and control

NMCP/PMI objectives

According to the 2016 MEAF, the CNM plans to develop a vector management strategy and an insecticide resistance monitoring plan in collaboration with PHD/OD staff, WHO, and other stakeholders. Utilizing entomological surveillance along with insecticide effectiveness and resistance information at the local level, the vector management strategy will implement potential intervention packages for reducing human-vector contact by geographic target area and will be updated on an *ad hoc* basis based on information about ongoing transmission in each targeted area. The current vector management strategy includes the distribution of LLINs/LLIHNs and focal IRS around index cases in areas of low transmission.

The CNM aims to cover at least 90% of populations at risk of malaria with an appropriate vector control intervention, the primary vector control tools being LLINs and LLIHNs. The CNM target is to provide one LLIN per 1.8 persons and 1 LLIHN per household in at-risk areas. Risk stratification will be done annually for each village. LLINs were distributed through mass campaigns in 2015 and will be conducted again in 2018. In addition, LLINs/LLIHNs will be distributed continuously through health centers and VMWs to persons or households without LLINs or with LLINs in need of replacement. LLINs/LLIHNs will also be distributed through net lending or net giving programs at places of employment, such as farms, plantations, and industrial sites as identified by the CNM. In addition, LLIHNs will be distributed continuously near forest locations at selected access points.

Between 2011 and 2012, 3,642,000 LLINs were procured and distributed with funding from Global Fund Round 6 and Round 9 grants, including through a mass LLIN distribution campaign which took place in early 2012 and covered 20 provinces (45 ODs). Following these mass LLIN distributions the proportion of households (all risk categories) with any LLINs increased from 52% in 2010 to 75% in 2013 while the proportion with sufficient LLINs increased from 23% in 2010 to 51% in 2013. A second mass campaign was conducted in 2015. The next mass distribution campaign is planned for 2018 but is facing a shortage of LLINs due to uncertainty about the commitment of the Global Fund after 2017.

a. Entomological monitoring and insecticide resistance management

Progress since PMI was launched

Based on *ad hoc* surveys at six sites, twenty-five malaria vector species have been identified in Cambodia. The primary vectors are *An. dirus*, *An. maculatus* s.l. and *An. minimus* s.l. *An. dirus* is more prevalent in the northeast in forested mountains and foothills as well as cultivated forests

such as rubber plantations. *An. minimus* is more prevalent in the west where it is found in areas outside of the forests or in areas where the forests have been cleared. *An. maculatus* s.l. is widespread throughout Cambodia. Other vectors such as *An. barbirostris*, *An. epiroticus*, *An. philippinensis*, *An. vagus*, and *An. hyrcanus* are also present in Cambodia. These vectors bite during all hours of the evening, but peak biting hours are usually between 8 pm and 12 am. Resistance to insecticides is thought to be low among most vector species, but this requires verification, particularly given the scale-up of LLINs and LLIHNs.

In ODs where elimination is planned, vector control has relied on top-up of LLINs/LLIHNs to cases identified by the surveillance system as well as focal IRS around the index case and surrounding households. Vector monitoring is needed to confirm whether IRS is an appropriate vector control tool in these settings as many cases have a history of travel and are likely imported. For those cases without a history of travel, it is unclear if transmission was peri-domestic or whether it occurred while farmers slept outside where they were tending their fields.

Progress during the last 12-18 months

PMI has previously supported the training of one CNM staff member on the use of the WHO susceptibility test kits and the bottle bioassay for detecting insecticide resistance. However, due to logistical constraints, little programmatically linked entomological monitoring has occurred in Cambodia. To date, most of the entomological information is derived from *ad hoc* data collected through specific research projects. PMI and the CNM have identified entomological monitoring as a priority to assist in the targeting of vector control interventions in Cambodia. Monitoring activities are expected to be initiated in late 2016/early 2017.

Plans and justification

There is a need for better entomological monitoring to determine the species of vectors present in each area and their susceptibility to insecticides, particularly pyrethroid insecticides on LLINs/LLIHNs. Furthermore, in elimination districts, it is essential to determine whether local transmission is peri-domestic or whether locally acquired infections occur in residents who spend nights outdoors. Therefore, PMI will support two sites for entomological monitoring and will provide support for *ad hoc* entomological investigations in elimination districts with residual foci of transmission. Longitudinal monitoring will include monthly estimates of mosquito densities and species composition as well as annual estimates of insecticide susceptibility. For the *ad hoc* entomological investigations, the aim will be to assess the reason for residual transmission and will include an assessment of the coverage of vector control interventions, a rapid determination of species composition and a measurement of insecticide resistance in the primary vector species present. Recommendations to eliminate transmission from the foci will be provided, including scaling up ITNs, conducting IRS or implementing larval source reduction as deemed appropriate. The foci investigations are intended to be short term but may be extended if residual transmission continues after recommendations are implemented.

Proposed activities with FY 2017 funding: (\$229,000)

- **Entomological and insecticide resistance monitoring:** PMI will support entomological monitoring to increase the capacity and range of surveillance for insecticide resistance as well as *ad hoc* entomological surveys to improve information on malaria transmission risk in residual foci and ecosystems. (\$200,000)
- **Entomological monitoring technical assistance:** Two TDYs will be conducted by a CDC entomologist who will provide technical assistance to build entomological capacity for insecticide resistance and to conduct LLIN durability monitoring. (\$29,000)

b. Insecticide-treated nets

Progress since PMI was launched

Since its launch in Cambodia, PMI has procured 217,053 LLINs to fill gaps in PMI-target districts and to reach MMPs. Target districts include those identified for elimination by the CNM as well as some districts with higher transmission. Most often, PMI LLINs are distributed through community channels targeting migrant populations (e.g. VMWs, MMWs, plantation malaria workers, employers of migrants to reach high-risk populations without access to LLINs).

A PMI-supported rapid household net coverage assessment was conducted in 45 villages in May 2012 to measure the effectiveness of the LLIN distribution campaigns. Results showed that more than 95% of the LLINs expected to be distributed were indeed received at the household level. A shortage of LLINs at the health facilities was the main reason some households did not receive a LLIN during the campaign. Also, use of LLINs by permanent household residents (the night before the survey) was found to be very high (~89%).

Progress during the last 12-18 months

In the third quarter of FY 2015, the national ITN distribution campaign started in all ODs, including in PMI-supported ODs. However, LLINs/LLIHNs procured by UNOPS were insufficient in number due to the underestimation of need in some ODs. Consequently, PMI provided both LLINs/LLIHNs and support for logistics costs where gaps were noted. During FY 2015, PMI supported the distribution of 95,215 LLINs and 28,246 LLIHNS. Of those distributed, 38,139 LLINs and 22,916 LLIHNS were distributed by VMWs/MMWs as top-up to any households or farms that did not have sufficient LLINs, based on data collected during monitoring visits. In FY 2015, 73,841 and 70,076 households were visited by VMWs in the first and second semesters, respectively and 11,562 and 10,976 farms were visited in the first and second semesters, respectively.

With FY2015 funds, PMI is currently supporting a net preference study to determine the factor associated with net choice and net use. Information from this study will inform future LLIN procurements and/or retreatment programs to ensure high coverage of ITNs in Cambodia, and may stimulate further research to determine how to improve utilization of LLINs. The study is currently underway and is expected to be completed by September 2016.

Commodity gap analysis

Malaria is endemic in 21 of the 25 provinces in Cambodia with an estimated at-risk population of approximately 9,000,000. Needs for continuous distribution are estimated at 165,000 for 2016 and 215,000 for 2017. Those projections are based on current distribution rates and expected expansion of program activities. These will be more than covered by planned procurements from the Global Fund and PMI. PMI-procured nets for continuous distribution are primarily targeted to the ODs supported by PMI and to migrant and mobile populations that were missed in the mass campaigns.

For the 2018 mass campaign, a total of 5 million nets are needed to cover the entire at-risk population of approximately 9 million people. To fill this gap, a pipeline of 1.1 million LLINs has been allocated by the Global Fund, and it is anticipated that an additional 2.7 million LLINs will be procured through future support.

If additional funding becomes available from PMI, ITNs will be prioritized and PMI will continue to monitor available funding from partners and adjust support for ITNs as needed.

Table 29: ITN Gap Analysis

Calendar Year	2016	2017	2018
Total targeted population*	9,209,108	9,350,929	9,494,933
Continuous Distribution Needs			
Channel #1: VMWs and worksites to reach MMPs*	165,240	214,685	214,685
<i>Estimated Total Need for Continuous</i>	165,240	214,685	214,685
Mass Distribution Needs			
2018 mass distribution campaign**	0	0	5,000,000
<i>Estimated Total Need for Campaigns</i>	0	0	5,000,000
Total Calculated Need: Continuous and Campaign	165,240	214,685	5,214,685
Partner Contributions			
ITNs carried over from previous year	0	483,710	543,725
ITNs from Government	0	0	0
ITNs from Global Fund (NFM)	562,950***	214,700	2,700,000
ITNs from other donors	0	0	0
ITNs planned with PMI funding	86,000	60,000	70,000
Total ITNs Available	648,950	758,410	3,313,725
Total ITN Surplus (Gap)	483,710	543,725	(1,900,960)

* Data source: CNM

** Data source: UNOPS

*** Includes LLINs and LLIHNs

Plans and justification

PMI will procure approximately 70,000 LLINs and LLIHNs for distribution primarily through health centers and village malaria workers in targeted ODs. LLINs may also be distributed as part of the 2018 mass campaign as there is uncertainty about the availability of LLINs after current Global Fund support ends in 2017. In addition, PMI will support LLIN/LLIHN durability monitoring to help guide Cambodia in developing the optimal replacement strategy and the optimal LLINs for the targeted populations.

Proposed activities with FY 2017 funding: (\$420,000)

- **Procurement of LLINs and LLIHNs:** PMI will procure approximately 70,000 LLINs and LLIHNs (hammocks) for focus areas, filling potential gaps, and targeting migrant and mobile populations in selected ODs. (\$200,000)
- **Community-level support for distribution, promotion and use of LLINs/LLIHNs:** PMI will provide support for the distribution and delivery of LLINs and LLIHNs through health centers and through VMWs in target ODs. The anticipated cost of distribution is approximately \$1/LLIN or \$1 per LLIHN. (\$70,000)
- **LLIN durability monitoring:** PMI will support durability monitoring of LLINs distributed by various partners including PMI and the Global Fund. Monitoring activities will include assessment of physical durability and insecticide activity/content, to inform future LLIN forecasting needs. (\$150,000)

2. Malaria in pregnancy

NMCP/PMI objectives

In Cambodia, only 15% of all malaria cases are in women of childbearing age. Therefore, malaria during pregnancy is uncommon. When malaria does occur during pregnancy, there is an increased risk of severe disease in the mother and low birth weight and an increased risk of neonatal mortality in the newborn - similar to the risks that occur in higher prevalence settings.

Control of MIP and implementation of strategies in Cambodia are further complicated by heterogeneous transmission settings, transmission of both *P. falciparum* and *P. vivax*, and multi-drug resistant malaria. In addition, ANC attendance among pregnant Cambodian women could be improved. Overall, 89% of pregnant women attended ANC at least once, but only 27% of pregnant women attended the recommended four visits.

PMI support for preventing malaria during pregnancy focuses primarily on ensuring universal coverage of LLINs and providing appropriate messaging to ensure that pregnant women consistently sleep under an LLIN throughout their pregnancy. The 2013 national malaria survey noted that 57% of pregnant women slept under an ITN the previous night. In addition, PMI has

supported scaling up of diagnosis and effective treatment of malaria at health facilities and through VMWs at community level, with particular targeting of migrant and mobile populations. National malaria treatment policies for pregnant women follow WHO recommendations: quinine is used in the first trimester and ACTs in the second and third trimesters. For severe malaria, quinine is recommended in the first trimester and artesunate or artemether in the second and third trimesters. Primaquine is contraindicated during pregnancy and is currently not registered in Cambodia. Because of the overall low prevalence of malaria during pregnancy, IPTp is not recommended. However, the MEAF recommends that pregnant women residing in endemic areas be screened for malaria during their first antenatal visit.

Progress since PMI was launched

District-level campaigns supported by the Global Fund and PMI have resulted in high household LLIN ownership in all malaria-risk areas of Cambodia. With PMI support, almost one million IPC encounters have been conducted to encourage regular use of LLINs.

In addition, approximately 681 facility health workers and VMWs per year underwent refresher training in malaria case management, which includes specific guidance on management of malaria in pregnant women.

To better understand MIP policies and practices, PMI conducted an assessment in Cambodia in 2013. Knowledge about the causes and prevention of malaria among pregnant women was found to be good where VMWs were present, but several challenges were noted. Limited coordination between the maternal and child health and malaria control departments within the ministries of health, as well as limited training of maternal and child health staff on MIP were noted as major hurdles. The risk of malaria infection in pregnancy was highest in the most remote areas with least access to services for prevention, diagnosis, and case management. To improve access to ANC, the assessment noted that novel approaches were needed (e.g. the Reproductive Health Association of Cambodia promotes ANC attendance by providing free delivery in health centers to those women who attend four ANC visits). The assessment also noted the challenges associated with the case management of *vivax* malaria, which was equally likely to be the cause of infection in pregnant women.

Progress during the last 12-18 months

To better assess the burden of malaria among pregnant women in Cambodia, PMI conducted a rapid assessment by instituting malaria screening at 13 ANCs across three provinces in differing malaria risk areas of Cambodia (Pursat, Battambang, and Mondulkiri). A detailed analysis of this data was conducted to assess the feasibility of this policy as well as the burden of MIP. In total, 8,875 ANC visits were recorded from the 13 health facilities during the period of data collection. Overall, 2,718 women attended their first ANC visit; 22% (1,911) of visits took place in the first trimester of pregnancy (≤ 13 weeks), 43% (3,818) of visits were conducted during the second trimester (14-26 weeks) and 34% (3,049) of visits were undertaken in the final trimester. According to ANC records completed by health care providers, in 86% (11,122) of the ANC visits, health education was delivered to pregnant women through IPC on malaria testing,

treatment, and prevention. Out of 8,875 registered ANC visits, less than 1% (43 women) of those screened with a malaria RDT tested positive. Among these cases, 49% (21 women) were due to *P. vivax*, 23% (10 women) were *P. falciparum*, and 28% (12 women) were mixed infections.

Commodity gap analysis

IPTp is not implemented in Cambodia. Therefore, SP is not required.

Plans and justification

PMI will continue to support LLIN distribution to pregnant women, IPC to encourage LLIN use, and training and supervision of health workers and VMWs in malaria case management, which includes specific training in the management of malaria in pregnancy. PMI will support closer coordination with the maternal and child health program to ensure quality case management of MIP. PMI will also continue to monitor the implementation of the revised recommendation to test pregnant women at their first antenatal visit for malaria.

Proposed activities with FY 2017 funding: (\$0)

- **LLIN distribution and promotion:** PMI will continue to support distribution of LLINs and IPC for pregnant mothers to promote LLIN use through district-level campaigns, in coordination with the Global Fund. (see ITN and SBCC sections)
- **Strengthen case management of malaria in pregnancy:** Support will continue for training of facility health workers and VMWs in malaria diagnosis and treatment, including specific guidance on the treatment of malaria during pregnancy. PMI will support improved coordination with ANCs as well as monitoring of the CNM's implementation of testing for malaria at the first antenatal visit. (See Case Management section)

3. Case management

a. Diagnosis and treatment

NMCP/PMI objectives

The MEAF list as one of its five main objectives to “Achieve universal coverage of case management services by 2016, to ensure 100% parasitological diagnosis of all suspected cases, and effective treatment of all confirmed cases.” Cambodia already has made great progress towards achieving that goal at public sector health facilities and at the community level, through its network of VMWs. With the scale-up of VMWs, an increasing percentage of malaria cases are diagnosed at the community level. Of the total 51,262 malaria cases diagnosed in Cambodia in 2015, 16,370 (32%) were diagnosed by VMWs.

After a health worker or VMW confirms that a patient has malaria by microscopy or RDT, national policy directs them to provide the first dose of treatment under direct observation and then follow up patients to ensure they complete the three days of treatment. In areas of known resistance, VMWs also have been trained to prepare a blood slide for microscopy on Day 3. In PMI-supported areas, DOT is provided and VMWs visit patients to ensure adherence on Day 1 and Day 2. In the pilot elimination OD, Sampov Loun, all treatment doses are provided under observation and blood slides collected on Day 3, 7, and Day 28 to ensure complete cure of blood stage infection.

Because of increasing rates of treatment failures to DHA-Pip in Western and Northern Cambodia and genetic evidence of resistance (i.e. cytochrome b mutations), the national malaria treatment policy was updated in February 2015. The new policy recommends AS-MQ in areas where treatment failures to DHA-Pip have been identified, i.e. the Western and Northern Provinces, and continuation of DHA-Pip in areas where treatment failures have not been identified. Although low-dose primaquine is recommended in the national treatment policy for all confirmed *P. falciparum* cases, the policy has yet to be implemented due to initial concerns about adverse events in G6PD-deficient patients and lack of current drug registration. A PMI-supported primaquine safety study is completing enrollment and should provide further evidence to the CNM to support their policy change.

Progress since PMI was launched

Since its launch in Cambodia, PMI has procured 319,500 RDTs and 140,000 ACTs to fill gaps that were not covered by the Global Fund or government resources. With PMI's support, refresher training and routine supervision of both health facility workers and VMWs/MMWs was continued in 11 target ODs. In those ODs, PMI also assists with delivering commodities to health facilities and VMWs, on an *ad hoc* basis, to prevent stockouts of these essential commodities and has closely monitored stock levels at OD warehouses, reinforcing and strengthening logistic management at the peripheral level, and maintaining buffer stocks of laboratory commodities in PMI-targeted areas.

With PMI support, 588 VMWs have been trained and are providing malaria diagnosis and treatment services in villages in 11 targeted ODs. Training and supervision also has been provided to clinical and laboratory staff at 196 health facilities.

PMI also provides support for quality assurance and case reporting to a network of 430 registered private sector providers, leveraging support from the Global Fund that support training and provides subsidized RDTs and ACTs to these providers. Use of RDTs in these outlets has increased significantly since their introduction.

Progress during the last 12-18 months

In FY 2015, 18,000 treatments of DHA-Pip, 120,000 treatments of AS-MQ, and 285,000 RDTs were procured with PMI funding and distributed to targeted health facilities. The procurement and distribution of AS-MQ enabled Cambodia to launch its updated treatment policy.

In FY 2015, 4,895 malaria cases were confirmed and treated by PMI-supported VMW/MMWs in PMI-targeted ODs. In addition, 11,825 malaria cases were confirmed and treated by health facility (HF) staff and 167 private providers from the public-private mix were supported in 3 ODs. In Zone 2, 3,684 suspected malaria cases were tested by private providers, of which 2,036 were confirmed and treated. In Zone 1, 464 suspected malaria cases were tested and referred to HFs/VMW, of which 239 malaria cases were treated by HFs/VMWs. A total of 2,486 Day 0 cases were enrolled at 13 surveillance sites, of which only nine cases remained positive on Day 3. Of these nine cases, seven were followed up until Day 7 and four until Day 28.

More than 939 facility health workers and VMWs were trained in malaria case management. Another 49 received refresher training in malaria microscopy and 939 on the use of RDTs. With PMI support, 98 facilities received quarterly technical supervision visits.

Through PMI support and that of the Global Fund and domestic resources, 98% of all malaria cases were confirmed by a diagnostic test and more than half of all confirmed cases were diagnosed by VMWs.

In the private sector, PMI supported 1,034 quality assurance visits to the 430 participating providers, with 95% scoring Class A (excellent) or Class B (good) on their performance, a 14% increase in those scoring Class A. In 2015, 18,000 malaria cases were diagnosed and reported from these private sector outlets. Those data were incorporated into the malaria information system. The quality assurance visits described above include a record review, provider interview, and observations of patient-provider interaction. A standardized checklist developed on a DHIS-2 platform is used. Upon completion of the checklist, immediate feedback is provided to the provider, frequency of future supervisory visits determined based on performance, and troubleshooting carried out, as feasible. The supervisor also provides this information to provincial health authorities to be aggregated with public sector malaria case data. In 2016, there will be a realignment of support to private providers, with the CNM supporting all private providers in Tier 1 areas and Global Fund/PMI-funded partners supporting private providers in Tier 2 areas. With this realignment, the number of private providers covered with PMI support is likely to increase slightly.

Since 2011, PMI has continued to support the regional network which includes sentinel sites in Cambodia. Ten sentinel sites, alternating every other year, conduct drug efficacy monitoring of first-line and second-line treatments for both *P. falciparum* and *P. vivax*. Briefly, DHA-Pip efficacy testing at four sites in 2013-2014 showed ACPR >90%, but Day 3 positive rates ranged from 13%-44%. Three sites in 2014-2015 assessed DHA-Pip efficacy: Siem Reap, with 38% ACPR and 50% Day 3 positives; Stung Treng, with 65% ACPR and 13% Day 3 positives; and Mondulkiri, with 90% ACPR and 25% Day 3 positives. With increasing evidence of reduced efficacy of DHA-Pip to *P. falciparum* in the Northern and Western Provinces, the national drug policy was updated in 2015, recommending AS-MQ in the Northern and Western Provinces and continued use of DHA-

Pip in other areas. AS-MQ has recently been procured and distributed to the provinces where it is now recommended.

In 2015, PMI supported the CNM's therapeutic efficacy monitoring in Pailin, Pursat, Kratie, Kampong Speu, Steung Treng, and Siem Reap provinces. Results from these sites are currently pending. Preliminary plans for 2016 are to conduct therapeutic efficacy monitoring of DHA-Pip in Kampong Thom and Rattanakiri, AS-MQ in Preah Vihear and Kampong Speu, and AS-amodiaquine in Battambang and Siem Reap. AS-AQ is being tested on the advice of WHO as a possible alternative to the current first-line drugs.

Commodity gap analysis

Table 30: RDT Gap Analysis

Calendar Year	2016	2017	2018
RDT Needs			
Total country population	15,957,223	16,204,486	16,449,519
Population at risk for malaria	9,209,108	9,350,929	9,494,933
Total number of projected fever cases	15,137,777	15,370,899	15,787,098
Percent of fever cases tested with an RDT*	11.6%	11.6%	11.6%
Total RDT Needs**	800,917	993,096	767,047
Partner Contributions ***			
RDTs carried over from previous year	257,050	36,233	0
RDTs from Government	0	0	0
RDTs from Global Fund	360,100	790,250	0
RDTs from other donors	0	0	0
RDTs planned with PMI funding	220,000	110,000	300,000
Total RDTs Available	837,150	936,483	300,000
Total RDT Surplus (Gap)	36,233	(56,613)	(467,047)

* A significant percentage of the population of Cambodia lives in areas with no malaria transmission and, therefore, are only tested for malaria if they report travel to an area with malaria transmission. In addition, approximately half of all malaria cases are diagnosed by microscopy. These factors account for the low overall rate of fever cases tested with an RDT.

**RDT needs are based on consumption data, and not based on the morbidity data listed in the first part of this table. The projected need incorporates projections of future utilization, including the planned increase in numbers of VMWs and projected decrease in malaria burden/fever over time.

***Global Fund support post-2017 is uncertain at this point.

Table 31: ACT Gap Analysis

Calendar Year	2016	2017	2018
ACT Needs			
Total country population	15,957,223	16,204,486	16,449,519
Population at risk for malaria	9,209,108	9,350,929	9,494,933
Total projected number of malaria cases	56,459	57,328	58,211
Total ACT Needs*	67,312	77,833	68,057
Partner Contributions **			
ACTs carried over from previous year	112,440	156,727	137,360
ACTs from Government	0	0	0
ACTs from Global Fund	90,758	41,466	0
ACTs from other donors	0	0	0
ACTs planned with PMI funding	20,841	17,000	17,000
Total ACTs Available	224,039	215,193	154,360
Total ACT Surplus (Gap)	156,727	137,360	86,303

*ACT needs accounts for buffer stock, a small contingency for possible outbreaks or upsurge in cases, planned increase in numbers of VMWs, and the potential shift in treatment-seeking away from the private sector to the public sector.

** Support from the Global Fund should cover all ACT requirements for this three year period. PMI is allocating a small amount of funding to cover potential gaps. If no gaps exist, PMI will re-program to other priorities.

In 2016 and 2017, almost all commodity requirements are covered by the two Global Fund grants. With FY 2016 funding, PMI plans to procure approximately 100,000 RDTs and 50,000 ACTs to fill gaps not covered by the Global Fund and support reactive case detection and other active case finding activities in PMI-supported ODs. With both the Global Fund NFM and RAI grants scheduled to end in 2017 and the uncertainties of additional Global Fund support beyond the current grants, it is difficult to conduct comprehensive quantifications post-2017. Planned PMI procurements with FY 2017 funding were based on the assumption that Global Fund resources would be significantly reduced from current funding levels. If this assumption turns out to be incorrect and support from the Global Fund support continues at approximately the same level, PMI will reallocate excess resources for commodities to other priorities.

Plans and justification

PMI will continue support for diagnostic testing and clinical case management at facility and community level in targeted ODs in Cambodia, including provision of commodities to fill gaps, and refresher training and supervision of health facility staff and VMWs. This support also will include intensified case management activities in target elimination ODs.

Proposed activities with FY 2017 funding: (\$2,111,000)

- **Procure RDTs and microscopy supplies:** PMI will procure approximately 300,000 multi-species RDTs, plus limited quantities of reagents and supplies for microscopy to fill gaps in country requirements, particularly for migrant and mobile populations. With the uncertainty of Global Fund support past 2017, sufficient quantities of RDTs are planned to cover the requirements for six PMI-supported ODs. (\$225,000)
- **Procure ACTs:** PMI will procure approximately 25,000-50,000 ACTs (quantities vary depending on whether DHA-Pip or AS-MQ is procured and their cost) treatments which would cover almost all the ACT requirements for the country. (\$50,000)
- **Training, supervision, and quality assurance of malaria diagnosis and treatment at facility and community levels.** PMI will support its network of VMWs/MMWs and health facilities in targeted ODs, which will include refresher training and supervisory visits. PMI also will continue support for quality assurance of malaria diagnosis at targeted health facility laboratories. In Sampov Loun and other elimination ODs, this will include support for directly observed treatment and 28-day follow up of all clinical cases to monitor for clearance of parasitemia. (\$1,166,000)
- **Private sector quality assurance:** PMI will continue support for supervision and case reporting of a network of approximately 450 registered private providers, leveraging support from the Global Fund which supports training and subsidized RDTs and ACTs. PMI will closely monitor the realignment of support for private providers and adjust support to address any gaps caused by the transition. (\$400,000)
- **Conduct therapeutic efficacy monitoring:** PMI will continue to support therapeutic efficacy monitoring at 5-6 sites per year (10 sites every two years) at sentinel sites throughout the country. (\$270,000)

b. Pharmaceutical management

NMCP/PMI objectives

The Central Medical Store is responsible for distributing essential medicines and medical commodities to PHDs and ODs on a quarterly basis. Malaria commodities are largely purchased through the national budget and the Global Fund. Health facilities re-stock their commodities using a “pull” system from OD warehouses. In general, stocks are relatively well maintained through this system. An ACT Watch survey in 2013 found that 82% of health facilities and 88% of VMWs had stocks of antimalarials, with nearly 100% of those stocking recommended ACTs.

If the OD store is severely overstocked with a particular commodity, some OD stores will push commodities out to health centers, sometimes causing overstocking at that level. Cambodia’s Central Medical Store will also resort to “push” policies if it has commodities on its shelves that are nearing six months until expiry. As a result, these stocks will often expire at lower level

warehouses or health facilities. Undersupply and stockouts also occur, but with the drop in malaria burden, these are much less common than in the past.

PMI has supported buffer stocks of commodities in targeted ODs and delivers those commodities on an *ad hoc* basis to health centers and VMWs with imminent stockouts. This approach has largely ensured a continuous supply of commodities at service points in PMI-supported ODs

Malaria diagnostics and treatment services are free in public health facilities. However, many people prefer to seek treatment at private sector clinics, pharmacies, and drug sellers for various reasons, including convenience and perceptions of a higher quality of care. As stated earlier, the Global Fund, PMI, and the CNM support training and supervision of registered private providers, as well as providing them with subsidized quality-assured ACTs and RDTs.

Progress since PMI was launched

Given the limited role that PMI played in supplying commodities, PMI support for commodity management has been limited to support for quantification of malaria commodities, as well as monitoring pipelines, so potential bottlenecks in procurement and distribution of malaria commodities (including Global Fund-financed commodities) can be quickly addressed. PMI also has supported a regional logistics advisor to provide technical assistance on forecasting, supply chain management issues, and manage regional procurements.

An assessment conducted in 2014 on data and commodity flows from village to central level to assess the availability and quality of data from Cambodia's LMIS concluded that the Drug Inventory Database, a component of the LMIS, was a fairly robust system. One weakness that was identified was that information in the Drug Inventory Database is not sufficiently disaggregated to be used by key decision-makers at national level. For example, the CNM only has access to quarterly data aggregated by OD, hindering efforts to identify and mitigate shortages and stockouts of malaria commodities. Stockouts of ACTs have resulted from procurement constraints or lack of access or availability of consumption data.

Progress during the last 12-18 months

In FY 2015, PMI supported a two-day logistics quantification overview workshop. The workshop focused on strengthening CNM staff capacity in the use of malaria forecasting data and methods, and supply planning concepts and tools. Subsequent to this workshop, PMI has been supporting the CNM to conduct a national quantification exercise for malaria commodities with the CNM and malaria partners. This included supporting the quantification of commodities that fed into the budget attached to the MEAF. In PMI-supported ODs, 198 health workers were trained on logistics and malaria commodity management.

Plans and justification

The weaknesses outlined in the LMIS affect not only malaria commodities. Therefore, a number of USG-supported programs and initiatives, including PEPFAR and USAID's TB and maternal

and child health programs, have prioritized funding for activities to strengthen the LMIS system over the next few years.

Proposed activities with FY 2017 funding: (\$100,000)

- **Support for pharmaceutical management and logistics:** PMI will leverage the investments of other USG programs and contribute to this broader effort to support strengthening and updating of Cambodia's LMIS system. PMI also will continue to support the CNM to conduct periodic national quantification of malaria commodities. (\$100,000)

c. Drug Quality

NMCP/PMI objectives

As with other Mekong countries, poor quality and counterfeit drugs have been a significant challenge, particularly in the private sector. PMI and other partners have prioritized efforts to improve the quality of malaria treatments available in the private sector, including removal of artemisinin monotherapies. For example, the Global Fund supports the Department of Drugs and Food (DDF) to eliminate banned oral artemisinin monotherapies, combat counterfeit and substandard malaria drugs through sample screening at public and private pharmacies, and strengthen the national pharmacovigilance system. These activities, while focused on malaria, will also help to ensure access of quality-assured essential medicines for TB, HIV/AIDS, and other health priority programs.

In addition to these efforts, the Cambodian government's Counter Counterfeit Committee was established in 2014. This cross-sectoral task force is comprised of representatives from the Ministries of Interior, Justice, Health Finance, Commerce, and Defense. The Counter Counterfeit Committee is dedicated to combatting counterfeit products, unregistered or unlicensed providers, and substandard clinical services. In January 2015, the Counter Counterfeit Committee facilitated the development of a joint action plan between Cambodian Ministries of Interior and Health centered on performing inspections in private markets.

Progress since PMI was launched

In past years, USAID and PMI had supported market surveys to collect samples from public and private sector outlets and conduct quality testing on those samples. PMI worked closely with the DDF and other local partners to ensure that regulatory authorities continued to make routine drug inspections and field visits. With assistance from PMI, the DDF successfully launched raids on facilities selling unregistered and falsified antimalarial medications. Additionally, to ensure a continuous stream of professionals aware of the problem with substandard and falsified medicines, PMI supported the updating of QA/QC and medicine regulations curriculum for Cambodian pharmacy and medical students. These market surveys have now been phased out as poor quality drugs were rarely identified.

In addition, as mentioned previously, the Global Fund and PMI also support a network of more than 400 registered private providers. Participating providers are trained and supplied with quality-assured ACTs and RDTs at subsidized prices. Periodic supervisory visits are carried out to monitor the quality of these services.

As a result of these interventions, the situation in private sector outlets has improved in recent years. In 2013, a survey by ACT Watch found that among private sector outlets that stocked antimalarials, ACTs were stocked in 90% of private health facilities, 95% of pharmacies, 70% of drug stores and 79% of itinerant drug vendors. A recent study of antimalarial quality in Cambodian outlets¹⁶, though, illustrated a mixed picture with respect to drug quality. The study analyzed drugs purchased from retail outlets, categorizing them as being of “acceptable” quality, “falsified (fake drugs which do not contain the stated active pharmaceutical ingredient or API)” or “substandard (genuine medicines produced by authorized manufacturers which do not have the correct amount of API)”. Although no falsified drugs were detected, 31% were classified as substandard.

Progress during the last 12-18 months

With PMI support, the DDF’s National Health Products Quality Control Center laboratory is making progress towards their goal of ISO 17025 certification. This has included developing a draft quality assurance manual, standard operating procedures, and several of the necessary monographs that will be required to receive ISO certification. PMI also supported the National Health Products Quality Control Center’s participation in an Asia-Pacific inter-laboratory quality assurance program.

Plans and justification

In line with the priorities of the DDF’s pharmaceutical sector strategic plan of action 2013-2018, PMI will continue to support the National Health Products Quality Control Center to implement its roadmap towards the attainment of ISO certification by 2017.

Proposed activities with FY 2017 funding: (\$50,000)

- **Drug Quality Assurance:** PMI will provide technical assistance to the National Health Products Quality Control Center’s laboratory to achieve international standard ISO 17025 certification. (\$50,000)

¹⁶ Yeung, et al. Am J Trop Med Hyg **2015** 14-0391

4. Health system strengthening and capacity building

NMCP/PMI objectives

The MOH's Third Health Strategic Plan (2016 – 2020) sets out an operational framework that ensures the Cambodian health strategy is consistently implemented across all health institutions at all levels of health system and available resources are targeted to priority areas in their operations. This framework identifies four priority program areas and five cross-cutting health system strategies. The four priority program areas include: reproductive, maternal, newborn, child health, and nutrition; communicable diseases (including HIV/AIDS, tuberculosis, malaria, dengue, neglected tropical diseases, and other emerging infectious diseases); non-communicable diseases and public health concerns; and health system strengthening. One of the objectives in the four focus areas is to reduce morbidity and mortality mainly due to HIV/AIDSs, tuberculosis, and malaria by 2020. The five health system strategies include: health service delivery; health care financing; human resources; health information systems; and health system governance.

In support of the Third Health Strategic Plan, NMCP's 2016 – 2020 MEAF sets an ambitious agenda to achieve elimination of *P. falciparum* and multi-drug resistant malaria by 2020. To reach these goals, the NMCP will build the capacity of community and facility-based health care workers to actively find malaria cases and improve case management while strengthening linkages with the private sector. In addition, the NMCP will need to strengthen surveillance and information systems to meet the need for real-time data to support an elimination strategy.

PMI works in close partnership with the CNM to build capacity in the form of technical assistance and training to the CNM, PHD, and OD staff. PMI also supports VMWs as these staff are critical extensions of the public health system and are essential for the treatment of malaria cases at the village level – where the burden of disease remains highest. Another important component of the health system is the vast private sector, where PMI supports data quality improvement and quality of services.

Although some improvements have been made in the health care system, Cambodia still faces many challenges, such as decentralization and integration of malaria control into existing health care services, which places an additional management burden on the provincial and district levels. Low salaries of government health staff results in limited availability of public services. Village malaria workers who provide front-line services in communities for early detection and treatment of malaria are covering many malaria-endemic parts of the country, but receive insufficient support from district and provincial management. In addition, quality of care with regard to diagnostics and treatment faces many challenges in both the public and private sectors.

PMI's capacity building efforts are also complemented by broader health systems strengthening activities using other USG funding. For example, USAID is also providing technical assistance: to implement and expand Cambodia's social health protection scheme; to strengthen the HMIS and LMIS; to support the MOH in licensing and registration of private health care providers; and to develop new health financing approaches. USAID is supporting reproductive, maternal, newborn, child health, and nutrition; HIV/AIDSs, tuberculosis, and neglected tropical diseases as

well. All USAID and PMI-supported health systems work is in line with the MOH's Third Health Strategic Plan.

Progress since PMI was launched

PMI has supported health systems strengthening activities at the VMW, health facility, private provider, CNM, PHD, and OD levels. At the community level, PMI has supported training and skills strengthening of VMWs in performing multi-species RDTs to diagnose malaria and provide correct treatment. In addition, PMI has supported the implementation of a community supply system linked to health facilities, close monitoring of diagnostic stock levels at operational division warehouses, reinforcing and strengthening logistic management at peripheral level, and maintenance of buffer stocks of laboratory commodities in PMI-targeted areas.

At the health facility level, QA systems for microscopy have been established with regular supervision visits. PMI has also provided support for QA and case reporting for a network of private sector providers. At PHD and OD levels, PMI also supports the development of annual operations plans that promote government ownership of health activities at lower levels of the health system and are used to plan, coordinate, and monitor malaria and other health activities at sub-national level.

With regard to drug efficacy, therapeutic efficacy monitoring study execution emphasizes quality diagnostics, and builds the CNM's capacity to conduct research, such as protocol development, study monitoring, and QA practices.

PMI also provides direct technical assistance in field entomology, emphasizing training in vector bionomics, monitoring of insecticide resistance, and assessment of LLIN durability.

Progress during the last 12-18 months

In September 2015, PMI supported a four-day national quantification workshop and exercise to prepare a two-year forecast and supply plan of the total commodity and funding needs both for the public and private sector in Cambodia for 2016 and 2017. The technical assistance included the use of different forecasting methodologies for estimating commodity requirements, and training for the CNM in PipeLine®, a supply planning software tool.

PMI also provided technical assistance to DDF on plans to establish an ISO-certified drug quality testing laboratory that would provide the country with the capacity to ensure drug quality in the country.

PMI has also continued to support capacity building of malaria program managers and staff through trainings such as case management, quality of malaria laboratory diagnosis, and malaria commodities supply chain management. PMI also provided coordination support to existing provincial-level working groups on malaria elimination in Battambang, Oddar Meanchey, Pursat,

and Steung Treng provinces which serve as a platform for stakeholder coordination on elimination activities. A District Special Working Group for malaria elimination was established to support an elimination package model in Sampov Loun. PMI also continued to roll out a QA system and tools to improve the quality of malaria diagnosis and care in the private sector. More than 400 private providers have been assessed so far.

Plans and justification

PMI will continue to work closely with the CNM to identify and fill capacity gaps. Such discussions have identified needs in technical areas such as enhancing SM&E, developing capacity to effectively implement various aspects of malaria control and elimination, enhancing the CNM's capacity to effectively coordinate malaria stakeholders, and manage malaria tools and reports generated by CNM partners (such as standard operating procedures and study reports). Health systems strengthening activities are implemented through relevant PMI core technical areas, with the aim of strengthening the CNM's capacity in various aspects of diagnosis and case management, supply chain and logistics, quality improvement, and SM&E.

Proposed activities with FY 2017 funding: (\$150,000)

- **Management capacity building:** PMI will support the CNM and targeted ODs and PHDs to strengthen their capacity in program and supply chain management and M&E. (\$150,000)

Table 32: Health Systems Strengthening Activities

HSS Building Block	Technical Area	Description of Activity
Health Services	Case Management	<ul style="list-style-type: none"> • PMI will continue support for supervision and case reporting of a network of private providers who are supported by the Global Fund. • PMI also will continue support for quality assurance of malaria diagnosis at targeted health facility laboratories.
Health Workforce	Case Management SBCC	<ul style="list-style-type: none"> • Build, through training and technical assistance, a cadre of community health workers /VMWs to properly diagnose, treat, and report on malaria cases into the public health system. This will include refresher training and supervisory visits. Additional training to be added for treatment of malaria during pregnancy. • New communication tools, materials, and job aids will be developed for health care providers to help improve acceptance and implementation of elimination activities around diagnosis, case investigation, and treatment. Interpersonal communication for each patient will also be tailored to specific risk behaviors of individual patients, households, and villages.
Health Information	Pharmaceutical Management & Logistics Monitoring and Evaluation	<ul style="list-style-type: none"> • The LMIS will be modernized to provide real-time data to decision-makers and avoid stockouts. • The malaria information system will be updated to a web-based system.
Essential Medical Products, Vaccines, and Technologies	Pharmaceutical Management & Logistics	<ul style="list-style-type: none"> • PMI will monitor and address potential bottlenecks in procurement and distribution of malaria commodities (including Global Fund-financed commodities). Technical support will focus on supply chain strengthening, forecasting, quantification, management, and distribution of pharmaceuticals and RDTs.
Leadership and Governance	Elimination	<ul style="list-style-type: none"> • PMI will strengthen sub-national committees (PHDs/ODs) to manage elimination activities in target ODs.

5. Social and behavior change communication

NMCP/PMI objectives

In Cambodia, SBCC efforts play a crucial role in reaching hard-to-reach populations, which are often at the highest risk of malaria. High-risk populations include residents of forested areas, new settlers, internal migrant workers, and people crossing border areas. Currently there is a BCC Working Group that is organized and chaired by the CNM. In the MEAF 2016 -2020, the national malaria SBCC strategy was revised and linked to control and elimination activities to protect at least 95% of all populations residing in malaria active foci with an appropriate vector control intervention. The key objectives of the new SBCC interventions in this MEAF are to increase consistent use of ITNs among target communities, improve health-seeking behaviors among at-risk populations, improve compliance with medication, and increase awareness of risks related to artemisinin monotherapies. With increased mobility within and beyond national boundaries, the above strategy outlines components specific for MMPs that focuses on providing tailored SBCC interventions to migrants at four stages/settings: 1) where they live prior to migration, 2) *en route* along the migration path, 3) at arrival points, and 4) at cross-border areas. In each OD, the CNM will work with all partners to conduct a mapping exercise to identify source communities for mobile and migrant populations, and will use community mobilization or interpersonal approach to educate them for malaria prevention and treatment.

Progress since PMI was launched

PMI has supported several innovative approaches targeting MMPs, including tailored mass media, messaging through taxi drivers around migrant corridors, as well as strengthening cross-border collaboration. Malaria awareness campaigns targeting local residents, mobile seasonal workers, and people traveling into endemic areas have been conducted through various channels for reinforcement. Travelers into endemic zones receive and discuss malaria prevention issues and messages with trained malaria volunteers at key transit points and taxi drivers participating in the program. VMWs and MMWs provide counseling and treatment services to patients in villages, at farms, and plantations. PMI also trains registered pharmacists and drug sellers in cities and towns on diagnostic testing and rational drug use.

Progress during the last 12-18 months

With FY 2015 funding, PMI intensified SBCC efforts, particularly IPC, among MMPs building upon successes of prior years. As of March 2016, 100,023 individuals were educated through IPC and 125 villages conducted World Malaria Day activities. As PMI is piloting elimination activities in Sampov Loun, SBCC activities will be streamlined and focus less on control efforts across large geographic areas. A variety of SBCC materials in multiple languages were produced for VMWs, MMPs, and health care providers including posters, leaflets, flipcharts, stickers, t-shirts, banners, bags, signboards, and billboards. Early diagnosis and treatment and health education were provided by 196 health facilities and 588 VMWs/MMWs.

As of March 2016, a total of 939 health workers were trained on IPC and provided outreach IPC to patients and at-risk populations in target provinces and districts - reaching 93,276 mobile and migrant workers. Among them were 47,529 women, of which 1,058 were pregnant. Various forms of “infotainment” have been employed to capture the attention of rural populations. Mobile malaria video shows and malaria quizzes, provided along with testing and treatment services, were presented in 125 endemic villages. During these activities, 4,380 people were tested and 140 were treated after testing positive for malaria.

A folk play group was engaged to perform live community theatre to bring malaria stories and key messages to rural low-literate audiences in forested areas. The group performed 8 sessions to 8,676 (1,646 MMPs) spectators. In a province in the northeast where children less than 15 years old constitute 17% of malaria patients, PMI supported training of 373 primary school teachers on malaria transmission, malaria parasites, signs/symptoms, care-seeking behaviors, and malaria prevention so that they can continue teaching schoolchildren to prevent malaria and seek appropriate malaria treatment.

At border areas in the west, to which Cambodians travel for work, PMI supported the provision of materials in Khmer language explaining malaria services in Thailand and possible side effects from malaria treatment. PMI has also supported semi-annual meetings between Cambodian and Thai health authorities along border provinces to discuss harmonization of bilingual SBCC materials and to share malaria information about cross-border migrant populations. It is anticipated that information-sharing will continue with local resources.

PMI is currently initiating efforts with FY 2015 funds to assess current net use and preferences to guide donors’ LLIN procurement and retreatment policies. Since a large number of untreated nets are privately purchased in the GMS, PMI will identify net preferences and barriers to LLIN use.

Plans and justification

As Cambodia is moving from malaria control to elimination in certain ODs, PMI will focus SBCC efforts and messages to serve control and elimination goals. SBCC interventions will focus increasingly on supporting elimination efforts, including: developing targeted SBCC messages specific to the highest risk migrant groups within elimination ODs and increasing acceptance of reactive/active case detection efforts. A multi-pronged, comprehensive approach for SBCC interventions will be implemented to sustain community involvement and support, promote health behaviors, and reduce risk-taking in the context of malaria exposure. New communication tools, materials, and job aids will be developed for health care providers to help improve acceptance and implementation of elimination activities around diagnosis, case investigation, and treatment. IPC will also be tailored to specific risk behaviors of individual patients, households, and villages.

Proposed activities with FY 2017 funding: (\$150,000)

- **SBCC community-level implementation in target areas:** PMI will support development and implementation of effective SBCC approaches for target elimination and control ODs. Careful consideration will be given to training of health workers and VMWs, and tailoring of SBCC messages according to identified risk factors. PMI will assist the CNM to identify those risk factors and to refine approaches in support of the National SBCC Strategy. In elimination areas, SBCC efforts will also focus on increasing acceptance of reactive/active case detection in the context of declining infections. In control areas, PMI will continue supporting SBCC activities (IPC & media) to reach the highest risk groups by focusing on improving coverage and use of malaria prevention measures (LLINs/LLIHNs), increasing awareness of MIP, dangers of counterfeit antimalarials, as well as ensuring prompt diagnosis and effective treatment. (\$150,000)

6. Surveillance, monitoring, and evaluation

NMCP/PMI objectives

Cambodia's 2011-2025 NSP for Elimination of Malaria has set a national goal to eliminate all forms of malaria by 2025. To support the NSP, Cambodia has developed and launched the MEAF (2016-2020) to guide the country's transition to elimination in a phased approach (Figure 18). One of the objectives of the MEAF aims to enhance the surveillance system to detect, immediately notify, investigate, classify, and respond to all cases and foci by 2017 to move toward malaria elimination.

Cambodia relies on the HMIS to collect data from public health facilities throughout the country. In addition, a parallel malaria information system developed on an Access® platform has been used to capture malaria caseload data in malaria-endemic areas. The malaria information system captures patient-level data mostly from VMWs/MMWs, health centers, some private providers, and receives aggregate numbers of cases from the military annually. District and provincial hospital data are only captured in the HMIS. Data from the HMIS are currently automatically extracted and incorporated into the malaria information system to provide a complete picture of the malaria burden in the country. The HMIS currently uses a web-based platform and there are no current plans to adopt the DHIS-2 platform.

The CNM prioritizes data collection through a variety of methods, including routine program monitoring, baseline, mid-term, and end-line quantitative and qualitative surveys. Cambodia has conducted periodic national malaria household surveys in 2004, 2007, 2010, and 2013. These data have shown decreasing malaria prevalence by microscopy and increasing ITN coverage and use.

Progress since PMI was launched

PMI has supported routine malaria surveillance data collection at the community level, provided technical support for household malaria surveys, and national-level surveillance system strengthening. As part of its case management activities, PMI also works with CNM personnel to build capacity and ensure that malaria data from case management activities, such as number of tests conducted and malaria cases diagnosed by VMWs are captured by the health centers and ODs. PMI has worked closely with both public health personnel from the provincial level to the community level as well as registered private providers to collect, verify, and analyze monthly malaria data.

For routine passive case reporting, PMI supported the CNM's malaria information system that incorporates health facility and community-level malaria data reported by VMWs/MMWs. This system was designed to include relevant program data (e.g., bed net distribution, malaria drug and diagnostic stock, and listing of private sector providers) and link to the national HMIS.

Progress during the last 12-18 months

In an effort to improve data flow from communities to the central level, PMI has begun working with the CNM and other partners to assess alternative surveillance platforms designed for real-time malaria surveillance.

Since the majority of malaria cases are treated in the private sector, Cambodia's malaria surveillance data underestimates the true malaria burden. PMI therefore continues to engage with private sector providers to improve malaria case reporting as well as quality case management. PMI has supported the development of a tablet-based quality assurance tool to improve case management and facilitate collection of malaria case data. This system was built off a DHIS-2 software platform, with the intention that it would be able to feed private sector case data directly into the national malaria information system. A smartphone app also has been developed to enable providers to enter their case data directly into the system, greatly reducing the time and effort required to collect paper-based data. Although the engagement with and current coverage of 430 registered private providers are dynamic and currently under transition, the reporting system is now fully scaled-up and case information, for the first time this year, is being captured in the malaria information system. In 2015, 88% (17,866/20,296) of all cases reported from the private sector were reported through the PMI-supported platform. To improve collection of data from MMPs, a cadre of MMWs has been deployed and their malaria data are now incorporated into the malaria surveillance system.

In Sampov Loun, the PMI-supported OD for malaria elimination, elimination activities were launched in July 2015. Since then, 5,324 malaria tests have been conducted with 324 testing positive (test positivity rate=6%). Using the "1-3-7" approach, 83% were reported within one day, 77% investigated within three days, and 82% of response activities conducted within seven days. As part of the response, surrounding households and co-travelers were screened (n=988) and 10 (test positivity rate=1%) were found to be positive, all in co-travelers.

Table 33: Surveillance, Monitoring, and Evaluation Data Sources

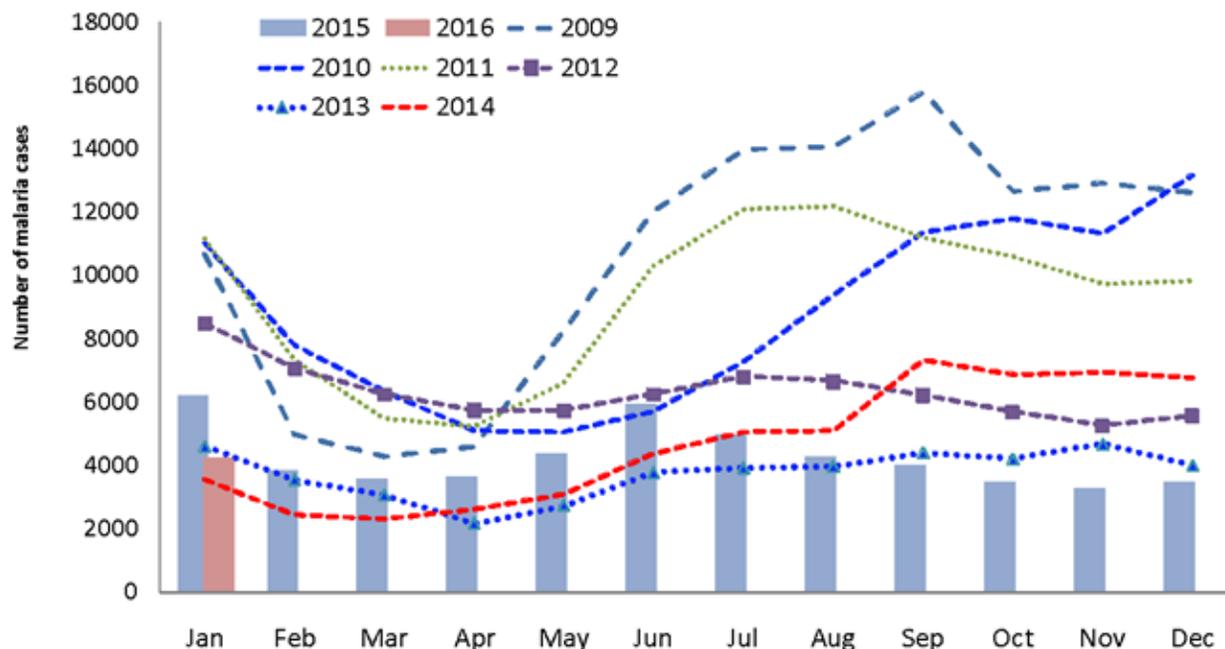
Data Source	Survey Activities	Year								
		2009	2010	2011	2012	2013	2014	2015	2016	2017
Household surveys	Demographic Health Survey (DHS)*		X				X			
	Malaria Indicator Survey (MIS)*		X			X				
Malaria surveillance and routine system support	Support to malaria surveillance system					X	X	X	X	X
	Support to HMIS*					X	X	X	X	X
Therapeutic	<i>In vivo</i> efficacy testing	X	X	X	X	X	X	X	X	X
Entomology	Entomological surveillance and resistance monitoring				X*	X*	X*	X*	X	X

*Not PMI-funded

Table 34: Routine Surveillance Indicators

Indicators	Value
Total number of reported malaria cases Data source: HMIS/Malaria Information System	51,262
% diagnostically confirmed	97.2%
Number of <i>P. falciparum</i> (%)	23,703 (46%)
Number of <i>P. vivax</i> (%)	20,274 (40%)
Number of mixed infections (%)	6,323 (12)
<i>If available, report separately for outpatients and inpatients</i>	
Number of reported malaria cases from VMWs (%)	16,370 (32%)
Number of reported malaria cases from health centers and hospitals (%)	34,892 (68%)
Total number of reported malaria deaths Data source: HMIS/Malaria Information System	10
Malaria test positivity rate (outpatients) Data source: HMIS/Malaria Information System	22.2%
Completeness of monthly health facility reporting Data source: HMIS 2013	100%
Numerator: Number of monthly reports received from health facilities	87
Denominator: Number of health facility reports expected (i.e., number of facilities expected to report multiplied by the number of months considered)	87

Figure 19: Number of treated malaria cases by month and year, 2009-2016 (Source: CNM, MOH)



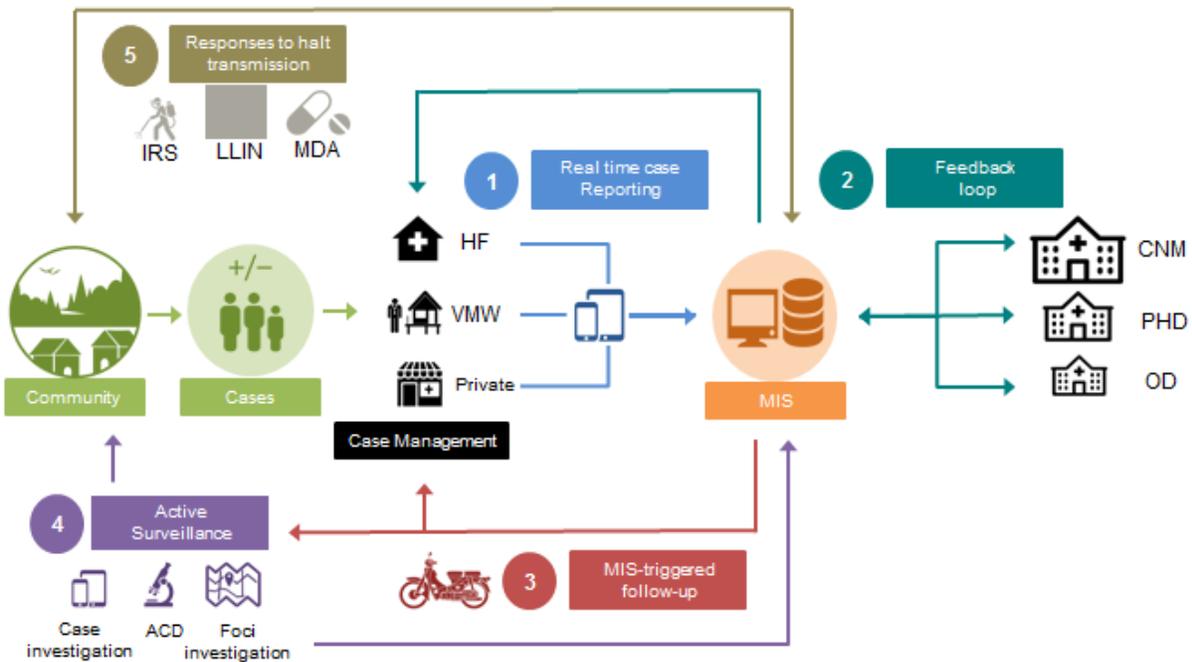
Source: HMIS/MOH & MIS/CNM 2009-2015

Plans and justification

As the CNM implements its elimination action framework, access to timely malaria information becomes critical. As malaria cases decrease, PMI will work with the CNM to ensure rapid reporting of malaria cases, initiate timely case investigation and response activities, including reactive surveillance, and to eliminate transmission foci as laid out in the MEAF (Figure 20). PMI will continue to support the CNM's two-pronged approach of strengthening the passive malaria information system to enable better malaria surveillance in endemic areas, as well as increase its support for enhanced, real-time surveillance in elimination areas.

Although the current MIS platform is functioning and able to provide comprehensive malaria data, it is not yet equipped to handle case investigation and response data that will be collected in elimination districts. The majority of the funding to upgrade the current malaria information system will be provided by the Global Fund and the Bill & Melinda Gates Foundation. PMI's contribution will be to provide technical assistance on developing the M&E plan, ensuring that PMI's experiences in elimination implementation inform the national operational guidelines, manuals, and data collection forms. PMI's support to adopting the new malaria information system platform will focus on training provincial and district level staff in to collect and utilize the new platform for decision-making.

Figure 20: Schematic of proposed Cambodia malaria surveillance system



Proposed activities with FY 2017 funding: (\$570,000)

- Support for national level SM&E strengthening:** Support will be provided in updating the national M&E plan and technical assistance will be provided to ensure that operational guidelines, manuals, and standardized data collection forms informed by current elimination activities are developed by the CNM. Technical assistance will be provided to develop a new web-based malaria information system platform and to support the transition by training PHD/OD level staff. (\$150,000)
- Support for implementing enhanced SM&E in elimination settings:** Support for developing and implementing a case-based, real-time reporting system in elimination ODs, including training of provincial and district level staff to use real-time data to inform response activities. In all focus ODs, PMI will support training costs for all levels, software and hardware, data collection at the community level, and monthly meeting costs. In addition, the selected elimination ODs in consultation with CNM will implement the “1-3-7” approach which will require real-time notification of passively detected cases (within one day), case investigations (within three days), and response activities which will continue to evolve but for the time being include LLIN top-up for those without LLINs and screening of household members and co-travelers of the index case (within seven days). Throughout the project life cycle, lessons learned will be disseminated to inform the national strategy and plans for scale-up to additional ODs targeted for elimination with mainly Global Fund support. (\$400,000)

- **Private sector malaria data collection:** PMI will provide targeted support to improve case management QA activities in the private sector, as well as implementing a reporting system to capture malaria confirmed case information, which will be increasingly and more frequently incorporated into the Cambodian malaria information system at lower levels. (see Case Management section)
- **Technical assistance with M&E:** Two CDC TDYs are planned to provide technical assistance for M&E. (\$20,000)

7. Operational research

NMCP/PMI objectives

The MEAF aims to strengthen OR for malaria and set forth several activities to improve coordination and procedures. The CNM plans to conduct the following activities: 1. review and finalize the Policies and Guidelines to Conduct Malaria Research in Cambodia; 2. name a focal point for coordinating all OR for malaria; 3. once guidelines are established, collaborate with partners to conduct trainings for all staff on research design and implementation; 4. establish a malaria research working group under the CNM research network to review protocols and provide technical input and direction for the country's research agenda; and 5. require all partners to submit research data on a regular basis and share information widely to inform changes in strategy.

Priority research topics include new, sensitive field diagnostics, improved surveillance for malaria drug resistance, and scale-up of cost-effective personal prevention measures. In areas of high transmission, the CNM will implement a research project to assess the potential utility and cost-effectiveness of housing improvements to decrease transmission and assess the costs of deploying this intervention.

Progress since PMI was launched

PMI supported an evaluation of a third generation point-of-care RDT to assess G6PD deficiency. A point-of-care test that could safely guide treatment with primaquine both for the clearance of *P. falciparum* gametocytes as well as for the prevention of relapses by *P. vivax* will have tremendous programmatic implications. The third generation RDT had high sensitivity in detecting G6PD enzymatic activity of <30% comparable to the fluorescent spot test, which is the current laboratory standard¹⁷. This information confirmed the potential use of the product for use in radically curative regimens for *P. vivax* malaria.

Due to concerns of severe variants of G6PD deficiency and limited G6PD testing capacity at the peripheral level, Cambodia has not provided primaquine therapy. WHO now recommends that a single dose of 0.25mg/kg primaquine be given to patients with *P. falciparum* to reduce

¹⁷ Field Trial Evaluation of the Performances of Point-of-Care Tests for Screening G6PD Deficiency in Cambodia, A. Roca- Feltrer et al; PlosOne, 2014

transmission without G6PD deficiency testing¹⁸. Cambodia recently endorsed this policy; however, the use of primaquine radical cure for *P. vivax* still requires G6PD testing. PMI has been supporting a study to assess the tolerability and safety of low-dose primaquine for transmission blocking in symptomatic *falciparum*-infected Cambodians to assess the hematological response of administering low-dose primaquine in G6PD-deficient subjects.

Progress during the last 12-18 months

In 2015, enrollment began for the “Tolerability and safety of low-dose primaquine for transmission blocking in symptomatic *falciparum*-infected Cambodians” study. To date, no serious adverse events have been noted. If proven safe, data obtained from this study will provide the CNM with the evidence to widely implement this newly adopted strategy to target *P. falciparum* gametocytes. Although PMI funds were available to conduct a study to assess the “Feasibility of deploying G6PD RDTs to health facility and community levels,” the study was not approved by the national ethical committee and the funds were reprogrammed.

Table 35: PMI-funded operational research studies

Completed OR Studies				
Title	Start date	End date	Budget	Justification
Test performance of the CareStart® G6PD RDT	January 2013	December 2013	\$100,000	Initial evaluation of newly marketed test to screen for G6PD deficiency
Ongoing OR Studies				
Title	Start date	End date	Budget	Justification
Tolerability and safety of low-dose primaquine for transmission blocking in symptomatic <i>falciparum</i> -infected Cambodians	February 2015	September 2016	\$150,000	Assists CNM in decision to deploy low-dose primaquine as part of national policy

Plans and justification

There are no planned OR studies with FY 2017 funding.

8. Staffing and administration

One health professional serves as Resident Advisor (RA) to oversee PMI in Cambodia, representing USAID. In addition, one Foreign Service Nationals (FSNs) works as part of the PMI team. All PMI staff members are part of a single interagency team led by the USAID Mission Director or his/her

¹⁸ WHO Policy Brief on single-dose primaquine as a gametocytocide in *P. falciparum* malaria, January 2015

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 RA positions (whether initial hires or replacements) will be evaluated and/or interviewed jointly by USAID and CDC, and both agencies will be involved in hiring decisions, with the final decision made by the individual agency.

The PMI interagency 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 and direction to PMI implementing 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 Deputy Director and thus the PMI RA report to the USAID Health Office Deputy Director for day-to-day leadership, and work together as a part of a single interagency team. Technical expertise housed in Atlanta, Washington and the USAID/Regional Development Mission for Asia located in Bangkok complements PMI programmatic efforts.

The PMI RA is physically based within the USAID health office but is expected to spend approximately half of his/her time with and providing TA to the NMCP and implementing partners, including time in the field monitoring program implementation and impact.

The number of locally-hired staff and necessary qualifications to successfully 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 U.S. Global Malaria Coordinator.

Proposed activities with FY 2017 funding: (\$720,000)

- Support for USAID/PMI Resident Advisor, including 100% FSN, and in-country programmatic support and administrative costs. (\$710,000)
- Travel costs for RDMA-based USAID/PMI Resident Advisor and FSN. (\$10,000)

Table 1: Budget Breakdown by Mechanism**President's Malaria Initiative – Cambodia
Planned Malaria Obligations for FY 2017**

Mechanism	Geographic Area	Activity	Budget (\$)	%
CMEP	National and PMI project operational districts	Entomologic monitoring; ITN distribution; LLIN durability monitoring; case management at the community level; capacity building for in-country coordination and support to CNM and PHDs; SBCC community level implementation; national level SM&E strengthening; enhanced surveillance and M&E in elimination settings in target ODs.	\$2,436,000	54%
GHSC-PSM	National and PMI project operational districts	Procurement of LLINs/LLIHNs, RDTs, and ACTs.	\$475,000	11%
WHO umbrella grant	National	TES monitoring.	\$270,000	6%
CDC IAA	National and PMI project operational districts	Two SM&E TDYs and two entomology TDYs.	\$49,000	1%
TBD (private sector)	National	Quality assurance of case management in the private sector.	\$400,000	
TBD (drug quality)	National	Strengthening National Quality Control Laboratory.	\$50,000	1%
TBD (supply chain)	National	Supply chain strengthening.	\$100,000	2%
USAID	National	Staffing, administrative, and travel costs.	\$720,000	16%
Total			\$4,500,000	100%

Table 2: Budget Breakdown by Activity

**President's Malaria Initiative – Cambodia
Planned Malaria Obligations for FY 2017**

Proposed Activity	Mechanism	Budget (\$)		Geographic Area	Description
		Total	Commodity		
PREVENTIVE ACTIVITIES					
VECTOR MONITORING AND CONTROL					
Entomologic monitoring and insecticide resistance management					
Entomologic monitoring	CMEP	\$200,000	-	Sentinel Sites and Residual Foci	Focus on increasing capacity and surveillance for insecticide resistance; <i>ad hoc</i> entomological surveys to improve information on malaria transmission risk in particular residual foci and ecosystems.
Entomologic technical assistance	CDC IAA	\$29,000		National	Two TDYs for entomologic support.
Subtotal Entomologic monitoring		\$229,000	-		
Insecticide-treated Nets					

Procurement of ITNs	GHSC-PSM	\$200,000	\$200,000	6 Operational Districts	Support for approximately ~70,000 LLINs and LLIHNs (hammocks) for PMI-supported areas, filling potential national gaps, and targeting migrant and mobile populations.
Distribution of ITNs	CMEP	\$70,000		6 Operational Districts	Support for distribution of LLIN/LLIHNs (approximately \$1/LLIN).
LLIN durability monitoring	CMEP	\$150,000		Sentinel Sites	Durability monitoring of LLINs (incl. physical durability and insecticide content) to inform timing of future LLIN procurements.
Subtotal ITNs		\$420,000	\$200,000		
Indoor Residual Spraying					
Subtotal IRS		-	-		
SUBTOTAL VECTOR MONITORING AND CONTROL		\$649,000	\$200,000		
Malaria in Pregnancy					
LLIN distribution and promotion for MIP prevention	N/A	-	-		See ITN and SBCC sections.
Strengthening malaria case management for pregnant women	N/A	-	-		See Case Management section.
Subtotal Malaria in Pregnancy		-	-		

SUBTOTAL PREVENTIVE		\$649,000	\$200,000		
CASE MANAGEMENT					
Diagnosis and Treatment					
Procurement of RDTs	GHSC-PSM	\$225,000	\$225,000	6 Operational Districts	Procure 300,000 RDTs and microscopy supplies for focus areas for use by community level health volunteers with expansion to new operational districts.
Procurement of ACTs	GHSC-PSM	\$50,000	\$50,000	6 Operational Districts	Procure ~17,000 ACTs or other first-line treatments for use by community level health volunteers or workers; targeting migrant and mobile populations and to fill commodity gaps in public and private sector.
Case management at the community level, including implementation, training and supervision	CMEP	\$1,166,000		6 Operational Districts	Training and supervision of community-based malaria case management activities for both control and elimination districts; includes specific case management practices for malaria in pregnancy.
Quality assurance of case management in the private sector	TBD	\$400,000		6 Operational Districts	Improve quality of private sector case management through medical detailing, monitoring and supervision, and provision of malaria data to national surveillance system.

TES monitoring	WHO	\$270,000		Sentinel sites	TES implementation costs to support drug policy decisions.
Subtotal Diagnosis and Treatment		\$2,111,000	\$275,000		
Pharmaceutical Management					
Supply chain strengthening	TBD	\$100,000		National	Strengthen pharmaceutical management systems, forecasting, quantification, management, and distribution of pharmaceuticals and RDTs.
Strengthening National Quality Control Laboratory	TBD	\$50,000		National	Support for the DDF laboratory, maintenance of equipment, standard operating procedures, and monographs.
Subtotal Pharmaceutical Management		\$150,000	-		
SUBTOTAL CASE MANAGEMENT		\$2,261,000	\$275,000		
HEALTH SYSTEM STRENGTHENING / CAPACITY BUILDING					
Capacity building for in-country coordination and support to CNM and PHDs	CMEP	\$150,000		National	Capacity building for CNM and PHDs/ODs to support oversight and management of control and elimination activities.

SUBTOTAL HSS & CAPACITY BUILDING		\$150,000	-		
SOCIAL AND BEHAVIOR CHANGE COMMUNICATION					
SBCC community level implementation	CMEP	\$150,000		6 Operational Districts	Support for implementing effective SBCC approaches for control and intensified approaches for elimination activities (e.g., early detection and treatment of individual cases, conducting response activities to index cases, strategies to educate malaria patients on the importance of case follow-up and regimen adherence, maintaining community engagement as malaria incidence decreases etc.).
SUBTOTAL SBCC		\$150,000	-		
SURVEILLANCE, MONITORING, AND EVALUATION					
SM&E strengthening	CMEP	\$150,000		National	Support transition to a new web-based malaria information system platform, including technical assistance for software development; Build capacity at PHD/OD level to collect, analyze and use data.

Enhanced SM&E in elimination settings	CMEP	\$400,000		6 Operational Districts	Support for implementing case-based, real-time reporting system in elimination ODs, including training and use of electronic reporting. Includes costing of elimination-specific activities.
CDC technical assistance for M&E	CDC IAA	\$20,000		National	Two TDYs for M&E support.
SUBTOTAL SM&E		\$570,000	-		
OPERATIONAL RESEARCH					
SUBTOTAL OR		-	-		
IN-COUNTRY STAFFING AND ADMINISTRATION					
Staff salary and administrative costs	USAID	\$710,000			Support for USAID/PMI Resident Advisor, including 100% FSN, and in-country programmatic support and administrative costs.
RDMA FSN and RA travel	USAID	\$10,000			TA travel from RDMA.
SUBTOTAL IN-COUNTRY STAFFING		\$720,000	-		
GRAND TOTAL		\$4,500,000	\$475,000		