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## Cambodia

## Malaria Operational Plan FY 2023

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This FY 2023 Malaria Operational Plan has been approved by the Acting U.S. Global Malaria Coordinator and reflects collaborative discussions with national malaria control programs and other partners. Funding available to support outlined plans relies on the final FY 2023 appropriation from the U.S. Congress. Any updates will be reflected in revised postings.

This document was prepared in the early months of 2022 as the COVID-19 pandemic continued to evolve worldwide, including in PMI-partner countries. The effects of the pandemic on malaria control and elimination work in 2023 are difficult to predict. However, because U.S. Congressional appropriations for PMI are specific to work against malaria and any appropriations for work against COVID-19 are specific for that purpose and planned through separate future U.S. Government planning processes, this FY 2023 MOP will not specifically address the malaria–COVID-19 interface and will reassess any complementary work through timely reprogramming in countries.

# CONTENTS

## ABBREVIATIONS

| | |
|---|---|
| ACT | Artemisinin-based Combination Therapy |
| AS-MQ | Artesunate-Mefloquine |
| BCC | Behavior Change Communication |
| CDC | U.S. Centers for Disease Control and Prevention |
| CMS | Cambodia Malaria Survey |
| CNM | National Center for Parasitology, Entomology, and Malaria Control |
| CY | Calendar Year |
| DOT | Directly Observed Therapy |
| DSMET | District Special Malaria Elimination Team |
| FY | Fiscal Year |
| G6PD | Glucose-6-Phosphate Dehydrogenase |
| Global Fund | Global Fund to Fight AIDS, Tuberculosis and Malaria |
| GMS | Greater Mekong Subregion |
| HF | Health Facility |
| iDES | Integrated Drug Efficacy Surveillance |
| IEC | Information, Education, and Communication |
| IPC | Institute Pasteur of Cambodia |
| IPTf | Intermittent Preventive Treatment for Forest-Goers |
| IPTp | Intermittent Preventive Treatment for Pregnant Women |
| IRS | Indoor Residual Spraying |
| L1 | Local Case |
| LLIHN | Long-lasting Insecticide-treated Hammock Mosquito Net |
| LLIN | Long-lasting Insecticide-treated Mosquito Net |
| MEAF | Malaria Elimination Action Framework |
| MIP | Malaria in Pregnancy |
| MIS | Malaria Indicator Survey |
| MMP | Mobile Migrant Population |
| MMW | Mobile Malaria Worker |
| MOH | Ministry of Health |
| MOP | Malaria Operational Plan |
| MORU | Mahidol-Oxford Tropical Medicine Research Unit |
| NSP | National Strategic Plan |
| NTG | National Treatment Guideline |
| OD | Operational District |
| OR | Operational research |
| PE | Program Evaluation |
| PHD | Provincial Health Department |

| | |
|---|---|
| PMI | U.S. President's Malaria Initiative |
| PQ | Primaquine |
| PSMET | Provincial Special Malaria Elimination Team |
| QA | Quality Assurance |
| RDT | Rapid Diagnostic Test |
| SBC | Social and Behavior Change |
| SLD PQ | Single Low-Dose Primaquine |
| SM&E | Surveillance, Monitoring, and Evaluation |
| TA | Technical Assistance |
| TDA | Targeted Drug Administration |
| TES | Therapeutic Efficacy Study |
| TWG | Technical Working Group |
| USAID | United States Agency for International Development |
| VMW | Village Malaria Worker |
| WHO | World Health Organization |

## EXECUTIVE SUMMARY

To review the specific country context for Cambodia, please refer to the Cambodia Country Malaria Profile, which provides an overview of the country malaria situation, key indicators, the National Malaria Control Program Strategic Plan, and the partner landscape.

### The U.S. President's Malaria Initiative

Launched in 2005, the U.S. President's Malaria Initiative (PMI) supports implementation of malaria prevention and treatment measures as well as cross-cutting interventions. PMI's 2021–2026 strategy, *End Malaria Faster*, envisions a world free of malaria within our generation with the goal of preventing malaria cases, reducing malaria deaths and illness, and eliminating malaria in PMI partner countries. PMI currently supports 24 countries in sub-Saharan Africa and three programs across the Greater Mekong Subregion (GMS) in Southeast Asia to control and eliminate malaria. Cambodia began implementation as a PMI focus country in fiscal year (FY) 2011.

### Rationale for PMI's Approach in Cambodia

PMI's investments are aligned with the National Strategic Plan (NSP) for Elimination of Malaria in the Kingdom of Cambodia 2011–2025 and the Cambodia Malaria Elimination Action Framework (MEAF) 2021–2025, which outline three main objectives: 1) early detection, and effective and safe treatment of 100 percent of cases, and provision of effective personal protection to at least 90 percent of the high-risk population; 2) intensification of focal interventions to interrupt transmission in endemic locations with highest risk (including mobile migrant populations (MMPs/forest-goers) to eliminate *Plasmodium falciparum* by 2023 and *P. vivax* by 2025; and 3) investigation, clearing, documentation, and follow-up of 100 percent of cases and foci to interrupt transmission and prevent re-establishment.

### Overview of Planned Interventions

The proposed FY 2023 PMI funding for Cambodia is $9 million. PMI will support the following intervention areas with these funds:

#### 1. Vector Monitoring and Control

PMI will support integration of entomological monitoring as part of foci investigations, strengthen field and laboratory capacity at the central and provincial levels, and facilitate the national vector control working group. PMI will support procurement and distribution of long-lasting insecticide-treated mosquito nets (LLINs) and long-lasting insecticide-

treated hammock mosquito nets (LLIHNs) to address gaps, and will also support procurement and distribution of topical repellents along with LLINs and LLIHNs to mobile and migrant workers.

**2. Malaria in Pregnancy (MIP)**

PMI's support will ensure access and use of LLINs/LLIHNs for all persons at risk, including women of child-bearing age, as well as access and use of rapid diagnosis and treatment of malaria at community and health facility (HF) levels.

**3. Drug-based Prevention**

The National Center for Parasitology, Entomology, and Malaria Control (CNM) recommends targeted drug administration (TDA) and intermittent preventive treatment for forest-goers (IPTf) as part of foci management. PMI will support implementation of these approaches in active foci in PMI-supported areas alongside robust monitoring.

**4. Case Management**

PMI will support training and joint supervision of health care staff, including at the community level, to strengthen both the quality of care and routine reporting of malaria cases. Training will focus on the rapid diagnosis and management of uncomplicated and severe malaria; glucose-6-phosphate dehydrogenase (G6PD) testing. Radical cure for *P. vivax* with strong pharmacovigilance will also be highlighted. In addition, PMI supports gap-filling for malaria case management commodities as well as the implementation of integrated drug efficacy surveillance (iDES) and quality microscopy.

**5. Health Supply Chain and Pharmaceutical Management**

PMI will procure and distribute malaria commodities and will continue engaging CNM in collaborative supply chain strategic planning, quantification, and improving the management of commodity logistics data. PMI will also provide technical advice on strengthening warehousing, distribution, and inventory management. In addition, PMI will initiate the procurement of topical repellents for forest-goers.

**6. Social and Behavior Change (SBC)**

PMI will support the national malaria SBC technical working group (TWG) and promote coordination among stakeholders. Additionally, PMI will: conduct an assessment to explore the barriers and facilitators of *P. vivax* radical cure adherence; support the implementation, monitoring, and evaluation of a theory-informed and evidence-based package of SBC activities among target populations; and explore options to introduce appropriate vector control tools into markets through social marketing.

### 7. Surveillance, Monitoring, and Evaluation (SM&E)

PMI will expand support to CNM for SM&E at all levels to provide high quality data in support of the 1-3-7 surveillance system. PMI will assist CNM to establish guidelines and systems supporting surveillance for sustaining elimination as a model for use in provinces across the country.

### 8. Operational Research (OR) and Program Evaluation (PE)

PMI will not propose new OR in FY 2023 but will consider PE to strengthen activities targeting MMPs, including forest-goers, to improve prevention, diagnosis, and treatment of malaria in high-risk populations. PMI will also consider evaluation of safety and feasibility for *P. vivax* radical cure.

### 9. Capacity Strengthening

PMI will support activities to explore transitional solutions to enable the integration of malaria services and surveillance activities into the wider health system, including integration of village malaria workers (VMWs) and mobile malaria workers (MMWs) into community health structures. PMI will support development of a lab capacity maintenance system so health workers do not lose their skills in malaria detection and diagnosis as cases decrease.

### 10. Elimination

PMI will increasingly support activities to sustain malaria elimination gains in the long term. This will include support for national and subnational documentation of elimination, iDES, and activities for prevention of re-introduction.

# I. CONTEXT AND STRATEGY

## 1. Introduction

Cambodia began implementation as a U.S. President's Malaria Initiative (PMI) focus country in fiscal year (FY) 2011. This FY 2023 Malaria Operational Plan (MOP) presents a detailed implementation plan for Cambodia based on the strategies of PMI and the National Center for Parasitology, Entomology, and Malaria Control (CNM). It was developed in consultation with CNM and with the participation of national and international partners. The activities that PMI is proposing build on investments made by partners to improve and expand malaria-related services, including the Global Fund to Fight AIDS, Tuberculosis, and Malaria (Global Fund). This document provides an overview of the strategies and interventions in Cambodia, describes progress to date, identifies challenges and relevant contextual factors, and provides a description of activities that are planned with FY 2023 funding. For more detailed information on the country context, please refer to the Country Malaria Profile, which provides an overview of the country's malaria situation, key indicators, the CNM strategic plan, and the partner landscape.

## 2. PMI

PMI is led by the U.S. Agency for International Development (USAID) and implemented together with the U.S. Centers for Disease Control and Prevention (CDC). Launched in 2005, PMI supports implementation of malaria prevention and treatment measures—long-lasting insecticide-treated mosquito nets (LLINs), indoor residual spraying (IRS), accurate diagnosis and prompt treatment with artemisinin-based combination therapies (ACTs), intermittent preventive treatment of pregnant women (IPTp), and drug-based prevention—as well as cross-cutting interventions such as surveillance, monitoring, and evaluation (SM&E); social and behavior change (SBC); and capacity strengthening. PMI's 2021–2026 strategy, *End Malaria Faster*, envisions a world free of malaria within our generation with the goal of preventing malaria cases, reducing malaria deaths and illness, and eliminating malaria in PMI partner countries. PMI currently supports 24 countries in sub-Saharan Africa and three programs in the Greater Mekong Subregion (GMS) in Southeast Asia to control and eliminate malaria. Over the next five years, PMI aims to save lives, reduce health inequities, and improve disease surveillance and global health security.

Under the strategy, and building upon the progress to date in PMI-supported countries, PMI will work with National Malaria Control Programs and partners to accomplish the following objectives by 2026:

1. Reduce malaria mortality by 33 percent from 2015 levels in high-burden PMI partner countries, achieving a greater than 80 percent reduction from 2000.
2. Reduce malaria morbidity by 40 percent from 2015 levels in PMI partner countries with high and moderate malaria burden.
3. Bring at least 10 PMI partner countries toward national or subnational elimination and assist at least one country in the GMS to eliminate malaria.

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

1. **Reach the unreached:** Achieve, sustain, and tailor deployment and uptake of high-quality, proven interventions with a focus on hard-to-reach populations.
2. **Strengthen community health systems:** Transform and extend community and frontline health systems to end malaria.
3. **Keep malaria services resilient:** Adapt malaria services to increase resilience against shocks, including COVID-19 and emerging biological threats, conflict, and climate change.
4. **Invest locally:** Partner with countries and communities to lead, implement, and fund malaria programs.
5. **Innovate and lead**: Leverage new tools, optimize existing tools, and shape global priorities to end malaria faster.

## 3. Rationale for PMI's Approach in Cambodia

### 3.1. Malaria Overview for Cambodia

Approximately half of the population of Cambodia is at risk of malaria with an annual incidence at 0.26 per 1,000 population nationally[1]. To strategically deploy interventions, Cambodia has been stratified into high-risk, risk, medium-risk, low-risk, and no-risk areas with different interventions deployed based on transmission level. The principal malaria vectors are *An. dirus*, and *An. minimus.* Cambodia has made marked progress toward the elimination of malaria with targets of elimination of *P. falciparum* by 2023 and *P. vivax* by 2025. Central to achieving these goals are the national objectives of early detection and safe treatment of 100 percent of cases, and provision of effective personal protection to at least 90 percent of the high-risk population; intensification of focal interventions in endemic locations with highest risk, including mobile migrant

[1] Cambodia Ministry of Health Malaria Information System, 2021.

populations (MMPs) such as forest-goers, and investigation, clearance, documentation, and follow-up of 100 percent of cases and foci.

As Cambodia progresses toward *P. falciparum* elimination and intensifies efforts to eliminate *P. vivax*, innovative approaches to eliminate and prevent re-introduction of malaria that are targeted through robust surveillance are essential. The Cambodia Surveillance Manual for Malaria Elimination targets activities in villages after local cases are identified. All malaria cases should be reported within one day and classified within three days as local (i.e., occurring within the village), from elsewhere in Cambodia, imported from outside Cambodia, or relapse/recrudescent (for *P. vivax*). Once local cases are identified, the investigation of the focus should be completed within one week which results in classification of the village as an active, residual, or cleared-up focus. In addition to this surveillance approach, in 2019 the CNM developed an intensification plan for the seven highest burden provinces that included strengthened training and coordination of village malaria worker (VMW) and mobile malaria worker (MMW) services, effective vector control strategies for MMPs, and prompt case reporting and investigation. In 2021, CNM began nationwide efforts to aggressively target remaining active *P. falciparum* foci under the “Last Mile for Malaria Elimination” program that includes recruitment of VMWs/MMWs, LLIN distribution to vulnerable groups, active fever screening, targeted drug administration (TDA) and intermittent preventive treatment for forest-goers (IPTf). Cambodia has now documented substantial declines, particularly in *P. falciparum* cases, and marked increases in VMW and MMW malaria testing which now accounts for 80 percent of all testing. *P. vivax* is now the predominant species, which led to deployment of a national *P. vivax* radical cure program in 2021.

For more detailed information on malaria indicators, please refer to the Country Malaria Profile.

### 3.2. Key Challenges and Contextual Factors

In its third decade of peace and economic growth, Cambodia has made great strides in reducing poverty and improving health. With these gains come better access to services, including malaria testing and treatment at the community level. However, significant obstacles remain. Some forest activities, such as logging, represent means of livelihood for certain populations and provide new habitats for mosquitoes, increasing exposure of vulnerable populations to their malaria-transmitting bites. In addition, the remote distances from forest work sites to the nearest health care provider as well as opportunity costs create barriers limiting prompt and proper health seeking. Treatment of *P. vivax* poses further barriers to community-level treatment by VMWs due to the need for glucose-6-phosphate dehydrogenase (G6PD) testing at health facilities (HFs) and prolonged therapy to ensure radical cure. High-level antimalarial drug resistance

limits options for treatment of *P. falciparum* with first-line antimalarial regimens having significant side effects, making it more difficult for patients to complete treatment or to continue participating in drug-based prevention programs in the absence of malaria. Additionally, as malaria cases decline, advocacy to keep malaria awareness and practices at acceptable levels becomes more difficult. Cambodia has made substantial progress toward elimination, but this progress also presents challenges. Acute needs include integration of the malaria-specific VMW and MMW cadres into the broader health system, a need to pivot from control efforts to documentation of elimination and prevention of re-introduction, and an increasing focus on non-falciparum malaria.

### 3.3. PMI's Approach for Cambodia

PMI's investments align with the National Strategic Plan (NSP) for Elimination of Malaria in the Kingdom of Cambodia 2011–2025 and the Cambodia Malaria Elimination Action Framework (MEAF) 2021–2025, which outline three main objectives: 1) early detection and effective and safe treatment of 100 percent of cases, and provision of effective personal protection to at least 90 percent of the high-risk population; 2) intensification of focal interventions to interrupt transmission in endemic locations with highest risk (including MMPs/forest-goers) to eliminate *P. falciparum* by 2023 and *P. vivax* by 2025; and 3) investigation, clearing, documentation, and follow-up of 100 percent of cases and foci to interrupt transmission and prevent reestablishment.

Cambodia has made significant progress toward malaria elimination. Malaria epidemiology is changing, contexts are changing, and policies and approaches are changing. With dramatic reduction in cases, the needs for some commodities are decreasing (e.g., treatment drugs) while other needs and challenges are emerging (e.g., the need to continue to detect and test suspected cases amid "testing fatigue" and to continue to promote the use of malaria prevention tools). Building and strengthening the capacity of Cambodia's health system—from the central level to the community level — to effectively implement and sustain evidence-based malaria control and elimination activities is central to PMI programming. PMI will leverage the strength of existing and new partners, including expanding the local partner base, to more effectively reach MMPs, especially forest-goers, a crucial population for malaria elimination. PMI will continue to monitor evidence of effectiveness of new interventions such as Last Mile for Malaria Elimination activities and adapt/adopt accordingly. As provinces secure elimination status, PMI will assist CNM to develop a prevention of a re-introduction model that can be applied as provinces transition. Given that the malaria elimination certification process is new for CNM, PMI will assist with preparing for this process and with ensuring high-quality systems are in place to support its application when it is time.

In addition, while PMI understands it will take time for Cambodia to fully finance its own development priorities, PMI will work with other partners (e.g., the Global Fund) to advocate for increased domestic resource mobilization for malaria elimination.

### 3.4. Key Changes in This MOP

The FY 2023 MOP is largely consistent with prior FYs but includes some new activities specifically targeted at driving toward elimination. PMI plans to procure topical repellents to be used by forest-goers in combination with other standard approaches (i.e., LLINs and long-lasting insecticide-treated hammock mosquito nets [LLIHNs]) to provide additional protection against malaria. This is a new development as PMI has not previously procured repellents for malaria outside of operational research (OR). It comes in response to the needs and particular elimination context in Cambodia. Additionally, consistent with national guidance and building on in-country experience, PMI will support the deployment of TDA and IPTf in active foci in PMI-supported areas.

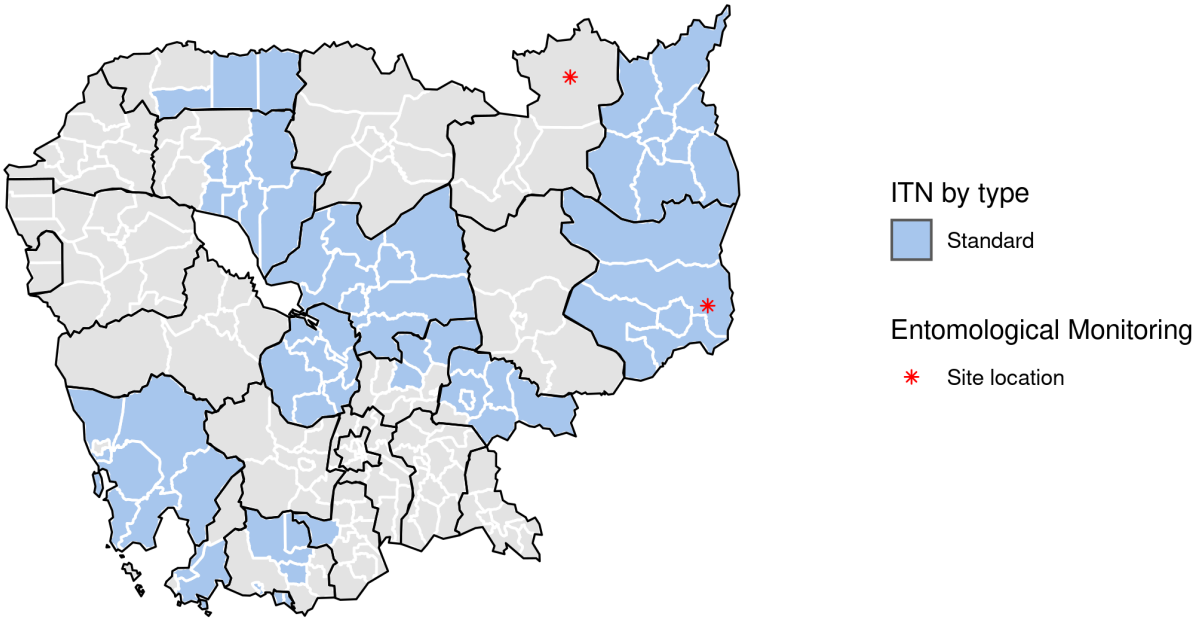
# II. OPERATIONAL PLAN FOR FY 2023

## 1. Vector Monitoring and Control

### 1.1. PMI Goal and Strategic Approach

PMI supports CNM's goals for vector control as described in the MEAF 2021–2025, including entomological surveillance, distribution of LLINs and LLIHNs via mass campaigns and continuous channels, and distribution of topical repellents in forest packs to MMPs in the highest risk areas (annual parasite incidence>20 and forest cover>70 percent). PMI has supported entomological monitoring at sentinel sites in Mondulkiri and Stung Treng Provinces but is transitioning to provide support for entomological monitoring as part of foci investigations. LLIN coverage of one per 1.8 persons and one LLIHN per household is achieved through periodic mass campaigns followed by community distribution as well as through focal interventions to maintain the target coverage level. As transmission continues to decline and becomes increasingly heterogeneous, PMI supports the procurement and/or distribution of standard pyrethroid LLINs as needed to fill gaps. While the MEAF 2021–2025 includes IRS as a potential response as part of foci investigations, it is not currently supported by PMI or any other donor. LLIN mass distributions and PMI-supported entomological monitoring sites for calendar year (CY) 2021 are shown in Figure 1 below.

**Figure 1. Map of Vector Control Activities in Cambodia—ITN Mass Distribution**



### 1.2. Recent Progress (between April 2021 and March 2022)

PMI supported the following vector control activities:

- Conducted entomological monitoring in two sentinel sites in two operational districts (ODs) in Mondulkiri and Stung Treng Provinces in collaboration/partnership with CNM, provincial health department (PHD) and OD staff. Monitoring activities included vector bionomics monitoring and insecticide resistance monitoring.
- Procured and distributed via mass campaigns 71,000 LLIHNs to 18 provinces, including three PMI-targeted provinces; distributed 79,675 LLINs to 93,254 villagers in 102 targeted villages in Preah Vihear Province; distributed 12,200 LLINs to eight provinces.
- Distributed 11,535 standard LLINs to high-risk malaria populations in 379 villages through continuous distribution by VMWs.
- Final 36-month durability monitoring data collection for standard LLINs distributed in the 2018 mass campaigns in Battambang and Pursat Provinces.
- Community-level SBC activities covering 91 percent of 9,700 targeted households in PMI-supported provinces to monitor LLIN use, provide additional LLINs, as needed, and provide health education through interpersonal communication. For more information, please refer to the **SBC section** below.

### 1.3. Plans and Justification for FY 2023 Funding

The FY 2023 funding tables contain a full list of vector monitoring and control activities that PMI proposes to support in Cambodia with FY 2023 funding. Please visit www.pmi.gov/resources/malaria-operational-plans-mops for these FY 2023 funding tables.

#### 1.3.1. Entomological Monitoring

In CY 2022, PMI is supporting a hybrid approach to entomological surveillance. Longitudinal monitoring at the two sites in Mondulkiri and Stung Treng will continue every other month and, in alternating months, PMI is providing support to include an entomological component to foci investigations, where needed and in consultation with CNM. As malaria transmission continues to decline in Cambodia, PMI plans to shift all of its entomological support, including those implemented with FY 2023 funds, from longitudinal monitoring in fixed sites to entomological support for foci investigations as well as entomological training to PHD and OD staff who support the foci investigations. PMI will also provide support for the vector control technical working group (TWG) led

by CNM which will be essential to reposition Cambodia's vector monitoring and control activities from supporting elimination efforts to prevention of re-introduction.

**Summary of Distribution and Bionomics of Malaria Vectors in Cambodia**

The primary vectors in Cambodia are *An. dirus* and *An. minimus*. Peak abundance of *An. dirus* occurs from September to November while peak abundance of *An. minimus* was observed from November to February. *An. dirus* is closely associated with dense forest although it has also been reported from orchards and rubber plantations. This species generally feeds outdoors on people entering the forest where there are no formal structures. However, in villages within the deep forest, *An. dirus* has been collected indoors by CDC light traps although usually in lower numbers compared to outdoor trapping methods. *An. dirus* readily feeds on humans and is one of the most common mosquito species collected in or near forests using human-baited traps. It is much less common in animal-baited traps. Peak biting times for *An. dirus* are from dusk until around 10pm although a secondary peak later in the night has been observed in some sites. Furthermore, in heavily forested areas with a dense canopy, *An. dirus* has been reported to bite throughout the day. The bionomics of *An. minimus* are similar to *An. dirus*. However, *An. minimus* is often found in less forested areas, particularly along stream beds where the larvae develop in pools left by receding waters at the end of the rainy season. Secondary vectors include *An. maculatus, An. peditaeniatus, An. barbirostris* group, *An. phillipinensis*, *An. vagus*, and *An. hyrcanus* group. Less is known about the biology of these species. It is unlikely that they are able to sustain malaria transmission in the absence of *An. dirus* or *An. minimus*.

**Status of Insecticide Resistance in Cambodia**

Insecticide resistance data in Cambodia is limited to the sentinel sites where PMI is currently supporting entomological monitoring and is focused primarily on pyrethroids as LLINs are the primary vector control intervention. *An. dirus* from Mondulkiri Province was susceptible to alphacypermethrin, deltamethrin, and permethrin. *An. dirus* from Steung Treng Province was only tested against alphacypermethrin but was fully susceptible. *An. minimus* and *An. maculatus* from Mondulkiri were both fully susceptible to deltamethrin. The only evidence of pyrethroid resistance was observed in the secondary vector *An. peditaeniatus* from Steung Treng which was resistant to both alphacypermethrin and deltamethrin.

### 1.3.2. LLINs

PMI will continue to support procurement and distribution of LLINs through mass and continuous distribution channels as gaps are identified. The current gap analysis for CY 2022–2024 does not indicate a need for LLIN procurement by PMI. However, PMI will

procure approximately 30,000 LLIHNs during this period. PMI will provide technical support to Cambodia's 2023–2024 mass distributions and support SBC to promote proper use and care of LLINs. The most recent PMI-supported LLIN durability monitoring was completed in CY 2021. Please see the Cambodia Country Profile for more information.

In Cambodia, LLINs are distributed via mass campaigns every three years—though not all provinces are targeted in the same year—as well as continuous channels, mainly via VMWs and MMWs. The next mass campaign will be in 2023–2024; targeted provinces have not yet been finalized. The country is still using standard pyrethroid-only nets as there is no evidence of pyrethroid resistance among the primarily malaria vectors that would indicate a need to shift to other types of LLINs.

Please refer to the **LLIN and LLIHN Gap Analysis Tables** in the annex for more detail on planned quantities and distribution channels.

#### 1.3.3. IRS

PMI does not support IRS in Cambodia.

#### Topical Repellents

In CY 2022, PMI will support the procurement and distribution of topical repellents in forest packs to provide additional protection against malaria for forest-goers in six PMI-supported provinces (Battambang, Pailin, Pursat, Kampot, Kep, and Koh Kong). SBC activities will be conducted in support of these newly proposed PMI interventions.

## 2. Malaria in Pregnancy (MIP)

### 2.1. PMI Goal and Strategic Approach

While the prevalence of malaria overall is very low, and malaria primarily affects adult and adolescent males who work in forested areas, cases of malaria are reported among women of reproductive age and pregnant women. Of the 9,234 total malaria cases reported in 2020 nationally, 7,335 were male and 1,699 were female, of which 259 cases occurred among pregnant women. The national strategy does not recommend IPTp nor does it specifically focus on targeting interventions to pregnant women (e.g., LLINs are not distributed in locations where pregnant women could be reached such as in antenatal care or immunization clinics). Prevention and management of MIP, therefore, focuses on ensuring access and use of LLINs for all persons at risk, including women of child-bearing age as well as rapid diagnosis and treatment of malaria at community and HF levels. The 2013 Cambodia Malaria Survey (CMS) reported LLIN use among pregnant women at 57.2 percent. While the 2017 and 2020 Malaria Indicator

Survey (MIS) did not collect information on the use of LLINs among pregnant women and children under five years of age, the 2020 MIS reported 72 percent of households had access to an LLIN. While vector control and case management interventions focus specifically on adult male forest-goers, women do accompany men/husbands into the forest to collect forest products. According to a recent study by Institute Pasteur of Cambodia (IPC), approximately 8 to 12 percent of forest-goers surveyed were women.[2] The Cambodian National Treatment Guidelines (NTGs) which are under development describe the management of uncomplicated and severe MIP and include recommendations for malaria prevention during pregnancy. Specifically, the NTGs state that pregnant women should be encouraged to use appropriate prevention measures (including personal protection) when living in areas with ongoing transmission. In addition, pregnant women should be advised not to visit forested areas during pregnancy.

### 2.2. Recent Progress (between April 2021 and March 2022)

In line with Cambodia's national strategy, PMI does not support activities specifically targeted toward pregnant women; however, pregnant women are included in PMI-supported malaria prevention and elimination activities as described in the other sections of the MOP.

### 2.3. Plans and Justification for FY 2023 Funding

In line with Cambodia's national strategy, PMI does not plan to support activities specifically targeted toward pregnant women; however, pregnant women are included in all planned PMI-supported malaria prevention and elimination activities as described in the other sections of the MOP.

## 3. Drug-based Prevention

### 3.1. Seasonal Malaria Chemoprevention (SMC)

As SMC is not recommended in the MEAF 2021–2025, PMI does not support this intervention in Cambodia.

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[2] Kunkel, Amber, Chea Nguon, Sophea Iv, Srean Chhim, Dom Peov, Phanith Kong, Saorin Kim, et al., "Choosing Interventions to Eliminate Forest Malaria: Preliminary Results of Two Operational Research Studies Inside Cambodian Forests," *Malaria Journal* 20, no. 51 (2021), https://doi.org/10.1186/s12936-020-03572-3.

### 3.2. Other Drug-based Prevention

Cambodia's *Surveillance for Malaria Elimination: Operational Manual* (2020) outlines intensified and aggressive approaches for implementation in active foci where a locally acquired *P. falciparum* or mixed infection case has been detected within the last 12 months as part of the Last Mile for Malaria Elimination program. These interventions include the following:

- **TDA:** Following a census conducted within 14 days in villages identified and classified as active foci, health staff and VMWs will carry out household visits over five days and provide every male 15 to 49 years of age with artesunate-mefloquine (AS-MQ; three-day treatment) once per month over two consecutive months (two rounds). TDA is to be conducted in the first two months following detection of the locally acquired case.
- **IPTf:** In villages with active foci following the two rounds of TDA, health staff and VMWs will conduct weekly fever screening for high-risk populations and identify all adults planning to travel to forest areas in the following four weeks. Male forest-goers between 15 to 49 years of age will receive AS-MQ (three-day treatment) to take before they travel into malaria-risk areas. To reduce adverse effects, IPTf with AS-MQ is given no more than three times during a year (even with continued forest exposures) and no more frequently than every four weeks.

After completion of two rounds of TDA, IPTf distribution within an active focus is continued in combination with the weekly fever screening activities for up to 12 months following the detection of the locally acquired case.

A pilot implementing the Last Mile for Malaria Elimination program began in Kampong Speu Province in December 2020 with Global Fund support. The World Health Organization (WHO) is supporting qualitative and quantitative evaluation of the approach. Based on initial acceptability of the approach, CNM expanded this program to an additional four provinces (Kratie, Mondulkiri, Ratanakiri, and Stung Treng) targeting 89 villages with active foci. TDA and IPTf have been implemented in 89 percent (79/89) of villages with active foci with the remaining 10 villages providing IPTf only as no primary vectors had been detected (i.e., R0V1 foci). As noted above, the Last Mile for Malaria Elimination program is now included in the national strategy as a part of elimination efforts.

### 3.3. PMI Goal and Strategic Approach

MOP FY 2023 programmatic activities will align with the objectives detailed in the MEAF 2021–2025 and will contribute toward the PMI goal of eliminating malaria in the GMS. It

is likely that CNM will implement TDA and IPTf in PMI-supported areas in the near future, either in existing areas in the event new active foci are identified or in provinces where PMI is considering expanding its efforts. PMI will support the implementation of these activities in PMI-supported areas when there is an active focus. SBC activities will be designed and conducted for these newly proposed PMI interventions as appropriate. Routine deployment of this approach will be robustly documented to evaluate coverage, acceptance, and impact on VMW/MMW workload. PMI will also actively support CNM and WHO to conduct technical reviews of TDA/IPTf activities as well as discussions around program evaluation (PE) opportunities in this area.

### 3.4. Recent Progress (between April 2021 and March 2022)

To date, PMI has not supported Last Mile for Malaria Elimination activities.

### 3.5. Plans and Justification for FY 2023 Funding

PMI will support Last Mile for Elimination activities in response to active foci that occur in areas supported by PMI, as decided in consultation with CNM. Specifically, PMI will support training, supervision, and monitoring of VMW/MMW implementation of TDA/IPTf in active foci. Monitoring and evaluation of this approach in PMI-supported areas will help inform national and regional policies considering similar activities.

The FY 2023 funding tables contain a full list of activities related to other drug-based prevention that PMI proposes to support in Cambodia with FY 2023 funding. Please visit www.pmi.gov/resources/malaria-operational-plans-mops for these FY 2023 funding tables.

## 4. Case Management

### 4.1. PMI Goal and Strategic Approach

CNM's strategic objective (MEAF 2021–2025) for case management aims to detect 100 percent of cases early and to treat all cases effectively and safely by:

- Ensuring all suspected malaria patients receive a parasitological test within 48 hours of symptom onset and all patients with confirmed malaria receive first-line antimalarial treatment and other treatment regimens according to NTGs.
- Ensuring all patients with confirmed severe malaria are treated according to NTGs.
- Ensuring all targeted villages are achieving full coverage of diagnosis and treatment for all confirmed cases within 48 hours of symptom onset by community networks (VMWs/MMWs).

- Ensuring all suspected malaria patients from private sector providers are referred to a public sector facility.
- Ensuring all national, provincial, and referral hospitals and testing labs are qualified for malaria services and comply with quality assurance (QA) guidelines.
- Testing and regularly monitoring drug efficacy.
- Improving the uptake of malaria interventions for case management and prevention through information, education, and communication (IEC)/behavior change communication (BCC).

Cambodia has already made great progress toward these objectives, particularly at the community level through a network of VMWs and MMWs established in 2004. VMWs and MMWs are predominantly the first access points for diagnosis and treatment of uncomplicated malaria. In recent assessments, more than 60 percent of malaria is currently diagnosed by VMWs/MMWs using point-of-care rapid diagnostic tests (RDTs) rather than at HFs. The annual blood examination rate reached 9 percent in 2020 with CNM planning to continue to expand testing with annual blood examination rate targets of 10 percent by 2024. However, as malaria has increasingly become diagnosed by VMWs/MMWs, fewer blood smears are being collected to be read by a microscopist at the local referral hospital. While RDTs are recommended for diagnosis of uncomplicated malaria, microscopy is still recommended for initial diagnosis and follow-up of severe cases and to monitor therapeutic efficacy of antimalarials. Since April 2018, the Ministry of Health (MOH) has banned all malaria diagnosis and treatment in the private sector; private providers are strongly recommended to refer patients with suspected malaria to public facilities. PMI partners track private provider referrals within PMI-supported provinces.

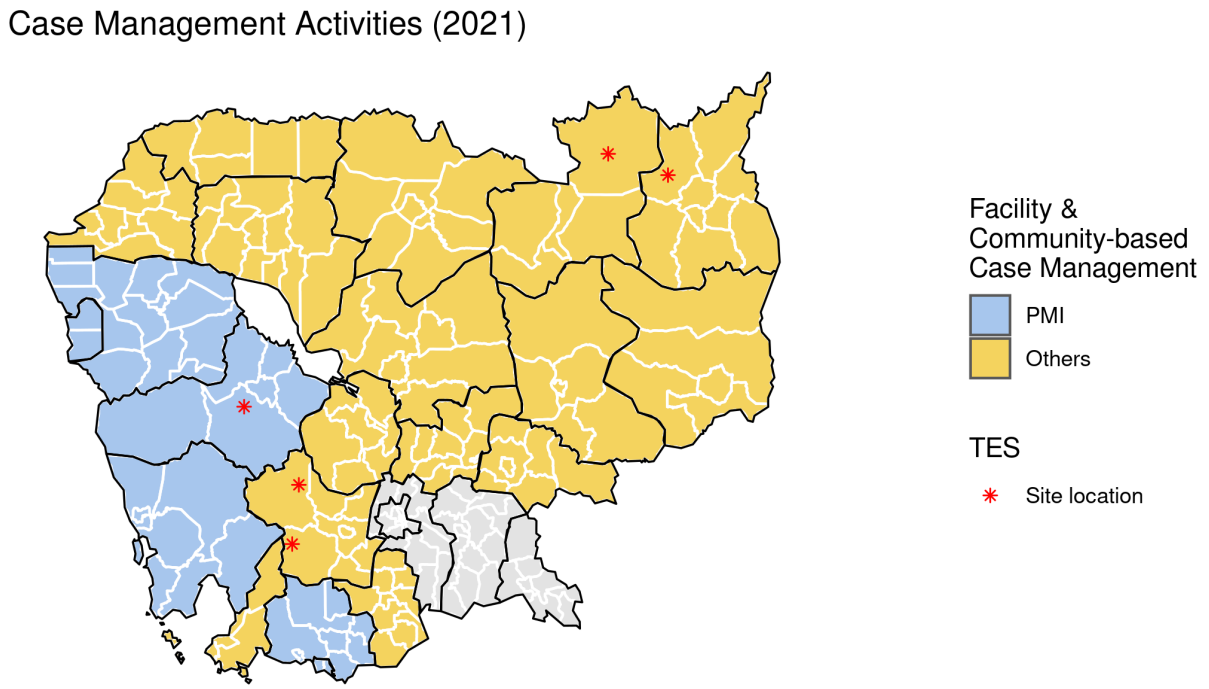
The first-line drug for all malaria species is AS-MQ as directly observed therapy (DOT). Second-line malaria treatment is artesunate-pyronaridine or Pyramax®. Single low-dose primaquine (SLD PQ) is recommended for all non-pregnant patients with *P. falciparum* regardless of G6PD level. For *P. vivax,* a patient's G6PD enzyme level is measured first and if the result is normal, 14 days of primaquine (PQ; 3.5mg/kg total dose) is provided for radical cure, in addition to AS-MQ. Quantitative G6PD testing and radical cure for *P. vivax* has been scaled up nationally in 2021. G6PD testing occurs at HFs and hospitals only and not by VMWs/MMWs. Recently, CNM has decided to incorporate plans for provision of weekly PQ treatment for eight weeks for G6PD-deficient males and females, as well as G6PD-intermediate females.

PMI aligns case management activities with the MEAF 2021–2025 objectives. PMI works with the CNM to support activities in Battambang, Pailin, and Pursat Provinces in

western Cambodia and Kampot, Kep, and Koh Kong Provinces in southwestern Cambodia (see Figure 2) through an OD-centered approach to build capacity for malaria control and elimination activities. Through implementing partners, PMI supports training and joint supervision of VMWs/MMWs, HF staff, and OD staff to strengthen both the quality of care and routine reporting. Training includes the rapid diagnosis and management of uncomplicated and severe malaria, G6PD testing and radical cure for *P. vivax*, and MIP. In addition, PMI supports gap-filling for malaria case management commodities, integrated drug efficacy surveillance (iDES)/therapeutic efficacy study (TES), and quality microscopy. Furthermore, PMI is supporting the development of new communication tools and job aids for health care providers to help improve acceptance and implementation of elimination activities especially for diagnosis, case investigation, and treatment.

PMI does not currently provide direct routine payment to VMWs and MMWs, but rather pays a performance-based incentive rooted in outreach, case reporting, treatment monitoring, and investigation through PMI's implementing partners. Each VMW receives approximately US$45 to $60 per month. While integration of VMWs and MMWs into the existing community health worker system (specifically the Village Health Support Group members) is being explored, existing community health workers are also not routinely paid but are provided benefits (e.g., partially subsidized health care) for serving in this role.

**Figure 2. Map of Case Management and Community Health Service Delivery Activities in Cambodia**




Provinces shown in gray are non-endemic for malaria.

### 4.2. Recent Progress (between April 2021 and March 2022)

PMI supported the following national-level case management activities:

- Trained and implemented radical cure of *P. vivax*, including the shift from qualitative to quantitative G6PD (SD Biosensor®) testing.
- Supported the seven Provincial Special Malaria Elimination Teams (PSMETs) and the 17 District Special Malaria Elimination Teams (DSMETs) in the six PMI-supported provinces. Led by the deputy provincial governor, the PSMET coordinates activities under other ministries (including health, environment, and law enforcement) at the subnational level to strengthen malaria elimination efforts.
- Convened and attended regular case management TWG meetings.
- Conducted a refresher training of 30 microscopists from referral hospitals and health centers in PMI-supported provinces on quality malaria microscopy techniques.
- Supported CNM and PHDs to conduct 141 supportive supervisory visits in PMI-supported areas. These supervisory visits provide guidance to the OD malaria team, HFs, and VMWs/MMWs on diagnosis and treatment,

surveillance and case reporting, supply chain for commodities, and to address their challenges during malaria program implementation.
- Supported WHO to build the capacity of the CNM National Reference Laboratory to conduct their own microscopy QA activities, including National Competency Assessment of Malaria Microscopists evaluations of active microscopists based on current program needs

PMI supported the following case management commodities activities:

- Procurement and distribution of 183,200 RDTs in 2021 (arrived in 2022) for nationwide use, accounting for approximately 20 percent of forecast needs in 2022. This is in addition to previous procurements and carryover stocks.

PMI supported the following facility-level case management activities:

- Public HFs in PMI-supported provinces performed 46,186 RDTs for malaria (100 percent of all suspected malaria cases). A total of 376 malaria cases (11 *P. falciparum*/mix and 365 *P. vivax* cases) in PMI-supported provinces were diagnosed in 2021.
- Due to COVID-19 restrictions, routine case management training was shifted from in-person group training to onsite coaching provided during monthly meetings. Ultimately 479 health care providers were included in on-site coaching with another 29 health care providers receiving on-site refresher training. Training on the appropriate recognition and referral of suspected malaria patients was provided to 78 percent of registered private providers in PMI-supported provinces during the last 12 months; private providers have not been allowed to diagnose and treat malaria since April 2018.
- The DSMET conducted 394 supervisory visits to VMWs who were absent from regular monthly meetings.
- Convened two regional meetings with district officials to develop annual operational plans in each OD and to review the progress and challenges of implementing the plans from prior years.

PMI supported the following community-level case management activities:

- VMWs/MMWs in Cambodia performed 99,006 RDTs diagnosing a total of 500 malaria cases (10 *P. falciparum*/mix and 490 *P. vivax* cases) in PMI-supported provinces in 2021.
- In PMI-supported provinces, VMWs and MMWs reached 258,669 people through interpersonal communication and malaria outreach activities to

provide key messages regarding malaria prevention, diagnosis, and treatment.

Please note that recent progress with monitoring antimalarial efficacy and the TES approach is presented in the **Plans and Justification for FY 2023 Funding** section immediately below.

### 4.3. Plans and Justification for FY 2023 Funding

The FY 2023 funding tables contain a full list of case management activities that PMI proposes to support in Cambodia with FY 2023 funding. Please visit www.pmi.gov/resources/malaria-operational-plans-mops for these FY 2023 funding tables.

In FY 2023, PMI plans to support the following national-/provincial-level case management activities:

- Continue support for case management activities in Battambang, Pailin, and Pursat Provinces in western Cambodia and Kampot, Kep, and Koh Kong Provinces in southwestern Cambodia. Additional provinces may be supported contingent on current needs in FY 2023 and subsequent discussions with CNM.
- Support CNM to strengthen pharmacovigilance monitoring systems to ensure the detection, assessment, reporting, and prevention of adverse effects associated with provision of weekly PQ for G6PD-deficient patients with *P. vivax* infection.
- Monitor and strengthen iDES implementation as *P. falciparum* case counts approach zero and *P. vivax* cases are included in drug efficacy monitoring surveillance.
- Support WHO and other partners to build the capacity of the CNM National Reference Laboratory to conduct their own microscopy QA activities, entomological assays (e.g., ELISA for sporozoite detection), and nucleic acid amplification tests to measure antimalarial resistance markers (e.g., Kelch13, pfmdr, and Plasmepsin2).

In FY 2023, PMI plans to support the following case management commodities activities:

- Procure 300,000 RDTs for diagnosis of *P. falciparum* and *P. vivax*. All other case management commodities will be procured by the Global Fund, including ACTs and supplies for G6PD testing, or the MOH (PQ and injectable artesunate for severe malaria).

Please refer to the **ACT, RDT, Injectable Artesunate, and PQ Gap Tables** in the annex for more detail on planned quantities and distribution channels.

In FY 2023, PMI plans to support the following facility-level case management activities:

- Continue to support training and joint supervision of provincial, district, and health center staff to strengthen both the quality of care and routine reporting through implementing partners. Training includes the rapid diagnosis and management of uncomplicated and severe malaria, G6PD testing and radical cure for *P. vivax*, MIP, and other topics in the future consistent with CNM priorities.
- Strengthen pharmacovigilance monitoring systems at the health center level to ensure the detection, assessment, reporting, and prevention of adverse effects associated with provision of weekly PQ for G6PD-deficient patients with *P. vivax* infection.

In FY 2023, PMI plans to support the following community-level case management activities:

- Continue to support training and joint supervision of VMWs and MMWs to strengthen both the quality of care and routine reporting through implementing partners. Training includes the rapid diagnosis and management of uncomplicated malaria, referral of severe malaria, monitoring radical cure for *P. vivax*, MIP, and other topics in the future consistent with CNM priorities.
- Continue to expand access to G6PD testing and radical cure for *P. vivax* either by expanding access at the point of care (increased G6PD testing and treatment by VMWs/MMWs) or to strengthen referral systems for patients to receive G6PD testing at HFs and hospitals (potentially with VMWs/MMWs escorting patients to these facilities).
- Strengthen training of VMWs and MMWs to ensure the detection, assessment, reporting, and prevention of adverse effects associated with provision of weekly PQ for G6PD-deficient patients with *P. vivax* infection.

PMI does not currently provide direct routine payment to VMWs and MMWs but rather pays a performance-based incentive based on outreach, case reporting, treatment monitoring, and investigation. PMI will continue discussions on VMW/MMW integration into the existing community health worker system and will continue remuneration for these workers with the MOH.

Please see the **SBC section** below for details on challenges and opportunities to improve case management intervention, uptake, and maintenance.

### Monitoring Antimalarial Efficacy

After the current year (see Table 1), no further TESs are planned as drug efficacy monitoring will be incorporated into iDES. iDES had been piloted in 2019 in Takeo Province, but expansion of iDES was delayed due to limited resources and difficulties initiating new activities during the COVID-19 pandemic. Beginning in the second quarter of 2022, WHO and CNM will establish national, regional, and provincial teams to facilitate scale-up of iDES through training and supportive oversight of district health staff (including health center staff and VMWs/MMWs) who will be primarily responsible for iDES implementation. iDES will initially incorporate drug efficacy monitoring for *P. falciparum* with *P. vivax* to be added in future years. iDES will include DOT for both *P. falciparum* and *P. vivax* with AS-MQ. Patients with *P. falciparum* will also receive SLD PQ and will have return visits at Days 0, 1, 2, 28, and 42. Patients with *P. vivax* will be treated with 14 days of PQ and will return at Days 0, 1, 2, 28, and 90. Blood smears and filter paper collection (for testing of genetic markers) will be performed.

CNM will introduce iDES in provinces that had been supporting TESs including: Kampong Speu, Kratie, Mondulkiri, Ratanakiri, and Stung Treng and will expand nationally in CYs 2022 and 2023.

**Table 1. Ongoing and Planned Therapeutic Efficacy Studies**

| Ongoing Therapeutic Efficacy Studies for *P. falciparum* | | | |
|---|---|---|---|
| **Year** | **Site name** | **Treatment arm(s)** | **Plan for laboratory testing of samples** |
| 2021 | 1. Veun Sai, Ratanakiri<br>2. Siem Pang, Stung Treng<br>3. Chambok, Kampong Speu<br>4. Trapaing Cho, Kampong Speu | AS-MQ<br>AS-MQ<br>AS-MQ<br>AS-MQ | Ongoing<br>Effectiveness estimates are polymerase chain reaction–corrected to differentiate recrudescence from re-infection by IPC. Day 0 samples are tested for Kelch13, pfmdr, and Plasmepsin2. |

## 5. Health Supply Chain and Pharmaceutical Management

### 5.1. PMI Goal and Strategic Approach

The CNM aims to ensure a responsive supply chain system that provides an uninterrupted supply of malaria commodities for malaria activities across the country. PMI has procured, and will continue to procure where necessary, key antimalarial products (LLINs, LLIHNs, RDTs, antimalarial drugs) to cover needs and gaps, ensuring adequate access for target populations. This approach has largely ensured a continuous supply of commodities at service points in PMI-supported ODs and

elsewhere in the country. PMI support for commodity management has focused on forecasting and supply planning (quantification) of malaria commodities as well as monitoring pipelines, so potential bottlenecks in procurement and distribution of malaria commodities (including commodities procured by other sources) can be addressed in a timely manner. In addition, PMI plans to procure topical repellents to be used by forest-goers and provide additional protection against malaria. This is a new development as PMI had not procured repellents outside of OR previously. It comes in response to the needs and particular elimination context in Cambodia.

### 5.2. Recent Progress (between April 2021 and March 2022)

PMI's principal supply chain investments aimed at improving malaria commodity availability at service delivery sites included forecasting and supply planning, direct warehousing, delivery of commodities to health sites, and procurement of key commodities. In addition, PMI continued to provide technical support to the monthly supply coordination meeting.

**Forecasting**

- In August 2021, provided technical assistance (TA) to CNM in conducting the national forecasting of key malaria commodities (AS-MQ and RDTs) for 2022–2023.
- In November 2021, supported conducting the forecasting of pyronaridine-artesunate Pyramax® for pediatric use for 2022 (as AS-MQ 25+50mg phased out).
- Since December 2021, supported CNM to conduct a stock analysis of AS-MQ for 2022.
- In January 2022, supported CNM in conducting the G6PD refresher forecasting for 2023.

**Procurement**

- Procured LLINs and RDTs as mentioned above in the vector control section.

**Storage and Distribution**

- Distributed LLINs as mentioned above in the vector control section.
- Supported CNM in conducting a warehouse storage capacity assessment.
- Provided ongoing support to CNM with temporary storage of PMI-procured LLINs.

Service delivery point stockout levels for both AS-MQ and RDTs in Cambodia have consistently been below 10 percent. However, ensuring stock availability and monitoring

AS-MQ stocks closely remains critical, particularly given increased demand with the Last Mile for Malaria Elimination activities using AS-MQ as the drug-based prevention. There are also challenges with procuring AS-MQ from the manufacturer (Cipla) as minimum purchasing levels are much larger than quantities needed in-country. The next shipment of AS-MQ was expected to arrive around August or September 2022.

PMI will continue to support stock monitoring of key commodities. While the focus at the national level has been monitoring stock levels at central and OD levels, PMI is working with partners for closer monitoring at the HF and community levels. PMI is also ensuring minimum levels are adhered to and alert and response systems are in place. These efforts will ensure availability and limit expiry of key commodities.

### 5.3. Plans and Justification with FY 2023 Funding

The FY 2023 funding tables contain a full list of health supply chain and pharmaceutical management systems strengthening that PMI proposes to support in Cambodia with FY 2023 funding. Please visit www.pmi.gov/resources/malaria-operational-plans-mops for these FY 2023 funding tables.

Cambodia will continue to support forecasting and supply planning, direct warehousing and delivery of commodities to health sites (as needed), as well as procurement activities as described above in the **PMI Goal and Strategic Approach section.** Increasingly, these activities should be tailored to the specific context in-country where reduced caseloads lead to reduced use of some commodities (e.g., ACTs) and, as such, forecasting cannot be based on consumption levels (otherwise, we may end up with forecast levels of zero). The tailored forecasting should ensure availability of key commodities, while avoiding excess expiry of products. PMI will explore, where possible, potentially more efficient options and endeavors, such as regional forecasting and regional stockpiling, and harmonized delivery. In addition, PMI plans to begin procuring topical repellents to be used by forest-goers and to provide additional personal protection against malaria.

## 6. SBC

### 6.1. PMI Goal and Strategic Approach

The original MEAF detailed key SBC goals including the need for 90 percent of all people to seek treatment for fever within 24 hours at an HF or a qualified care provider and for at least 85 percent of the at-risk population to utilize an appropriate protection tool. In 2017, the National SBC Strategy was revised and linked to the MEAF to incorporate key SBC objectives including: 1) increase consistent use of LLINs among target communities; 2) improve care-seeking behaviors among at-risk populations; 3)

improve compliance with treatment regimes; and 4) increase awareness of risks related to artemisinin monotherapies. The MEAF 2021–2025 builds on these priorities, adding interventions to "improve the uptake of malaria interventions for case management and prevention through IEC/BCC" and to "create awareness and adapt behaviors by MMP and forest-goers, and improve community mobilization through IEC/BCC strategies."

In Cambodia, SBC efforts play a crucial role in reaching hard-to-reach populations, such as forest-goers and other MMPs, who are at high risk of contracting malaria. In each OD, CNM is working with partners to identify communities of MMPs and their locations, and to train MMWs to provide testing and treatment for malaria at entry points to the forest. In line with the MEAF (2021–2025), PMI and other partners support the development and implementation of SBC tools to improve care-seeking and the adoption and maintenance of preventive behaviors. While this focuses on working with at-risk populations, PMI will explore working with service providers, as well as with other relevant stakeholders (e.g., the Ministry of Environment and forest rangers) and the Ministry of Tourism, particularly given the increase in eco-tourism involving travel into forests.

### 6.2. Recent Progress (between April 2021 and March 2022)

The PMI-supported 2020 Formative Assessment Report on forest-goers is being used to design SBC packages to be deployed targeting these at-risk populations. Based on these results with guidance from CNM, PMI supported development of a package of SBC activities to encourage all forest-goers to visit a VMW, MMW, or public HF for malaria testing every time they exit the forest, regardless of whether they have symptoms. PMI supported a human-centered design approach to design a package of theory-informed, evidence-based activities. The final SBC package focuses on the message "Don't wait for symptoms!" and includes a variety of tools to encourage testing after every visit to the forest. These materials will be rolled out in 50 villages in three provinces (Kampong Speu, Pursat, and Kampong Chhnang) beginning in the second quarter of 2022. During the reporting period (April 2021 to March 2022), PMI also supported CNM to organize two meetings of the SBC TWG.

Below is an overview of trends and related SBC implications for each intervention that PMI supports in Cambodia:

**LLIN Access/Ownership**

- The proportion of households with at least one LLIN increased from 51.2 percent per the 2017 CMS to 72.2 percent in the 2020 CMS.
- Nearly 95 percent of MMPs reported owning at least one mosquito net, but only 58 percent owned at least one LLIN. The LLIN ownership coverage was

much higher among security personnel and forest-goers than among seasonal workers and construction workers.[3].

- Approximately 88 percent of forest-goers (n=654) owned at least one LLIN, and approximately 83 percent owned at least one LLIHN.[4]

**Conclusion/Recommendation**

- Access to LLINs among households and forest-goers is variable but does not appear to be a significant barrier to use. While LLINs may provide some level of protection to forest-goers due to their sleeping habits and mobility, efforts should be made to explore alternative or complementary vector control tools to fully protect forest-goers during their time in the forest.

**LLIN Use**

- In 2017, among those with LLINs/LLIHNs, 84.1 percent reported use the previous night, which decreased to 70.5 percent in 2020.[5]
- The proportion of forest-goers who reported sleeping under an LLIN the last time they slept in the forest increased from 42.0 percent in 2017 to 62.1 percent in 2020.[6]
- Approximately 76 percent of forest-goers (483/654) indicated that they sleep under an LLIN/LLIHN every night.[7]
- Reasons for not sleeping under an LLIN/LLIHN every night included: “too hot to sleep under” (50.6 percent); didn’t have an LLIN/LLIHN (20.7 percent); and didn’t bring their LLIN/LLIHN (19.3 percent).[8]
- Of forest-goers surveyed (n=654), 54.8 percent prefer to use spray topical repellents, 45.9 percent prefer lotion repellents, 45.7 percent prefer coils, and 34.8 percent prefer insecticide-treated clothing in the forest.[9]

**Conclusion/Recommendation**

- LLIN use among forest-goers is variable; however, it appears to be relatively high. PMI and CNM should continue to promote consistent LLIN use throughout the night among forest-goers and households in target villages.

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[3] WHO Malaria Program Review, 2019.
[4] PMI Formative Assessment, 2020/2021.
[5] CMS, 2017 and 2020.
[6] Ibid.
[7] PMI Formative Assessment, 2020/2021.
[8] Ibid.
[9] Ibid.

However, PMI and CNM recognize that LLINs are an imperfect vector control tool for forest-goers due to their sleeping habits and mobility, and they plan to provide topical repellents as additional protection for forest-goers during their time in the forest.

**Case Management**

- Based on a PMI-supported formative assessment in 2020, only 57 percent of forest-goers reported seeking care outside the home during their last febrile illness. Among those who sought care, only 39 percent reported receiving care within 24 hours.
- The first source of care for fever among those who sought care was: VMWs/MMWs (49 percent); public HFs (27.1 percent); and private HFs (16.4 percent).
- Only 43.6 percent of forest-goers received a confirmatory blood test (RDT or microscopy) during their last febrile illness.
- The reasons for not seeking care for fever included: the perception that the illness was not serious (50.9 percent); use of home treatment first (14.4 percent); and being in the forest during the onset of symptoms (38 percent).
- The 2020 CMS indicated that only 3.3 percent of respondents reported VMWs as a first point of consultation for fever. But the CMS surveyed the general population. Specifically among forest visitors, those who chose VMWs when sick while away from home or when staying in the forest was much higher at 40 percent. This suggests that VMWs were a significant source of care for malaria-related advice or treatment for forest visitors.

**Conclusion/Recommendation**

- Prompt testing of all symptomatic and high-risk asymptomatic individuals is the cornerstone of malaria case identification and management. SBC interventions to re-inforce demand-side issues related to appropriate testing for the most-at-risk individuals such as forest-goers remain critical.
- SBC activities aimed at improving care-seeking behavior should include a focus on social norms, including normalizing behavior to seek testing for malaria every time someone exits the forest, as social norms were a significant determinant for seeking care within 24 hours.
- VMWs/MMWs are the most accessible malaria service providers for those at greatest malaria risk (i.e., forest-goers) and should continue to be supported/enhanced to ensure quality service delivery in support of malaria elimination by 2025. SBC should continue to promote the VMWs/MMWs channels as reliable sources of malaria prevention and treatment in the

community and support VMWs/MMWs in providing effective consultation to suspected malaria patients.

***P. vivax* Radical Cure**

- Within six PMI-supported provinces between February 2020 to December 2021, only 54.6 percent of *P. vivax* patients received PQ radical cure (314/575).[10]
- The reasons for low rates of PQ initiation include: low referral rate from VMWs; narrow eligibility criteria (at the time PQ treatment was offered to men only and treatment is available only for those weighing >20kg); and lack of availability of HF staff or G6PD testing materials in some high-burden areas.

**Conclusion/Recommendation**

- As *P. vivax* cases account for >90 percent of total malaria cases and Cambodia aims to eliminate all human malaria by 2025, substantial effort will be required to increase the proportion of patients starting and completing *P. vivax* radical cure.
- A rapid formative assessment to understand the barriers and facilitators to uptake and adherence of *P. vivax* radical cure should be considered. Findings from the assessment could then inform SBC activities to promote *P. vivax* radical cure uptake and adherence.

### 6.3. Plans and Justification with FY 2023 Funding

The FY 2023 funding tables contain a full list of SBC activities that PMI proposes to support in Cambodia with FY 2023 funding. Please visit www.pmi.gov/resources/malaria-operational-plans-mops for these FY 2023 funding tables.

PMI plans to continue implementing the theory-informed and evidence-based package of SBC activities mentioned above in 50 target villages in Kampong Speu, Kampong Chhnang, and Pursat Provinces, but may potentially expand geographic scope of the current package of SBC activities to additional forest fringe villages. Additionally, PMI will conduct a formative assessment to explore the barriers and facilitators of *P. vivax* radical cure adherence and inform the implementation of theory-informed, evidence-based SBC activities to promote *P. vivax* adherence. PMI may also help bring appropriate vector control tools to markets through social marketing. PMI will also

[10] Annual Malaria Conference, February 2022.

continue to support the SBC TWG, which provides an effective forum for coordination of malaria-related SBC activities.

### Priorities

In FY 2023, PMI support for SBC will prioritize test-seeking behavior of forest-goers, use of appropriate vector control tools, and adherence to *P. vivax* radical cure, as described in Table 2.

**Table 2. Priority Behaviors to Address**

| Behavior | Target Population | Geographic Focus | Programming to Address Behavior |
|---|---|---|---|
| Care-seeking, specifically test-seeking following every visit to the forest | Forest-goers | Selected villages with high malaria caseload and forest-goers in Kampong Speu, Kampong Chhnang, and Pursat | • PMI is currently implementing the package of interventions focused on this behavior described above to remind forest-goers to seek testing and care.<br>• The activity will use three main channels: 1) installation of SBC tools/materials in each target village; 2) house-to-house visits by VMWs; and 3) using a loudspeaker in target village. |
| Use of appropriate vector control tools according to context (e.g., forest versus village) and based on scientific evidence | Forest-goers | Selected villages with high malaria caseload + forest-goers in Kampong Speu, Kampong Chhnang/Mondulkiri, and Pursat | • This is not a current focus area; however, potential activities will be informed by assessments and analyses to develop a theory-informed package which may include:<br>• Introduction of appropriate vector control tools to the market through social marketing to increase access.<br>• Use of market analysis and formative assessment findings to design theory-informed, evidence-based SBC activities to promote uptake and use of appropriate vector control tools.<br>• Implement theory-informed, evidence-based SBC activities to promote uptake and use of appropriate vector control tools. |
| Adherence to *P. vivax* radical cure | Forest-goers who test positive for *P. vivax* | Selected villages with high malaria caseload and forest-goers in Kampong Speu, Kampong Chhnang/Mondulkiri, and Pursat | This is not a current focus area; however, potential activities include:<br>• Conducting of a rapid formative assessment of forest-goers and providers to understand the barriers and facilitators of *P. vivax* radical cure uptake and adherence.<br>• Use of formative assessment findings to design SBC activities to promote uptake and adherence to *P. vivax* radical cure. |

| Behavior | Target Population | Geographic Focus | Programming to Address Behavior |
|---|---|---|---|
| | | | • Implementation of theory-informed, evidence-based SBC activities to promote uptake and adherence to *P. vivax* radical cure. |

### Additional Support Activities

PMI's current package of SBC activities is informed by theory and based on evidence. During implementation, PMI will support a robust monitoring and evaluation component, supporting baseline, midline, and endline evaluation with FY 2023 funding to assess the success of the entire package of SBC activities. Monitoring and evaluation activities will focus on intermediate outcome (i.e., Examining, is the package of SBC activities resulting in the desired change in behavioral determinants?) The findings from these evaluations will be used to improve ongoing and future SBC activities.

Additional FY 2023 funding could be used to address gaps in SBC-related evidence, including formative research, audience monitoring, evaluations, and OR, to name a few, in the following ways:

- Conduct an assessment to understand the facilitators and barriers to uptake and adherence to *P. vivax* radical cure (potentially borrowing methodologies and experience from tuberculosis and HIV). Acceptance and adherence to *P. vivax* radical cure is increasingly important in Cambodia's drive to elimination. Evidence-based, theory-informed SBC interventions should be developed and implemented to support G6PD testing (for providers and community members), adhere to PQ regimen (for community members), and, if relevant and appropriate, introduce tafenoquine.
- Continue to support CNM Malaria SBC TWG to ensure malaria SBC activities are designed to address determinants of malaria-related behaviors and tailored to the target population, and to encourage collaboration and consensus on malaria SBC among partners.
- Support national and subnational capacity strengthening of CNM and PHD/OD/health centers to implement SBC activity and tailor SBC activities to their contexts.
- Promote coordination between different entities (governmental and non-governmental) in support of various aspects of malaria elimination—i.e., coordination between those supporting case management, surveillance, and SBC.

## 7. SM&E

### 7.1. PMI Goal and Strategic Approach

Under the MEAF 2021–2025, Cambodia aims to investigate, clear, document, and follow up 100 percent of cases and foci to interrupt transmission and prevent re-establishment. In 2019, CNM adopted a “Day 0 surveillance” system as the foundation for real-time case reporting in all endemic ODs targeted for elimination. When a case is diagnosed, service providers utilize mobile phone/tablet for real-time reporting of case details, including geolocated data through a mobile phone network to CNM’s Malaria Information System. Reporting a case into the Malaria Information System triggers an alert to malaria response teams at CNM and the PHD/OD/HF in the staff of relevant catchment areas. Supplied with the geolocated data collection, the Malaria Information System provides malaria case data down to the village level allowing for identification of high-risk villages or foci. CNM continues to strengthen its capacity to target foci of ongoing malaria transmission.

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. PMI provides technical support to CNM to continue strengthening the existing surveillance system to detect and immediately notify all malaria cases, and investigate, classify, and respond to malaria cases and foci to move toward malaria elimination.

In line with the MEAF 2021–2025, PMI aims to ensure that every suspected malaria case and focus is detected and adequately responded to in a timely manner. To achieve these goals, PMI supported the scale-up of an evidence-based elimination model piloted in Sampov Loun OD aimed at stemming indigenous malaria cases and to prevent re-introduction. This model, which incorporates 1-3-7 surveillance and response along with AS-MQ DOT for all cases, produced substantial reductions in the number of *P. falciparum* and mixed cases in Sampov Loun OD; the last indigenous case was reported in 2016. This model was expanded nationally in 2019.

Under CNM, Cambodia updated the Surveillance Manual for Malaria Elimination in 2021 in line with the MEAF 2021–2025 to provide the strategic framework for implementing surveillance and a combination of interventions to achieve the objectives for malaria elimination. It describes the system for determining which interventions should be applied based on the concept of a malaria focus, given that transmission is focalized and no longer homogeneous throughout the provinces. The Surveillance Manual defines a focus as an individual village that has been identified as the source of infection for a local case (referred to as “L1”). The investigation of a new active focus is

therefore triggered by an L1 and is completed within one week of case detection. The focus investigation includes four main parts:

1. Index case confirmation as an L1.
2. Desk review of past reported cases to determine the number of cases of all classifications over the preceding 36 months. Seasonality and sociodemographic information of L1s are assessed to understand the potential receptivity and vulnerability of transmission of the focus.
3. Mobility assessment of all households within the village using a standardized questionnaire to determine the inhabitants' forest activity within the preceding year.
4. Entomological surveillance, including nocturnal mosquito capture over three consecutive nights, to determine the presence of primary vectors.

Using a weighted scoring system, these data from the focus investigation determine the vulnerability (designated, "V0" or "V1") and receptivity (designated, "R0" or "R1") of the focus. Once the focus is classified, a response plan that takes into consideration the species of L1 is prepared by the OD in consultation with CNM and PHD focal points, and introduced within 14 days of the last L1.

In 2021, CNM began more aggressively targeting the remaining active foci of *P. falciparum* with implementation of the Last Mile for Malaria Elimination program in five provinces (and expanded to a sixth province in 2022), which guides the selection of interventions in active foci based on receptivity and vulnerability scoring (see Figure 3). Activities under this program include: 1) recruitment of VMWs/MMWs to conduct community engagement, enumerate the target population size in the village, and to identify potential forest-goers; 2) provision of two rounds of monthly TDA with AS-MQ for all males 15 to 49 years of age; 3) administering of IPTf with AS-MQ for a subset of the same target population who are forest-goers; 4) distributing of LLINs for vulnerable groups; and 5) screening for weekly active fever.

All foci undergo annual re-classification into one of three groups:

1. **Active focus** is a village from which at least one positive case has been investigated and classified as L1 within the past 12 months.
2. **Residual focus** is a village from which at least one positive case has been investigated and classified as L1 between 12 and 36 months ago.
3. **Cleared-up focus** is a village formerly defined as an active focus in which no cases investigated and classified as L1 have been detected in more than 36 months.

Villages previously classified as residual or cleared-up foci but with new L1s in the last 12 months are reclassified as active foci, triggering a new focus investigation and response.

In conjunction with rapid identification of foci, testing rates, especially among VMWs and MMWs, have increased significantly. Malaria testing increased from 281,820 tests in 2018 to 816,312 tests in 2021, of which 80 percent were conducted by MMWs and VMWs. In combination, these efforts have resulted in substantial declines in *P. falciparum* cases with *P. vivax* becoming the predominant species, now causing nearly 90 percent of malaria cases in 2021. In response, CNM initiated a nationwide *P. vivax* radical cure program, including G6PD testing and 14 days of PQ treatment for non-pregnant patients with *P. vivax* and normal G6PD levels. Recently CNM has introduced plans to expand the *P. vivax* radical cure program to provide PQ treatment once a week for eight weeks for all eligible patients with G6PD deficiency and non-pregnant women with intermediate G6PD levels. These aggressive strategies support Cambodia's goals to eliminate *P. falciparum* by 2023 and *P. vivax* by 2025.

For over ten years, PMI has been supporting TES activities in Cambodia. More recently, with decreasing malaria cases, the country is moving toward introducing iDES, as mentioned in the **Case Management section** above, and preventing re-introduction.

### 7.2. Recent Progress (between April 2021 and March 2022)

Over the last 12 months, PMI has:

- Supported training of VMWs/MMWs and HF staff in six provinces (Battambang, Kampot, Kep, Koh Kong, Pailin, and Pursat) to maintain and reinforce 1-3-7 elimination activities.
- Supported case-based, real-time reporting of cases (or within 24 hours of detection), including training and use of electronic reporting.
- Supported case investigation, ensuring that all cases are investigated within three days of diagnosis, including in hard-to-reach areas.
- Supported response for newly identified cases (including LLIN top-up distribution and testing of febrile household contacts and co-travelers) within seven days.
- Supported foci investigation within seven days and updated the foci register on a rolling basis.
- Increased active outreach among MMPs, including forest-goers, to improve malaria diagnosis and treatment in this high-risk group.
- Conducted 88 on-site training sessions on malaria surveillance from all public HFs in Kep, Kampot, and Koh Kong provinces.

- Strengthened health education and referral services among private providers to public HFs for diagnosis and treatment.
- Supported annual risk stratification exercises to review and update the methodology.

In Cambodia, malaria indicators as described in the MEAF 2021–2025, are generally derived from CMS conducted every three to four years, typically with support from the Global Fund. Since the baseline survey in 2004, follow-up CMS surveys have been conducted in 2007, 2010, 2013, 2017, and 2020. In previous years, the CMS usually included both household and facility-based surveys but, considering the availability of the robust Malaria Information System, which includes geolocated case data, the CMS 2020 conducted only a household survey without measurement of malaria prevalence. PMI does not currently provide any funding support for the Malaria Information System, but has previously supported the procurement of servers for the system, and continues to provide TA to test new modules as they are added to ensure that the system is responsive to stakeholder needs. In addition to CMS, additional assessments and surveys have been performed as per Table 5.

CNM maintains its Malaria Information System to collect geolocated data on case counts in real time. When a case is diagnosed, the VMW/MMW or HF staff report the case through a web-based application connected to CNM's Malaria Information System. Through its implementing partners, PMI supports HF and OD staff in PMI-supported districts with data entry and reporting to ensure accuracy, timeliness, and completeness of data entered into the Malaria Information System. PMI also supports HFs to ensure completion of the commodity stock data for monthly reviews. CNM often requests that PMI's implementing partners test new modules being added to the Malaria Information System prior to implementation. Once implemented, PMI supports training and supervision of HF and OD staff on use of these modules. One challenge that exists is that PMI and its implementing partners do not have regular access to Malaria Information System data; however, CNM does provide a quarterly data download and finalized Performance Indicator Tracking Table shortly after the data deadline for HFs to report. This arrangement has prohibited PMI from identifying any specific Malaria Information System strengthening efforts.

PMI will continue to provide substantial support to CNM for SM&E through activities at the provincial level down to the community level in the six PMI focus provinces to provide high-quality data to support the implementation and monitoring of the 1-3-7 surveillance system. PMI will also continue to support refresher trainings within regular meetings for OD/HF staff and VMWs, which have significantly improved timeliness, completeness, and accuracy of surveillance reports. PMI supports monthly meetings of

VMWs with HF staff as well as quarterly PSMETs and DSMETs. Please see FY 2023 PMI budget tables for a detailed list of proposed activities with FY 2023 funding.

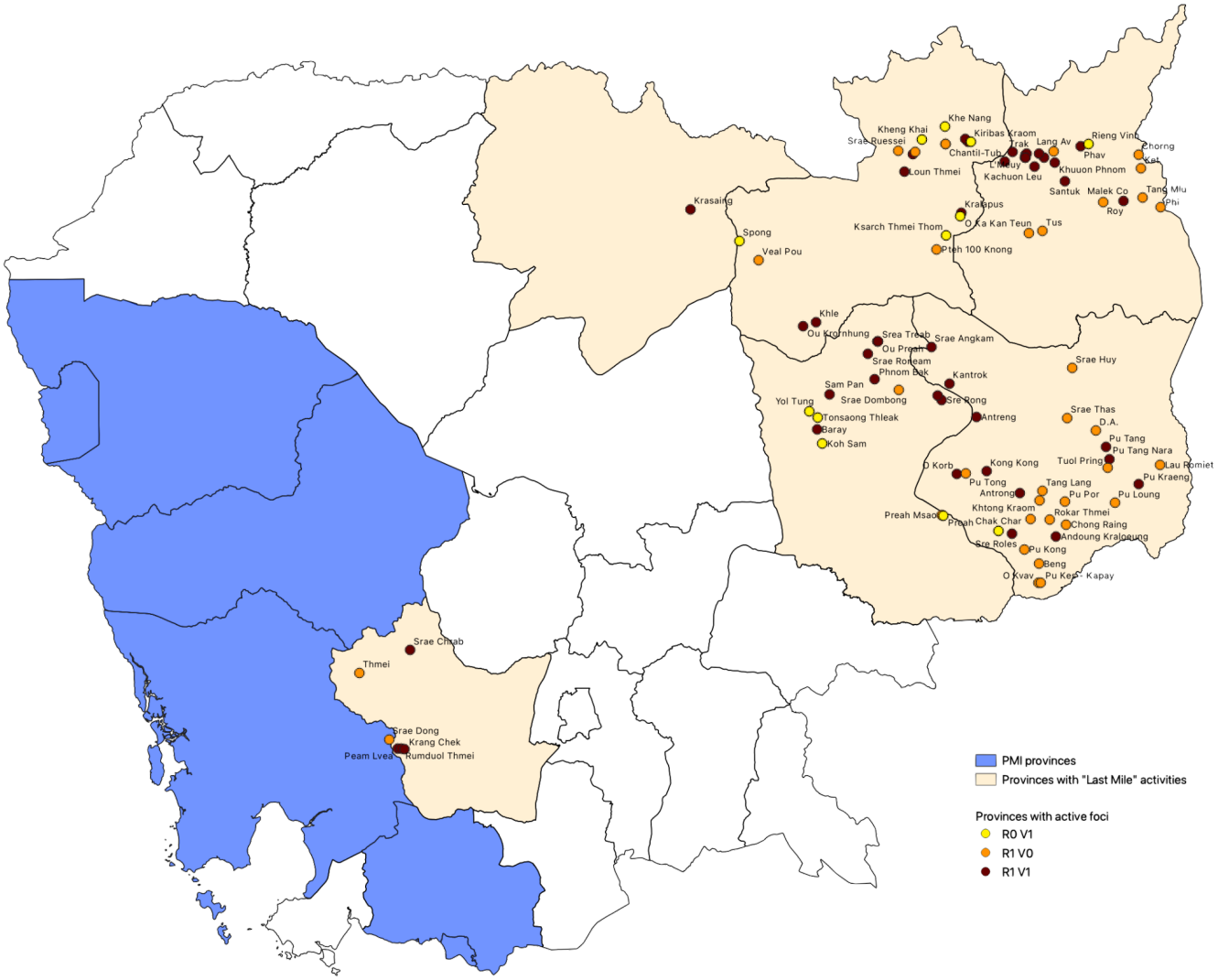
### 7.3. Plans and Justification with FY 2023 Funding

The FY 2023 funding tables contain a full list of SM&E activities that PMI proposes to support in Cambodia with FY 2023 funding. Please visit www.pmi.gov/resources/malaria-operational-plans-mops for these FY 2023 funding tables.

At the national level, PMI plans to provide continued technical support to CNM to strengthen the existing surveillance system to detect and immediately report all malaria cases and to investigate, classify, and respond to *P. falciparum* cases and foci to move toward malaria elimination. At the local level, PMI supports scale-up of an evidence-based elimination model that was first piloted in Sampov Loun OD and has now been adapted nationwide to eliminate indigenous malaria cases and prevent re-introduction. This model, which incorporates 1-3-7 surveillance and response along with DOT for all cases (including *P. vivax*), has produced substantial reductions in the number of *P. falciparum* and mixed cases in Sampov Loun OD; the last indigenous case was reported in 2016. PMI support for this model has been expanded to six provinces. PMI provides substantial support to CNM through activities at the provincial level down to the community level to ensure good quality data to support the implementation and monitoring of the 1-3-7 surveillance system. Furthermore, in FY 2023, alternative approaches such as 1-1-7 may be considered to streamline malaria case investigation and response further and increase the likelihood of long-term sustainability. In addition, PMI is currently working with partners to develop a prevention of re-introduction strategy to be rolled out in ODs with zero malaria cases.

PMI will continue to provide substantial support to CNM for SM&E through activities at the provincial level down to the community level in the six PMI focus provinces to provide high-quality data to support the implementation and monitoring of the 1-3-7 surveillance system. PMI will also continue to support refresher trainings within regular meetings for OD/HF staff and VMWs, which have significantly improved timeliness, completeness, and accuracy of surveillance reports. Please see FY 2023 PMI budget tables for a detailed list of proposed activities with FY 2023 funding.

**Figure 3. Cambodia Active Foci Classification, March 2022**




R = Receptive (areas with presence of primary vectors and ecological factors favoring malaria transmission)
V = Vulnerable (areas in proximity to malarious areas or prone to frequent influx of infected individuals)

**Table 3. Available Malaria Surveillance Sources**

| Source | Data Collection Activity | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|---|---|
| Household Surveys | Demographic and Health Survey | | P* | | | | |
| Household Surveys | Malaria Indicator Survey | X* | | | | | |
| Household Surveys | Multiple Indicator Cluster Survey | | | | | | |
| Household Surveys | EPI survey | | | | | | |
| Health Facility (HF) Surveys | Service Provision Assessment | | | | | | |

| Source | Data Collection Activity | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|---|---|
| HF Surveys | Service Availability Readiness Assessment (SARA) survey | | | | | | |
| HF Surveys | Other HF Survey | | | | | | |
| Malaria Surveillance and Routine System Support | Therapeutic Efficacy Studies | X | P* | | | | |
| Malaria Surveillance and Routine System Support | Integrated Drug Efficacy Surveillance | | | P | P | P | P |
| Malaria Surveillance and Routine System Support | Support to Parallel Malaria Surveillance System | X* | X* | P* | P* | | |
| Malaria Surveillance and Routine System Support | Support to Health Management Information System | | | | | | |
| Malaria Surveillance and Routine System Support | Support to Integrated Disease Surveillance and Response | | | | | | |
| Malaria Surveillance and Routine System Support | Electronic Logistics Management Information System | | | | | | |
| Malaria Surveillance and Routine System Support | Malaria Rapid Reporting System | X* | X* | P* | P* | | |
| Other | EUV | | | | | | |
| Other | School-based Malaria Survey | | | | | | |
| Other | Knowledge, Attitudes and Practices Survey, Malaria Behavior Survey | X | | | | | |
| Other | Malaria Impact Evaluation | | | | | | |
| Other | Entomologic Monitoring Surveys | X | X | X* | | | |

*Asterisk denotes non-PMI funded activities; “X” denotes completed activities; P denotes planned activities.

## 8. OR and PE

### 8.1. PMI Goal and Strategic Approach

In the MEAF 2016–2020, CNM identified several priority research topics, including the need for new sensitive field diagnostics, improved surveillance for malaria drug resistance, and scale-up of cost-effective personal prevention measures. In addition, CNM described several steps to strengthen OR for malaria and plans to improve communication between CNM and its partners. These plans have not changed under MEAF 2021–2025, but CNM emphasized the need for greater coordination with research partners to determine top research priorities over the next five years.

PMI has supported key OR activities in line with CNM's goals to address key programmatic and policy needs in Cambodia. Prior OR studies have included a field evaluation of a qualitative RDT to screen for G6PD deficiency, a qualitative study to identify determinants of net preference and acceptability, an assessment of the safety and tolerability of SLD PQ in patients with uncomplicated *P. falciparum* infections who are G6PD-deficient and non-deficient, and evaluating two different types of highly sensitive RDTs to diagnose subclinical malaria infection.

### 8.2. Recent Progress (between April 2021 and March 2022)

In CYs 2020 and 2021, PMI has supported an OR study to evaluate point-of-care diagnostics for screening G6PD deficiency, a major risk factor for severe hemolysis with PQ treatment. This study assessed the test performance (sensitivity and specificity) of the quantitative G6PD analyzers relative to the current gold standard method in both a community survey (phase 1) and in an HF setting (phase 2).

During Phase 1 the performance metrics (e.g., sensitivity, negative predictive value) of the quantitative point-of-care analyzers compared to spectrophotometry were lower than anticipated. Prior to Phase 2, the study team strengthened operational procedures and logistics and, as a result, the data show a much greater correlation between the quantitative point-of-care analyzers and standard spectrophotometry. Data analysis is being finalized and a manuscript is under development for publication in late 2022.

**Table 4. PMI-funded Operational Research/Program Evaluation Studies in Cambodia**

| Recently Completed OR/PE Studies | Status of Dissemination | Start date | End date |
|---|---|---|---|
| Field trial to evaluate the performance of novel point-of-care diagnostics for screening G6PD deficiency in malaria endemic areas in Cambodia | Preliminary results shared at the American Society of Tropical Medicine meeting in November 2021. Data analysis being finalized. Manuscript under development. | January 2020 | December 2021 |
| **Ongoing or Planned OR/PE Studies** | **Status** | **Start date** | **End date** |
| No PMI-supported OR/PE studies are ongoing currently | | | |

**Table 5. Non-PMI-funded Operational Research/Program Evaluation Studies Planned/Ongoing in Cambodia**

| Source of Funding | Implementing Institution | Research Question / Topic | Current Status / Timeline |
|---|---|---|---|
| Global Fund—RAI3E grant | Mahidol-Oxford Tropical Medicine Research Unit (MORU)<br>Asia-Pacific Malaria Elimination Network<br>University of California San Francisco<br>Action for Health Development | Sustaining village health worker programs with expanded roles in the GMS.<br>To be conducted in Cambodia, Thailand, and Vietnam. | Under ethics review.<br>To start in 2022. |
| Global Fund—RAI3E grant | Institute Pasteur of Cambodia<br>U.S. Armed Forces Research Institute of the Medical Sciences<br>PATH<br>University of California San Francisco | *P. vivax* elimination in the GMS: targeting the hypnozoite reservoir, expanding access to radical cure treatments, and enhancing safe and effective case management.<br>To be conducted in Cambodia and Laos. | Under ethics review.<br>To start in 2022. |
| Global Fund—RAI3E grant | Burnet Institute<br>Health Poverty Action | Personal protection packages for reducing residual malaria transmission in forest-going mobile migrant populations (MMPs) in the GMS: Stepped-wedge trials with nested mixed methods study.<br>To be conducted in Cambodia, Laos, Myanmar, and Vietnam. | Ongoing |
| Global Fund—RAI3E grant | Burnet Institute<br>Health Poverty Action | Global Optimizing 1-3-7 surveillance and response strategies to achieve malaria elimination across the GMS.<br>To be conducted in Cambodia, Laos, Myanmar, Thailand, and Vietnam. | Ongoing |
| MORU | MORU | Optimizing the dose of Tafenoquine for the radical cure of *P. vivax* malaria in Southeast Asia.<br>To be conducted in Cambodia, Laos, Myanmar, Thailand, and Vietnam. | In development |
| U.S. Government / Department of Defense | U.S. Armed Forces Research Institute of the Medical Sciences | Multicenter therapeutic efficacy assessment of pyronaridine-artesunate (Pyramax®) and new drug combinations with atovaquone-proguanil for the treatment of uncomplicated *P. falciparum* malaria in Cambodia. | Ongoing |
| University of Maryland | IPC | Open-labeled randomized clinical trial to determine | In development |

| Source of Funding | Implementing Institution | Research Question / Topic | Current Status / Timeline |
|---|---|---|---|
| | | therapeutic efficacy of artesunate or artesunate + PQ for *P. vivax* infection.<br>To be conducted in Cambodia. | |

### 8.3. Plans and Justification with FY 2023 Funding

No OR activities are proposed with FY 2023 funding.

## 9. Capacity Strengthening

### 9.1. PMI Goal and Strategic Approach

As Cambodia approaches their elimination targets, CNM will increasingly need to develop sustainable systems and policies that will maintain gains and prevent the re-introduction of malaria after elimination. PMI activities will continue to strengthen local capacity through TA as well as on-the-job training and coaching at all levels (i.e., CNM, PHD, OD, and village levels). In post-elimination settings where sufficient capacity has been built, PMI will increasingly transition responsibilities from project staff to provincial and district health staff to sustain program activities. PMI will apply FY 2023 funding to support the transition from donor-funded vertical assistance to an integrated program that enables health care providers to maintain skills, a reliable supply chain of malaria commodities, a responsive surveillance system, and high-quality lab capacity for accurate malaria diagnosis.

PMI's capacity-building efforts are also complemented by broader USAID/Cambodia health systems–strengthening activities such as improving the quality of health care at HFs, developing an accreditation program for HFs and providers, and improving resource mobilization for other infectious diseases at the subnational level.

### 9.2. Recent Progress (between April 2021 and March 2022)

PMI recently started supporting subnational laboratory capacity strengthening throughout the country to assess the status and capacity of malaria diagnostic laboratories and staff capabilities across various levels of the health system to determine gaps in capacity, policy, infrastructure, and resources and to provide recommendations and plans for addressing weaknesses and gaps identified through the assessment. Simultaneously, PMI will support the establishment of the National Reference Laboratory at CNM and strengthen QA in malaria diagnostics at the provincial level. These two activities will complement each other, with one focusing primarily at the subnational level and the other focusing primarily at the central level.

PMI is exploring potential support to strengthen the ability of provincial governments to budget and advocate for resources to sustain malaria elimination. This is in line with the Royal Government of Cambodia's de-concentration and decentralization policy aimed at transitioning central-level roles and authorities to subnational governments. PMI will provide CNM an overview of USAID/Cambodia's current support with HIV in building the program management and advocacy capacity at the provincial level. PMI will ascertain whether there is sufficient political will needed for engaging in this type of work for malaria.

### 9.3. Plans and Justification with FY 2023 Funding

The FY 2023 funding tables contain a full list of capacity strengthening activities that PMI proposes to support in Cambodia with FY 2023 funding. Please visit www.pmi.gov/resources/malaria-operational-plans-mops for these FY 2023 funding tables.

Based on the results of the baseline lab assessment, which will take place in 2022, PMI plans to support the resulting suggested activities that will strengthen the lab capacity for maintaining malaria elimination. It is anticipated that this assessment will provide insights into lab optimization and human resource capacity-building, and will assist CNM to develop and implement a plan for capacity maintenance of lower-level laboratory cadres. While activity development will need to wait until the assessment is complete, there are known inefficiencies in lab services for infectious diseases and no regular in-service professional development or refresher training. In line with the MOH's NSP 4 prioritization of digital health, PMI will explore introduction of a cost-efficient and sustainable online-based capacity maintenance system for laboratory cadres and potentially other malaria cadres as well.

Following on what was provided in FY 2022, PMI will provide support for key individuals involved in malaria elimination to participate in the frontline Field Epidemiology Training Program. Restructured as a formal program in 2019, the program aims to train at least one staff member from each OD over the next two years, and it currently has three cohorts of 20 students each year. As malaria programs become more integrated within the MOH's existing public health systems, having Field Epidemiology Training Program graduates who are familiar with malaria outbreak response will become more critical to sustain current program gains. PMI proposes supporting two students in each cohort (six per year) from PMI-supported provinces.

PMI expects to provide TA to CNM and the MOH to facilitate system thinking among key stakeholders, including coordinating institutions and national programs/centers leading key vertical interventions. Supported activities will promote policy development

and strengthen subnational health structures to enable the integration of malaria programming into the mainstream health system. Specifically, PMI will focus on integration of VMWs into the community health structure to sustain village-level surveillance post-elimination.

### 10. Staffing and Administration

A minimum of three health professionals oversees PMI in Cambodia. The single interagency team led by the USAID mission director or their designee consists of a resident advisor representing USAID, a resident advisor representing CDC, and one or more locally hired experts known as foreign service nationals. The PMI interagency team works 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.

## ANNEX: GAP ANALYSIS TABLES

**Table A-1. ITN (LLINs) Gap Analysis Table**

| Calendar Year | 2022 | 2023 | 2024 |
|---|---|---|---|
| Total country population | 17,126,530 | 17,332,049 | 17,540,033 |
| Total population at risk for malaria | 9,355,212 | 9,477,483 | 9,615,722 |
| PMI-targeted at-risk population | 2,192,364 | 2,219,885 | 2,251,563 |
| Population targeted for ITNs | 610,906 | 371,676 | 226,128 |
| **Continuous Distribution Needs** | | | |
| Channel 1: ANC | 0 | 0 | 0 |
| Channel 1: ANC Type of ITN | | | |
| Channel 2: EPI | 0 | 0 | 0 |
| Channel 2: EPI Type of ITN | | | |
| Channel 3: School | 0 | 0 | 0 |
| Channel 3: School Type of ITN | | | |
| Channel 4: Community/Village Malaria Workers (VMW) | 87,024 | 23,070 | 5,563 |
| Channel 4: Community Type of ITN | Single Pyrethroid | Single Pyrethroid | Single Pyrethroid |
| Channel 5: MOE, MoIH and MoND (Distribution to MMP) | 63,200 | 16,300 | |
| Channel 5: Type of ITN | Single Pyrethroid | Single Pyrethroid | Single Pyrethroid |
| Estimated Total Need for Continuous Channels | 150,224 | 39,370 | 5,563 |
| **Mass Campaign Distribution Needs** | | | |
| Mass distribution campaigns | 0 | 60,948 | 93,572 |
| Mass distribution ITN type | Single Pyrethroid | Single Pyrethroid | Single Pyrethroid |
| Estimated Total Need for Campaigns | 0 | 60,948 | 93,572 |
| **Total ITN Need: Continuous and Campaign** | **150,224** | **100,318** | **99,135** |
| **Partner Contributions** | | | |
| ITNs carried over from previous year | 268,834 | 316,510 | 385,892 |
| ITNs from Government | 0 | 0 | 0 |
| Type of ITNs from Government | | | |
| ITNs from Global Fund | 197,900 | 169,700 | |
| Type of ITNs from Global Fund | Single Pyrethroid | Single Pyrethroid | |
| ITNs from other donors | 0 | 0 | 0 |
| Type of ITNs from other donors | | | |
| ITNs planned with PMI funding | 0 | 0 | 0 |
| Type of ITNs with PMI funding | | | |
| **Total ITNs Contribution Per Calendar Year** | **466,734** | **486,210** | **385,892** |
| **Total ITN Surplus (Gap)** | **316,510** | **385,892** | **286,757** |

**Table A-2. ITN (LLIHNs) Gap Analysis Table**

| Calendar Year | 2022 | 2023 | 2024 |
|---|---|---|---|
| Total country population | 17,126,530 | 17,332,049 | 17,540,033 |
| Total population at risk for malaria | 9,355,212 | 9,477,483 | 9,615,722 |
| PMI-targeted at-risk population | 2,192,364 | 2,219,885 | 2,251,563 |
| Population targeted for ITNs | 610,906 | 371,676 | 226,128 |
| **Continuous Distribution Needs** | | | |
| Channel 1: ANC | 0 | 0 | 0 |
| Channel 1: ANC Type of ITN | | | |
| Channel 2: EPI | 0 | 0 | 0 |
| Channel 2: EPI Type of ITN | | | |
| Channel 3: School | 0 | 0 | 0 |
| Channel 3: School Type of ITN | | | |
| Channel 4: Community/Village Malaria Workers (VMW) | 0 | 0 | 0 |
| Channel 4: Community Type of ITN | | | |
| Channel 5: MOE, MoIH and MoND (Distribution to MMP) | 17,950 | 7,000 | |
| Channel 5: Type of ITN | Single Pyrethroid | Single Pyrethroid | Single Pyrethroid |
| Estimated Total Need for Continuous Channels | 17,950 | 7,000 | 0 |
| **Mass Campaign Distribution Needs** | | | |
| Mass distribution campaigns | 0 | 21,520 | 33,038 |
| Mass distribution ITN type | Single Pyrethroid | Single Pyrethroid | Single Pyrethroid |
| Estimated Total Need for Campaigns | 0 | 21,520 | 33,038 |
| **Total ITN Need: Continuous and Campaign** | **17,950** | **28,520** | **33,038** |
| **Partner Contributions** | | | |
| ITNs carried over from previous year | 0 | 50 | 10,984 |
| ITNs from Government | 0 | 0 | 0 |
| Type of ITNs from Government | | | |
| ITNs from Global Fund | 18,000 | 39,454 | |
| Type of ITNs from Global Fund | Single Pyrethroid | Single Pyrethroid | |
| ITNs from other donors | 0 | 0 | 0 |
| Type of ITNs from other donors | | | |
| ITNs planned with PMI funding | 0 | 0 | 30,000 |
| Type of ITNs with PMI funding | | | Single Pyrethroid |
| **Total ITNs Contribution Per Calendar Year** | **18,000** | **39,504** | **40,984** |
| **Total ITN Surplus (Gap)** | **50** | **10,984** | **7,946** |

**Table A-3. RDT Gap Analysis Table**

| Calendar Year | 2022 | 2023 | 2024 |
|---|---|---|---|
| Total country population | 17,126,530 | 17,332,049 | 17,540,033 |
| Population at risk for malaria | 9,355,212 | 9,477,483 | 9,615,722 |
| PMI-targeted at-risk population | 2,192,364 | 2,219,885 | 2,251,563 |
| **RDT Needs** | | | |
| Annual blood examination rate (ABER) | 8% | 9% | 10% |
| Projected quantity of RDTs to be used in "blood examination" | 748,417 | 852,973 | 961,572 |
| **RDT Needs (tests)** | **748,417** | **852,973** | **961,572** |
| Needs Estimated based on Other (specify in comments) | | | |
| **Partner Contributions (tests)** | | | |
| RDTs from Government | 0 | 0 | 0 |
| RDTs from Global Fund | 773,540 | 795,849 | |
| RDTs from other donors | 0 | 0 | 0 |
| RDTs planned with PMI funding | 183,200 | 0 | 486,900 |
| **Total RDT Contributions per Calendar Year** | **956,740** | **795,849** | **486,900** |
| **Stock Balance (tests)** | | | |
| Beginning Balance | 598,146 | 806,469 | 749,345 |
| - Product Need | 748,417 | 852,973 | 961,572 |
| + Total Contributions (received/expected) | 956,740 | 795,849 | 486,900 |
| **Ending Balance** | **806,469** | **749,345** | **274,672** |
| Desired End of Year Stock (months of stock) | 9 | 9 | 9 |
| Desired End of Year Stock (quantities) | 561,313 | 639,730 | 721,179 |
| **Total Surplus (Gap)** | **245,156** | **109,614** | **(446,507)** |

**Table A-4. ACT Gap Analysis Table**

| Calendar Year | 2022 | 2023 | 2024 |
|---|---|---|---|
| Total country population | 17,126,530 | 17,332,049 | 17,540,033 |
| Population at risk for malaria | 9,355,212 | 9,477,483 | 9,615,722 |
| PMI-targeted at-risk population | 2,192,364 | 2,219,885 | 2,251,563 |
| **ACT Needs** | | | |
| Total projected number of malaria cases | 5,703 | 3,463 | 1,402 |
| **Total ACT Needs (treatments)** | **15,455** | **11,782** | **11,782** |
| Needs Estimated based on Other (specify in comments) | | | |
| **Partner Contributions (treatments)** | | | |
| ACTs from Government | *0* | *0* | *0* |
| ACTs from Global Fund | 34,210 | 13,112 | |
| ACTs from other donors | 0 | 0 | 0 |
| ACTs planned with PMI funding | 0 | 0 | 0 |
| **Total ACTs Contributions per Calendar Year** | **34,210** | **13,112** | **0** |
| **Stock Balance (treatments)** | | | |
| Beginning Balance | *26,728* | 32,922 | 34,252 |
| - Product Need | *15,455* | *11,782* | *11,782* |
| + Total Contributions (received/expected) | *34,210* | *13,112* | *0* |
| Expired Amounts | 12,561 | | |
| **Ending Balance** | **32,922** | **34,252** | **22,470** |
| Desired End of Year Stock (months of stock) | 9 | 9 | 9 |
| Desired End of Year Stock (quantities) | 11,591 | 8,837 | 8,837 |
| **Total Surplus (Gap)** | **21,331** | **25,416** | **13,634** |

**Table A-5. Inj. Artesunate Gap Analysis Table**

| Calendar Year | 2022 | 2023 | 2024 |
|---|---|---|---|
| **Injectable Artesunate Needs** | | | |
| Projected number of severe cases | 102 | 62 | 37 |
| Projected number of severe cases among children | 0 | 0 | 0 |
| Average number of vials required for severe cases among children | | | |
| Projected number of severe cases among adults | 102 | 62 | 37 |
| Average number of vials required for severe cases among adults | 15 | 15 | 15 |
| **Total Injectable Artesunate Needs (vials)** | **1,530** | **930** | **555** |
| Needs Estimated based on HMIS Data | | | |
| **Partner Contributions (vials)** | | | |
| Injectable artesunate from Government | 0 | 0 | 0 |
| Injectable artesunate from Global Fund | 0 | 0 | 0 |
| Injectable artesunate from other donors | 0 | 0 | 0 |
| Injectable artesunate planned with PMI funding | 0 | 0 | 0 |
| **Total Injectable Artesunate Contributions per Calendar Year** | **0** | **0** | **0** |
| **Stock Balance (vials)** | | | |
| Beginning Balance | 17,676 | 16,146 | 15,216 |
| - Product Need | 1,530 | 930 | 555 |
| + Total Contributions (received/expected) | 0 | 0 | 0 |
| Expired Amounts | | | 14,661 |
| **Ending Balance** | **16,146** | **15,216** | **0** |
| Desired End of Year Stock (months of stock) | 6 | 6 | 6 |
| Desired End of Year Stock (quantities) | 765 | 465 | 278 |
| **Total Surplus (Gap)** | **15,381** | **14,751** | **(278)** |

**Table A-6 Primaquine Gap Analysis Table**

| Calendar Year | 2022 | 2023 | 2024 |
|---|---|---|---|
| Total Country Population | 17,126,530 | 17,332,049 | 17,540,033 |
| Total population at risk for malaria | 9,355,212 | 9,477,483 | 9,615,722 |
| PMI-targeted at-risk population | 2,192,364 | 2,219,885 | 2,251,563 |
| **Primaquine Needs** | | | |
| Total projected number of malaria cases | 5,703 | 3,463 | 1,402 |
| Total projected number of Pf cases | 199 | 40 | 0 |
| Total projected number of Pv cases and mix cases | 5,504 | 3,423 | 1,402 |
| Total projected number of mixed cases (Pf + Pv) | | | |
| **Total Primaquine Needs (tablets)** | **213,339** | **131,273** | **53,880** |
| Needs Estimated based on HMIS Data | | | |
| **Partner Contributions (tablets)** | | | |
| Primaquine from Government | 358,500 | 238,900 | 0 |
| Primaquine from Global Fund | 0 | 0 | 0 |
| Primaquine from other donors | 0 | 0 | 0 |
| Primaquine planned with PMI funding | 0 | 0 | 0 |
| **Total Primaquine Contributions per Calendar Year** | **358,500** | **238,900** | **0** |
| **Stock Balance (tablets)** | | | |
| Beginning Balance | 1,003,680 | 774,987 | 477,067 |
| - Product Need | 213,339 | 131,273 | 53,880 |
| + Total Contributions (received/expected) | 358,500 | 238,900 | 0 |
| Expired Amounts | 373,854 | 405,547 | |
| **Ending Balance** | **774,987** | **477,067** | **423,186** |
| Desired End of Year Stock (months of stock) | 6 | 6 | 6 |
| Desired End of Year Stock (quantities) | 106,670 | 65,636 | 26,940 |
| **Total Surplus (Gap)** | **668,317** | **411,430** | **396,246** |