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Cambodia

Malaria Operational Plan FY 2024

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This Fiscal Year (FY) 2024 Malaria Operational Plan has been approved by the 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 2024 appropriation from U.S. Congress. Any updates will be reflected in revised postings.

CONTENTS

ABBREVIATIONS

ACT	Artemisinin-based combination therapy
AS-MQ	Artesunate-mefloquine
AS-PYR	Artesunate-pyronaridine (Pyramax®)
CDC	U.S. Centers for Disease Control and Prevention
CNM	National Center for Parasitology, Entomology and Malaria Control
CY	Calendar year
FY	Fiscal year
G6PD	Glucose-6-phosphate dehydrogenase
Global Fund	Global Fund to Fight AIDS, Tuberculosis and Malaria
iDES	Integrated drug efficacy surveillance
IPTf	Intermittent preventive treatment for forest-goers
ITN	Insecticide-treated mosquito net
LLIHN	Long-lasting insecticide-treated hammock mosquito net
LLIN	Long-lasting insecticide-treated mosquito net
MEAF	Malaria Elimination Action Framework
MMW	Mobile malaria worker
MOP	Malaria Operational Plan
OD	Operational district
POR	Prevention of re-establishment
PQ	Primaquine
QA	Quality assurance
RDT	Rapid diagnostic test
SBC	Social and behavior change
SLD PQ	Single low-dose primaquine
TA	Technical assistance
TDA	Targeted drug administration
TES	Therapeutic efficacy study
USAID	United States Agency for International Development
VMW	Village malaria worker
WHO	World Health Organization

EXECUTIVE SUMMARY

To review specific country context for Cambodia, please refer to the country malaria profile located on PMI's country team landing page, which provides an overview of the country's malaria situation, key indicators, the strategic plan of the National Center for Parasitology, Entomology and Malaria Control (CNM), and the partner landscape.

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 27 countries in Sub-Saharan Africa and 3 programs across the Greater Mekong Subregion in Southeast Asia to control and eliminate malaria. Cambodia began implementation as a PMI partner country in fiscal year (FY) 2011.

Rationale for PMI's Approach in Cambodia

PMI's investments are aligned with the National Strategic Plan 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, effective and safe treatment of 100 percent of malaria cases, and provision of effective personal protection to at least 90 percent of population at high-risk for malaria; (2) intensification of focal interventions to interrupt transmission at endemic locations and among those at highest risk, such as mobile and migrant populations and forest-goers to eliminate *Plasmodium falciparum* by 2023 and all species by 2025; and (3) investigation, clearing, documentation, and follow-up of 100 percent of cases and foci to interrupt transmission and prevent re-establishment of malaria.

Overview of Planned Interventions

The proposed FY 2024 PMI funding for Cambodia is $9 million. PMI will support the following intervention areas with these funds.

1. Vector Monitoring and Control

PMI will continue to support integration of entomological monitoring as part of foci investigations, strengthen laboratory capacity at the central and subnational levels, and facilitate the national vector control working group. PMI will also continue to fund the procurement of long-lasting insecticide-treated hammock mosquito nets (LLIHNs) and topical repellents for mobile and migrant workers.

2. Malaria in Pregnancy

PMI's support will ensure access to long-lasting insecticide-treated mosquito nets (LLINs) and LLIHNs for all persons at risk, including women of childbearing age, as well as access to rapid diagnosis and treatment of malaria at the community and health-facility level.

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 active malaria foci management. PMI will fund the implementation of these evolving approaches for active foci in select areas.

4. Case Management

PMI will continue to fund training and joint supervision of health providers, including at the community level, to strengthen both the quality of malaria diagnosis and treatment and routine reporting of malaria cases. Training will focus on the rapid diagnosis and management of uncomplicated and severe malaria and glucose-6-phosphate dehydrogenase testing. Another continued priority will be the radical cure for *Plasmodium vivax* with strong pharmacovigilance. In addition, PMI will support 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 engage CNM in collaborative supply chain strategic planning, quantification, and improvement of the management of commodity logistics data. PMI will also provide technical advice, as needed, on strengthening warehousing, distribution, and inventory management. In addition, PMI will provide technical assistance to initiate and manage the procurement of commodities and, where needed, PMI will support the distribution of artemisinin-based combination therapies (ACTs), LLIHNs, and topical repellents for forest-goers.

6. Social and Behavior Change

PMI will support the national malaria social and behavior change (SBC) technical working group, promote coordination among stakeholders, and fund national and subnational capacity-strengthening of CNM and provincial health departments, operational districts, and health centers to implement SBC activities and to tailor SBC activities to their contexts. Additionally, PMI will support activities based on an assessment/evidence review that explores the barriers and facilitators of adherence to *P. vivax* radical cure as well as IPTf. PMI will also support the development, implementation, monitoring, and evaluation of a theory-informed and evidence-based package of SBC activities for select populations, and explore options to introduce appropriate vector-control tools into markets through social marketing.

7. Surveillance, Monitoring, and Evaluation

PMI will support CNM in strengthening the existing surveillance system to detect and immediately report all malaria cases and to investigate, classify, and respond to all cases and foci to move toward malaria elimination. PMI will assist CNM in implementing guidelines and systems that support surveillance for sustaining elimination and documentation of subnational elimination as a model for use in provinces across the country, including enhancing the iDES module.

8. Operational Research and Program Evaluation

PMI will not support new operational research projects in FY 2024 but will consider program evaluation needs closer to the implementation period related to strengthening activities targeting mobile and migrant populations, including forest-goers, to improve prevention, diagnosis, and treatment of malaria in high-risk populations.

9. Capacity Strengthening

PMI will support transitional solutions to enable the integration of malaria services into the wider health system, including increasing the integration of village malaria workers and mobile malaria workers into community health structures. PMI will provide training to sustain lab capacity among health workers, maintaining their malaria detection and diagnosis skills as cases decrease.

I. CONTEXT & STRATEGY

1. Introduction

Cambodia began implementation as a U.S. President's Malaria Initiative (PMI) partner country in fiscal year (FY) 2011. This FY 2024 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 the 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 describes activities planned with FY 2024 funding. For more detailed information on the country context, please refer to the country malaria profile located on PMI's country team landing page, which provides an overview of the country's malaria situation, key indicators, the CNM's strategic plan, and the partner landscape.

2. U.S. President's Malaria Initiative

PMI is led by the United States Agency for International Development (USAID) and implemented with the U.S. Centers for Disease Control and Prevention. Launched in 2005, PMI supports the implementation of malaria prevention and treatment measures such as insecticide-treated mosquito nets (ITNs), indoor residual spraying, accurate diagnosis and prompt treatment with artemisinin-based combination therapies (ACTs), intermittent preventive treatment for pregnant women (IPTp), and drug-based prevention, as well as cross-cutting interventions such as surveillance, monitoring, and evaluation; social and behavior change (SBC); and capacity strengthening. PMI's 2021–2026 strategy, *End Malaria Faster*, envisions a world free of malaria in our generation, with the goal of preventing malaria cases, reducing malaria deaths and illness, and eliminating malaria in PMI partner countries. PMI currently supports 27 countries in Sub-Saharan Africa and 3 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 on progress already made 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 Greater Mekong Subregion 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 0.24 per 1,000 population nationally.[1] To strategically deploy interventions, Cambodia has been stratified into high-risk, medium-risk, low-risk, and no-risk areas, with different interventions deployed based on transmission level. The principal malaria vectors are *Anopheles dirus*, *An. minimus,* and *An. maculatus.* Cambodia has made marked progress toward the elimination of malaria with targets of elimination of *Plasmodium falciparum* by 2023 and all species by 2025. Central to achieving these goals are these national objectives: early detection and safe treatment of 100 percent of cases and provision of effective personal protection to at least 90 percent of the risk population at high risk; intensification of focal interventions in endemic locations with highest risk, including those with mobile and migrant populations and 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-establishment of malaria that are targeted through prevention, robust surveillance, and case management 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 area should be completed within one week, resulting in the classification of the village as an active, residual, or cleared-up focus.

[1] Cambodia Ministry of Health Malaria Information System (2022).

In 2019, the National Center for Parasitology, Entomology and Malaria Control (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 mobile and migrant populations, and prompt case reporting and investigation. In 2021, CNM began a nationwide effort to aggressively target remaining active *P. falciparum* foci under the Last Mile for Malaria Elimination program, including recruiting VMWs and MMWs; distributing long-lasting insecticide-treated net (LLIN) and long-lasting insecticide-treated hammock net (LLIHN) distribution to groups experiencing vulnerability; and providing active fever screening, topical repellents, targeted drug administration (TDA), and intermittent preventive treatment for forest-goers (IPTf). Cambodia has now documented substantial declines in malaria incidence, particularly *P. falciparum* cases, and marked increases in VMW and MMW malaria testing, which now accounts for 80 percent of all testing. *Plasmodium vivax* is now the predominant species, which led to the deployment of a national *P. vivax* radical cure program in 2021.

For more detailed information on malaria indicators, refer to the country malaria profile.

3.2. Key Challenges and Contextual Factors

In its third consecutive decade of peace and economic growth, Cambodia has made great strides in reducing poverty and improving health. With these gains have come better access to services, including malaria testing and treatment at the community level. However, significant obstacles to malaria elimination remain. Some forest activities, such as logging, represent a means of livelihood for certain populations but result in increased exposure of forest-going people to malaria-transmitting mosquitoes. In addition, the remote distances from forest work sites to the nearest health care provider, as well as opportunity costs faced by traveling to health facilities, create barriers that limit prompt and proper health seeking. Even as *P. falciparum* incidence wanes, treatment of *P. vivax* creates further barriers to community-level treatment by VMWs due to the need for glucose-6-phosphate dehydrogenase (G6PD) testing at health facilities and prolonged therapy to ensure radical cure, especially among those who are deficient in G6PD. High rates of antimalarial drug resistance limit options for treatment of *P. falciparum*, and current first-line antimalarial regimens have significant side effects, making it more difficult to convince patients to complete treatment or participate in drug-based prevention programs in the absence of malaria. As malaria cases decline, ensuring adequate malaria awareness and diagnostic and treatment skills becomes more difficult. Through strong dedication and governance, Cambodia has made substantial progress toward elimination, but this progress also presents challenges. Additional work is needed to expand the integration of the malaria-specific VMW and MMW cadres into the broader health system, pivot from elimination efforts to documentation of elimination and prevention of re-establishment (POR) of malaria, and address the challenges to the elimination of several non-falciparum malaria species, such as *P. knowlesi* and *P. malariae*, which could hinder World Health Organization (WHO) elimination certification over the medium term.

3.3. PMI's Approach for Cambodia

PMI's investments align with the National Strategic Plan 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 population that is at high risk; (2) intensification of focal interventions to interrupt transmission in the endemic locations experiencing the highest risk (including those with mobile and migrant populations and forest-goers) to eliminate *P. falciparum* by 2023 and all species by 2025; and (3) investigation, clearing, documentation, and follow-up of 100 percent of cases and foci to interrupt transmission and prevent the re-establishment of malaria.

Because Cambodia has made significant progress toward malaria elimination, malaria epidemiology, contexts, policies, and approaches are rapidly changing. With the dramatic reduction in cases, the need for some commodities is decreasing (e.g., drugs for treatment) while other challenges are emerging (e.g., the need to continue to detect malaria infection through testing 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 leverages the strength of existing and new partners to more effectively reach mobile and migrant populations, especially forest-goers, a crucial population for malaria elimination. PMI supports interventions such as the Last Mile for Malaria Elimination program and adapts its programming according to its successes and needs. The geographic scope of each technical area supported by PMI varies according to country need, the shifting malaria landscape, and agreements with CNM. For example, PMI currently supports last-mile program interventions in six provinces in Cambodia's west and southwest (Battambang, Pailin, Koh Kong, Kampot, Pursat, and Kep) and entomological activities in two provinces in the east (Mondulkiri and Stung Treng), while supply chain and systems-strengthening interventions are typically nationwide in scope). Given that the malaria elimination certification process is new for CNM, PMI has begun assisting CNM and other levels of government in preparing for this process by ensuring high-quality systems, data, and documentation are in place to support the application for certification at the appropriate time. As provinces approach subnational elimination, PMI continues to assist CNM to develop a POR model that can be applied locally and eventually scaled up to other geographic units. In addition, while PMI understands it will take time for Cambodia to fully finance its own development priorities, PMI continues to 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 2024 MOP is largely consistent with prior fiscal years except it includes the potential expansion of activities specifically targeted at driving toward elimination—subject to conditions on the ground. These plans come in response to the needs and particular elimination context in Cambodia. PMI may expand the geographic scope of social and behavior change (SBC) activities to include additional forest-fringe villages and entomological surveillance during foci investigations to inform response interventions. To speed elimination of *P. vivax*, PMI will support national scaling of new protocols (e.g., seven-day and eight-week treatment) for *P. vivax* radical cure, expand access to G6PD testing at point-of-care sites, and potentially have MMWs administer testing. To document and verify elimination, PMI will support the development of guidelines for the POR of malaria and for collating documentation for verifying elimination at the subnational level.

II. OPERATIONAL PLAN FOR FY 2024

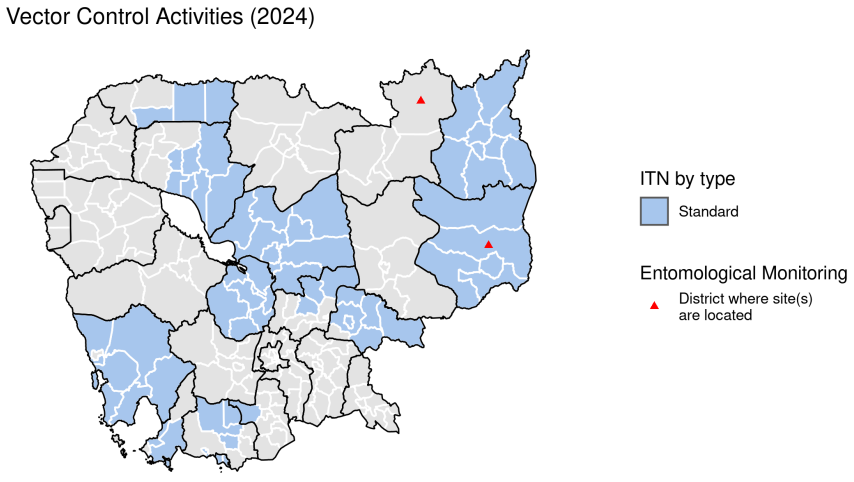
1. Vector Monitoring and Control

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 ITNs[2] via mass campaigns and continuous channels, and distribution of topical repellents in forest packs for mobile and migrant populations in the areas experiencing the highest risk. PMI has supported entomological monitoring at sentinel sites in Mondulkiri and Stung Treng Provinces and, starting in April 2022, transitioned to providing support for entomological monitoring as part of foci investigations to move toward elimination. This change was to improve timeliness and efficiency of foci response activities since, prior to this, these activities relied on sending samples to CNM and waiting until they got their turn to be analyzed and reports sent back. 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 ITNs as needed to fill gaps. While the MEAF 2021–2025 includes indoor residual spraying as a potential response as part of foci investigations, it is not currently supported by PMI or any other donor.

Planned LLIN mass distributions and PMI-supported geographical areas for entomological monitoring for calendar year (CY) 2024 are shown in Figure 1.

Figure 1. Map of Planned Vector Control Activities in Cambodia, 2024— ITN Mass Distribution and Entomological Monitoring Areas*



*Insecticide-resistance monitoring and support for foci investigations are currently being supported in two provinces (Stung Treng and Mondulkiri)

[2] The term "ITN" is used throughout the document when referring to both LLINs and LLIHNs, or where the distinction is not relevant.

1.2. Recent Progress (April 2022–April 2023)

PMI funded the following vector control activities:

- Bimonthly entomological monitoring, including vector bionomic monitoring and insecticide-resistance monitoring at two sentinel sites in two operational districts (ODs) in Mondulkiri and Stung Treng Provinces in collaboration/partnership with CNM, the provincial health department, and OD staff. For more information about entomological monitoring, refer to the 2021 Entomological Report.
- Human behavioral surveys at the two sentinel sites mentioned above. Data from the first round of collection during the dry season are being analyzed.
- Entomological surveillance in response to local cases of *P. falciparum* reported in Mondulkiri and Stung Treng Provinces to determine foci receptivity and vector behavior.
- Distribution of 117,750 LLINs from the central level to eight provinces and to partners.
- Continuous distribution of 44,151 ITNs (34,616 LLINs and 9,535 LLIHNs) to mobile and migrant populations during VMW-outreach and case-response activities.
- Technical assistance (TA) to 14 PMI-supported ODs to strengthen the ITN tracking system and ensure proper tracking of all ITNs received by or transferred to various levels, including community, health facility, and OD, and subsequent allocation and distribution to select mobile populations.
- Forecasting of needs for topical repellents for malaria activities in Cambodia, leading to the procurement of 568,872 100-ml bottles of topical repellent.

1.3. Plans and Justification for FY 2024 Funding

The FY 2024 funding tables contain a full list of vector monitoring and control activities that PMI proposes to support in Cambodia.

1.3.1. Entomological Monitoring

PMI will continue to support Cambodia with complementary case-based entomological surveillance during foci investigations and insecticide-resistance monitoring and by strengthening subnational capacity for conducting entomological surveillance during foci investigations through training and workshops. Rapid behavioral questionnaires, as part of foci investigations, may be conducted, as needed, to determine the interface between human and malaria vectors, with an aim of determining gaps in protection. PMI will continue to support CNM to plan for and convene the vector control working group. With the changing epidemiology and dynamic requirements as Cambodia approaches elimination, PMI will also explore possibilities of expanding its support on these activities to additional provinces.

Summary of Distribution and Bionomics of Malaria Vectors in Cambodia

The primary vectors in Cambodia are *An. dirus*, *An. minimus*, and *An. maculatus*. Peak abundance of *An. dirus* occurs from September to November, while peak abundance of *An. minimus* has been observed from November to February. *Anopheles dirus* is closely

associated with dense forest, though it has also been reported in orchards and rubber plantations. This species generally feeds outdoors on persons entering the forest where there are no formal structures. However, in villages deep within forest, *An. dirus* has been collected indoors by CDC light traps, although usually in lower numbers than with 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 commonly collected in animal-baited traps. Peak biting times for *An. dirus* are from dusk until around 10:00 p.m., though a secondary peak later in the night has been observed at 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. *An. maculatus* are found in hilly and mountainous terrains, breeding in or near permanent or semipermanent bodies of clean water, such as streams and rivers. Secondary vectors include *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 are limited to the sentinel sites where PMI is currently supporting entomological monitoring, and they are primarily focused on pyrethroids, as LLINs are the primary vector-control intervention. Based on testing conducted in 2021, *An. dirus* from Mondulkiri Province was susceptible to alpha-cypermethrin, deltamethrin, and permethrin. *Anopheles dirus* from Steung Treng Province was only tested against alpha-cypermethrin but was fully susceptible. In Mondulkiri, *An. minimus* and *An. maculatus* were both fully susceptible to deltamethrin, and *An minimus* was susceptible to permethrin. The only evidence of pyrethroid resistance was observed in the secondary vector *An. peditaeniatus* from Steung Treng, which was resistant to both alpha-cypermethrin and deltamethrin.

1.3.2. Insecticide-Treated Nets

PMI will continue to fund the procurement and distribution of key commodities, including ITNs, as needed. The current gap analysis for CY 2023–2025 does not indicate a need for LLIN procurement by PMI but does indicate a gap in LLIHNs. In response to this gap, PMI plans to procure approximately 170,000 LLIHNs during this period. PMI will provide technical support to Cambodia's 2023–2024 mass distributions and will support SBC to promote proper use and care of LLINs.

See the social and behavior change section for details on challenges and opportunities to improve intervention uptake or maintenance.

ITN Distribution in Cambodia

In Cambodia, LLINs are distributed via mass campaigns every three years—though not all provinces are targeted in the same year—as well as through continuous channels, mainly by VMWs and MMWs. The next mass campaign will be in 2023–2024. 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.

Refer to the ITN gap table in the annex for more detail on planned quantities and distribution channels.

1.3.3. Indoor Residual Spraying

PMI does not support indoor residual spraying in Cambodia.

1.3.4 Other Vector Control

Topical and Spatial Repellents

In CY 2023 and 2024, PMI will support the procurement and distribution of topical repellents in forest packs to provide additional protection against malaria to forest-goers. The quantities are expected to meet the approximate needs for the period in all endemic provinces. Therefore, there is no additional need for procurement with FY 2024 funds. SBC activities will be conducted in support of these new PMI interventions. In addition, PMI plans to support the development of guidelines for topical repellent storage, distribution, use, and proper disposal of the product and containers. PMI is currently considering program evaluations around the use of spatial repellents approved by the Environmental Protection Agency, pending further discussions with CNM and partners.

2. Malaria in Pregnancy

2.1. PMI Goal and Strategic Approach

While malaria incidence overall is very low, and malaria primarily affects adult men and adolescent boys who work in forested areas, cases of malaria are also reported among women of reproductive age and pregnant women. Of the 4,053 total malaria cases reported in 2022 nationally, 679 (17 percent) were among women and girls, 38 cases of which were among pregnant women. The national strategy neither recommends intermittent preventive treatment for pregnant women 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 specifically, such as antenatal care or immunization clinics). Prevention and management of malaria in pregnancy, therefore, focuses on ensuring access and use of LLINs for all persons at risk of malaria transmission in endemic ODs, including women of childbearing age, as well as rapid diagnosis and treatment of malaria at the community- and health-facility level. The 2013 Cambodia Malaria Survey reported LLIN use among pregnant women at 57.2 percent. While the 2017 and 2020 Malaria Indicator Surveys did not collect information on the use of

LLINs among pregnant women and children under five years of age, the 2020 survey reported 72 percent of households had access to one. While vector control and case management interventions focus specifically on adult male forest-goers, some women do accompany men/husbands into the forest to collect products. According to a recent study by Institute Pasteur of Cambodia, approximately 8–12 percent of forest-goers surveyed were women.[3] The Cambodian national treatment guidelines describe the management of uncomplicated and severe malaria in pregnancy.

2.2. Recent Progress (May 2022–April 2023)

In line with Cambodia's national strategy, PMI does not support activities specifically intended for 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 2024 Funding

In line with Cambodia's national strategy, PMI does not plan to support activities specifically intended for 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.

3.2. Other Drug-based Prevention

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

- **TDA:** Following a census conducted within 14 days in villages identified and classified as active foci, health staff and VMWs carry out household visits over five days and provide every male person between the ages of 15 and 49 with *Pyramax* (artesunate-pyronaridine, or AS-PY) once per month over two consecutive months (two total rounds, three-day course per round). TDA is to be conducted during the first two months following detection of the locally acquired case.

[3] Kunkel, Amber, Chea Nguon, Sophea Iv, Srean Chhim, Dom Peov, Phanith Kong, Saorin Kim, et al. 2021. "Choosing Interventions to Eliminate Forest Malaria: Preliminary Results of Two Operational Research Studies Inside Cambodian Forests," *Malaria Journal* 20 (51). https://doi.org/10.1186/s12936-020-03572-3.

- **IPTf:** In villages with active foci following the two rounds of TDA, health staff and VMWs will conduct weekly active 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 the ages of 15 and 49 will receive *Pyramax* in a three-day treatment prior to traveling into areas with malaria risk. IPTf distribution in an active focus area is continued in combination with the weekly fever screening activities for up to 12 months following the detection of a locally acquired case.

In late 2022, CNM shifted from artesunate-mefloquine (AS-MQ) to AS-PYR due to the reported side effects of AS-MQ when administered as TDA and IPTf. A pilot implementation of the last-mile program began in four villages in Kampong Speu Province in December 2020 with Global Fund support. In 2021, WHO supported a qualitative and quantitative evaluation of the approach. Based on the initial acceptability of the approach, CNM expanded this program to an additional four provinces (Kratie, Mondulkiri, Ratanakiri, and Stung Treng), targeting 55 villages with active foci. In 2022, CNM expanded it to Preah Vihear and Pursat. Currently, the last-mile program approach is being implemented in 124 villages at 41 health centers in 10 ODs in the 7 provinces (Kampong Speu, Kratie, Mondulkiri, Ratanakiri, Stung Treng, Preah Vihear, and Pursat). Pursat, one of the PMI-funded provinces, is implementing TDA with AS-PYR in one village with an identified locally transmitted *P. falciparum* case. CNM is currently working on new surveillance guidelines that might expand the use of AS-PYR for chemoprevention to areas that are not currently receiving the last-mile program interventions. The rapidly changing plans for the use of AS-PYR for chemoprevention in Cambodia has made quantification of the amounts needed for procurement difficult. PMI continues to work closely with CNM and the Global Fund to anticipate potential procurement needs of AS-PYR as far in advance as possible.

TDA or IPTf have been implemented in all last-mile program villages with active foci (78 percent; 97 out of 124 villages), with the remaining 27 villages providing IPTf only because no primary vectors were detected. As noted above, the last-mile program is now included in the national strategy as a part of elimination efforts.

3.3. PMI Goal and Strategic Approach

MOP FY 2024 programmatic activities will align with the objectives detailed in the MEAF 2021–2025 and will contribute to PMI's goal of eliminating malaria in the Greater Mekong Subregion. The national strategy and the revised national treatment guidelines for elimination efforts now include TDA and IPTf, and PMI will continue to fund 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 opportunities.

3.4. Recent Progress (April 2022–April 2023)

In April 2022, Pursat reported more than double the number of *P. falciparum* cases compared with the previous three months—and a significant increase compared with the same period in the previous year. Transmission in Pursat peaked during June, when 23 cases were reported. A second peak occurred during August and September. The provincial rapid response team investigated the outbreak and identified some potential high-risk areas of malaria transmission with populations whose members reported movement within the forest. PMI supported the provincial health department in conducting a village census to identify forest goers/workers, inform active fever screening and health education, and increase ITN distribution. PMI set up stationary teams to screen, treat, and administer preventive tools at forest entry/exit points associated with transmission. PMI administered TDA with AS-PYR in the village of Chamkar Phnom, where local transmission had occurred. The compliance rate for the treatment regimen in the first and second rounds of TDA was 98 percent. IPTf was conducted with AS-PYR in the three villages (Veal, Mol Rokat, and Veal Vong) where *P. falciparum* cases were reported in individuals who had traveled to the forest. In August 2022, coverage for the first round of IPTf among this population was 95 percent in Veal village, 93 percent in Mol Rokat village, and 89 percent in Veal Vong village. Coverage for the second round in September 2022 was 68 percent in Veal, 72 percent in Mol Rokat, and 55 percent in Veal Vong. No malaria infections were identified in the individuals who received TDA/IPTf nor among others in Pursat from September 2022 to the end of this reporting period.

In terms of procurement of ACTs for chemoprevention, PMI procured 63,610 blisters of AS-PYR (180/60 mg) for chemoprevention in January 2023 and in May 2023 was in the process of procuring 107,610 additional blisters.

3.1.3. Plans and Justification for FY 2024 Funding

PMI will continue to support last-mile program activities in response to active foci that occur in areas supported by PMI, as decided in consultation with CNM. This includes the extension of last-mile program activities to *P. vivax.* foci if CNM decides to pursue this strategy. Specifically, PMI will support training, supervision, and monitoring of VMW/MMW implementation of TDA/IPTf in active foci, providing species-specific SBC messages to targeted groups, as necessary. Close monitoring of this approach in PMI-supported areas will help inform national and regional policies that include similar activities.

The FY 2024 funding tables contain a full list of activities related to other drug-based prevention that PMI proposes to support in Cambodia.

Refer to the *Pyramax* (AS-PYR) gap analysis table in the annex for more detail on the planned quantities and distribution channels.

See the social and behavior change section for details on challenges and opportunities to improve intervention uptake and maintenance.

4. Case Management

4.1. PMI Goal and Strategic Approach

PMI supports CNM's strategic objective (MEAF 2021–2025) for case management, which aims to detect 100 percent of malaria 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 national treatment guidelines.
- Ensuring all patients with confirmed severe malaria are treated according to national treatment guidelines.
- Ensuring all targeted villages achieve full coverage of diagnosis and treatment for all confirmed cases within 48 hours of symptom onset by community networks (e.g., VMWs and MMWs);
- Ensuring all suspected malaria patients by 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; and
- Improving the uptake of malaria interventions for case management and prevention through SBC.

Cambodia has already made great progress toward these objectives, particularly at the community level through a network of VMWs and MMWs initiated in 2004. VMWs and MMWs are predominantly the first access point for diagnosis and treatment of uncomplicated malaria. In 2022, over 50 percent of malaria cases were diagnosed by VMWs or MMWs using point-of-care rapid diagnostic tests (RDTs) rather than at health facilities. The annual blood examination rate reached 9 percent in 2020, and CNM plans to continue to expand testing with a target of 10 percent by 2024. However, as malaria has increasingly become diagnosed by VMWs and 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, non-*falciparum* and non-*vivax* species, and to monitor the therapeutic efficacy of antimalarial drugs. Since April 2018, the Ministry of Health has banned all malaria diagnosis and treatment in the private sector; however, as of 2023, private providers are required to refer patients with suspected malaria to public facilities. PMI partners track private provider referrals within PMI-supported provinces. Malaria became a reportable disease in Cambodia in 2023.

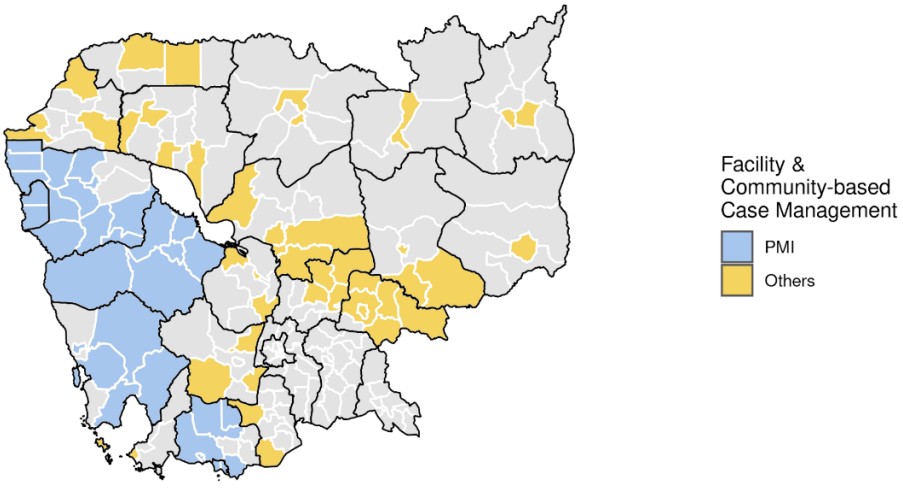
The first-line drug for all malaria species is AS-MQ as directly observed therapy. The second-line treatment is AS-PYR or Pyramax.® Single low-dose primaquine (SLD PQ) is recommended for all nonpregnant patients with *P. falciparum,* regardless of G6PD level. For *P. vivax,* a patient's G6PD enzyme level is measured first and, if the result is normal, the patient is given 14 days of primaquine (PQ; 3.5 mg/kg total dose) for radical cure in addition

to AS-MQ. Quantitative G6PD testing and radical cure for *P. vivax* was scaled up nationally in 2021. G6PD testing occurs at health facilities and hospitals only and, while VMWs and MMWs cannot the testing, they can refer patients to health facilities.

PMI aligns case management activities with Cambodia's 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 the training and joint supervision of 471 VMWs and 33 MMWs, health-facility staff, and OD staff to strengthen both the quality of care and routine reporting. The training includes the rapid diagnosis and management of uncomplicated and severe malaria as well as G6PD testing and radical cure for *P. vivax*. In addition, PMI funds the filling of malaria case management commodity gaps, integrated drug efficacy surveillance (iDES), 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, instead offering performance-based incentives rooted in outreach, case reporting, treatment monitoring, and investigation through PMI's implementing partners, in alignment with national policy. Each VMW receives US$45–60 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 specific 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, 2023



4.2. Recent Progress (April 2022–April 2023)

During the April 2022–April 2023 reporting period, 128,064 suspected cases were tested for malaria in the 14 PMI-supported ODs, of which 564 (0.4 percent) were confirmed positive and received correct treatment according to national treatment guidelines. Of the 564 positive cases, 107 *P. falciparum*, 1 mixed, 406 *P. vivax*, 45 *P. malariae*, and 5 *P. knowlesi* were detected. Of the 406 *P. vivax* cases, 366 were eligible for G6PD testing. The primary reasons for ineligibility were weight below 20 kg and pregnancy/breastfeeding. Of the eligible cases, 333 underwent G6PD testing and 33 declined testing. Reasons for the choice not to test were based on preferences to receive ACT treatment only and long distances to the health center where a patient would need to travel multiple times to maintain radical cure adherence. Among the 333 *P. vivax* patients who were tested for G6PD deficiency, 258 completed radical treatment; and 67 (26 percent) of those 258 patients were deficient in G6PD. Common reasons cited for not completing treatment among those eligible are lack of availability for radical treatment at the facility and patient refusal. The 8 female *P. vivax* patients with intermediate G6PD results and the 67 with G6PD deficiency received radical cure via eight-week radical cure study protocols (funded by Global Fund) because the eight-week radical cure regimen was not yet available under the national treatment guidelines at that time.

Of the 14 ODs funded by PMI, 10 have successfully interrupted transmission and prevented the re-establishment of malaria, having detected no indigenous cases over the past three years. These ODs will continue to implement POR activities and determine what documents are required for subnational verification of elimination. Surveillance is being adapted while the roles of VMWs are integrated into the community health care system. These VMWs remain critical to ensuring that services for testing, treatment, and surveillance capacity remain available in POR settings. Of the 502 VMW/MMW villages supported by PMI, 254 were included in the VMW integration plan. The role of the VMWs and MMWs related to malaria is currently primarily focused on surveillance because these villages were stratified as low risk for malaria based on their zero incidence status. In early 2023, PMI began discussions with CNM, WHO, and other partners to draft POR policy at the subnational and national levels as a precursor for the subnational verification process.

PMI supported the following national-level case management activities:

- Updating the national treatment guidelines and the integrated drug efficacy surveillance protocol, revising the national surveillance manual and national M&E plan; and conducting the mid-term review and evaluation of MEAF;
- Providing TA to CNM, provincial health departments, and ODs to develop an annual operational plan to implement and monitor the progress of their malaria programs;
- Convening regular case management technical working group meetings; and

- Supporting CNM and provincial health departments in conducting 120 supportive supervisory visits in PMI-supported areas, which provide guidance to the OD malaria team, health facilities, VMWs, and MMWs on diagnosis and treatment, surveillance and case reporting, supply chain for commodities, and addressing challenges during malaria program implementation.

PMI supported the following case management commodities activities:

- Procurement and distribution of 16,190 RDTs, and distribution of 82,302 Global Fund-procured RDTs in the six PMI-funded provinces.

PMI supported the following facility-level case management activities:

- Health facilities performed 41,067 RDTs for malaria (100 percent of all suspected malaria cases) and diagnosed 329 malaria cases (66 *P. falciparum*, 1 Mix, 212 *P. vivax*, 45 *P. malariae*, and 5 *P. knowlesi*) in PMI-supported provinces.
- Trained and implemented radical cure protocol for *P. vivax,* including 14-day treatment for patients with normal G6PD, refresher training for the shift from 14 days to 7 days, and eight-week primaquine treatment for *P. vivax* patients with G6PD deficiency.
- Trained 250 health facilities on malaria case-based management and surveillance.

PMI supported the following community-level case management activities:

- VMWs and MMWs performed 86,997 RDTs for malaria (100 percent of all suspected malaria cases) in PMI-supported provinces, with 235 malaria cases (41 *P. falciparum* and 194 *P. vivax*) diagnosed.
- Trained 738 community VMWs and MMWs and 351 health care providers at public health facilities in case management with ACTs and laboratory malaria diagnosis.
- Out of the 504 VMWs and MMWs in villages funded by PMI, 254 VMWs and MMWs were reassigned to general, integrated duties supporting multiple disease areas because they were classified as operating in settings with low malaria risk that are transitioning to a POR strategy.

Recent progress with monitoring antimalarial efficacy and the therapeutic efficacy study (TES) approach are presented in the **Plans and Justification for FY 2024 Funding** section below.

4.3. Plans and Justification for FY 2024 Funding

The FY 2024 funding tables contain a full list of case management activities that PMI proposes to support in Cambodia.

Provincial- and National-level Case Management Activities

In FY 2024, PMI plans to fund the following provincial- and national-level case management activities:

- Continued support in the provinces of Battambang, Pailin, and Pursat in western Cambodia and the provinces of Kampot, Kep, and Koh Kong in southwestern Cambodia;
- Ongoing support of CNM to strengthen pharmacovigilance monitoring systems to ensure the detection, assessment, reporting, and prevention of adverse effects associated with the provision of weekly PQ for patients with a G6PD deficiency and P. vivax infection;
- Monitoring and strengthening iDES implementation for *P. falciparum* and *P. vivax*; and
- Continued support of WHO and other partners to build the capacity of the CNM National Reference Laboratory to conduct microscopy QA activities, entomological assays (e.g., ELISA for sporozoite detection), and nucleic acid amplification tests to measure genetic antimalarial resistance markers (e.g., kelch13, pfmdr1, and plasmepsin2).

Commodities

No case management commodities are currently planned for procurement with FY 2024 funding. Discussions with the Global Fund have ensured adequate case management commodities will be procured nationally through 2025, including G6PD tests. See the ACT, RDT, injectable artesunate, and artesunate suppository gap analysis tables in the annex for more detail on planned quantities and distribution channels.

Facility Level

In FY 2024, PMI plans to fund the following facility-level case management activities:

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

Community Level

In FY 2024, PMI plans to support the following community-level case management activities:

- Continued training and joint supervision of VMWs and MMWs to strengthen both the quality of care and routine reporting through implementing partners. The training includes the rapid diagnosis and management of uncomplicated malaria, referral of severe malaria, and monitoring radical cure for *P. vivax* for adherence and adverse events, and it will include other topics in the future consistent with CNM priorities.
- Continued expansion of access to G6PD testing and radical cure of *P. vivax* by increasing access at points of care, including health facilities, and by potentially increasing G6PD testing and treatment by VMWs and MMWs. (All patients must undergo G6PD testing prior to being given PQ); strengthen referral systems for patients to receive G6PD testing at health facilities and hospitals, including potentially having VMWs and MMWs escort patients to these target facilities.)
- Ongoing refresher training of VMWs and MMWs to ensure the detection, assessment, reporting, and prevention of adverse effects associated with provision of weekly PQ by the HCs for patients with a G6PD-deficiency and *P. vivax* infection.

PMI does not currently provide direct routine payment to VMWs and MMWs but instead pays a performance-based incentive based on outreach, case reporting, treatment monitoring, and investigation. PMI will continue discussions on the integration of the remaining PMI-supported VMWs and MMWs into the existing community health worker system, as appropriate, and will advocate for the ongoing remuneration of these workers by the Ministry of Health.

Case Management Elimination Activities

CNM organized consultative workshops to revise the national treatment guidelines in March 2022 and June 2022. The revised guidelines were approved by the Ministry of Health by March 2023. The revisions include new treatment approaches for *P. falciparum* elimination, such as TDA, IPTf, and weekly active fever screening in active foci across five high-burden provinces. Every *P. falciparum* case detected requires cross-checking with microscopy to determine the QA of diagnosis and adequate parasitological response. SBC counseling for patients on how to manage suspected treatment failure for *P. falciparum* was also added. The updated national treatment guidelines indicate a seven-day radical cure for *P. vivax* patients with normal G6PD results using PQ primaquine at 0.25–0.5 mg/kg and radical cure for patients with G6PD deficiency and female patients with intermediate G6PD results with primaquine at 0.75 mg/kg of body weight once a week for eight weeks. SBC counseling for patients to increase adherence to a complete radical treatment course was added. Finally, the national treatment guidelines added iDES into the routine surveillance system. PMI will continue to support the expansion of the new *P. vivax* radical cure regimens in PMI focus areas.

In May 2023, the Ministry of Health circulated a directive to all provincial health departments and relevant partners that malaria has become an officially notifiable disease. By Cambodian public health law, this means that all public health facilities must notify malaria into the Malaria Information System within 24 hours and private health care providers are required to notify and refer suspected malaria cases to nearby VMWs and MMWs or public health facilities. Additionally, every individual who suspects that they may be infected with malaria should seek malaria services at the nearby VMW, MMW, or public health facility. The directive elevates malaria among priority diseases to achieve the nation's elimination goals for all species by 2025.

Monitoring Antimalarial Efficacy

As of 2023, no further TESs are planned in Cambodia, as drug efficacy monitoring will be incorporated into iDES. iDES was 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, with PMI support, established national, regional, and provincial teams to facilitate the scaling up of iDES through training and supportive oversight of district health staff, including health center staff, VMWs, and MMWs, who are primarily responsible for iDES implementation. IDES incorporates drug efficacy monitoring using directly observed therapy with AS-MQ for both *P. falciparum* and *P. vivax*. Patients with *P. falciparum* also receive SLD PQ and undertake return visits on days 0, 1, 2, 28, and 42. Patients with *P. vivax* are treated with the appropriate regimen of PQ per their G6PD status and return on days 0, 1, 2, 28, and 90. Blood smears and filter paper collection (for testing of genetic markers) are performed at predetermined visits.

CNM introduced iDES in provinces that had been supporting TESs, including Kampong Speu, Kratie, Mondulkiri, Ratanakiri, and Stung Treng; it will expand nationally in CY 2023.

Table 1. Ongoing Integrated Drug Efficacy Surveillance

Year	Sites	Treatment Arm(s)	Laboratory Testing of Samples
2022–current	37 health facilities in 10 provinces	• AS-MQ + single, low-dose PQ for P. falciparum • AS-MQ + PQ x 14 days (G6PD-normal) or PQ weekly x 8 weeks (women with G6PD deficiency or intermediate G6PD results and *P. vivax*	In-country at Institut Pasteur Cambodia

See the social and behavior change section for details on challenges and opportunities to improve intervention uptake or maintenance.

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 activities across the country. PMI supports CNM through the provision of TA and procurement of key malaria commodities 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, clearance, and distribution of malaria commodities—including those procured from other sources—can be anticipated and addressed in a timely manner.

5.2. Recent Progress (April 2022–March 2023)

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

Forecasting

- In December 2022, PMI supported the forecasting of *Pyramax* 180/60 mg tablets for TDA and IPTf for 2023 and 2024.
- Over the last year, PMI engaged in negotiations with headquarters teams, the CNM, WHO, and other key stakeholders to advocate for the efficient procurement and use of topical repellents, including identifying the desired modality and frequency of application, the physical and chemical properties and concentrations of the active substances, and the packaging. There was a detailed discussion on topics such as labeling and guidance to ensure proper use and compliance with regulations and registration requirements. This preparatory work enabled PMI to support the forecasting of topical repellents for populations at high risk of malaria, mainly forest goers, in January 2023, and ultimately to procure topical repellents, as reflected in the gap analysis tab on repellents.
- In February 2023, PMI supported the national forecasting for the Global Fund Regional Artemisinin Initiative 4 Elimination for all malaria commodities.

Supply Planning

- In September 2022, PMI conducted a training on the supply planning module of Quantification Analytics Tool
- PMI initiated the use of Quantification Analytics Tool for supply planning for malaria commodities procured by multiple partners.

- PMI continued its support for the monthly production of the Procurement Planning and Monitoring Report.

Procurement Support

- PMI supported the initiating of orders, managing them through the clarifications stage and providing assistance with their importation and clearance.

Storage and Distribution

- PMI distributed 117,750 LLINs.

5.3. Plans and Justification with FY 2024 Funding

The FY 2024 funding tables contain a full list of health supply chain and pharmaceutical management systems strengthening that PMI proposes to support in Cambodia.

Supply Chain Elimination Activities

Cambodia will continue to support forecasting and supply planning, as well as the procurement activities described in the **PMI Goal and Strategic Approach section** above, in addition to the delivery of commodities to health sites (as needed). Increasingly, these activities will be tailored to the specific in-country context as 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 in some locations). The tailored forecasting will ensure the availability of key commodities while avoiding irrational expiry of products. PMI will explore, where possible, potentially more efficient options and endeavors, such as regional forecasting and stockpiling within the Greater Mekong Subregion and harmonized delivery. In addition, PMI will distribute topical repellents to be used by forest-goers and to provide additional personal protection against malaria.

See the social and behavior change section for details on challenges and opportunities to improve intervention uptake or maintenance.

6. Social and Behavior Change

6.1. PMI Goal and Strategic Approach

The National SBC Strategy enumerates 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 regimens; 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 [information, education, and communication]/[behavior change communication]” and to “create awareness and adapt behaviors by mobile and migrant

populations and forest-goers, and improve community mobilization through [information, education, and communication]/[behavior change communication] strategies."

In Cambodia, SBC efforts play a crucial role in reaching hard-to-reach populations, such as mobile and migrant populations and forest-goers at high risk of contracting malaria. In each OD, CNM is working with partners to identify these communities and their locations, and to train MMWs to provide testing and treatment for malaria at entry/exit points to the forest where they are most likely to contact forest workers. In line with the MEAF (2021–2025), PMI and other partners support the development and implementation of SBC tools and activities to improve care seeking and the adoption and maintenance of preventive behaviors with a focus on populations at risk of malaria, such as forest-goers, as well as their key influencers, such as family and community members, VMWs, MMWs and health care providers. At the national level, PMI supports the design and development of new and updated evidence-based SBC activities and tools and the dissemination of innovations and lessons learned from prior SBC activities in Cambodia and the region, and it facilitates partner coordination to ensure the consistency of SBC activities. PMI will explore working with service providers as well as other relevant stakeholders (e.g., the Ministry of Environment, forest rangers, and the Ministry of Tourism), particularly regarding the increase in ecotourism involving travel into forests where most malaria transmission occurs.

To provide context on interventions that PMI supports in Cambodia, below is an overview of behavioral trends and related SBC implications.

ITN Ownership

- The proportion of households with at least one LLIN increased from 51.2 percent in 2017 to 72.2 percent in 2020, and the proportion of households with at least one ITN for every two people increased from 25.6 percent to 49.9 percent over the same period.[4]
- Nearly 95 percent of mobile and migrant people reported owning at least one mosquito net, but only 58 percent owned at least one LLIN. LLIN ownership coverage was much higher among security personnel and forest-goers than among seasonal workers and construction workers.[5]
- Approximately 88 percent of forest-goers owned at least one LLIN, and approximately 83 percent owned at least one LLIHN.[6]
- A LLIN rapid assessment was conducted after the completion of the 2021 ITN mass campaign. Based on a survey of 6,107 households in 10 provinces, the results of the assessment indicated high LLIN ownership (97 percent) among targeted households.[7]

[4] Cambodia Malaria Survey (2017; 2020).
[5] WHO Malaria Program Review (2019).
[6] PMI Formative Assessment (2020/2021).
[7] PMI Mid-Term Review Report (2022).

ITN Use

- In 2017, among those with LLINs or LLIHNs, 84.1 percent reported use the previous night, which decreased to 70.5 percent in 2020.[8]
- The proportion of forest-goers who reported sleeping under an LLIN the last time they slept in the forest increased from 42 percent in 2017 to 62 percent in 2020.[9]
- Approximately 76 percent of forest-goers indicated that they sleep under an LLIN or an LLIHN every night.[10]
- Reasons for not sleeping under an LLIN or LLIHN every night included: “too hot to sleep under” (51 percent); didn’t have an LLIN or LLIHN (21 percent); and didn’t bring their LLIN/LLIHN (19 percent).[11]
- Of the forest-goers surveyed (n=654), 55 percent prefer to use spray topical repellents, 46 percent prefer lotion repellents, 46 percent prefer coils, and 35 percent prefer insecticide-treated clothing in the forest.[12]
- In the LLIN rapid assessment conducted after the completion of the 2021 ITN mass campaign, the results of a survey of 6,107 households in 10 provinces indicated high LLIN usage (95 percent) among targeted households.[13]

Conclusions/Recommendations

- Access to LLINs among households and forest-goers varies 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 protect forest-goers during their time in the forest.
- LLIN/LLIHN use among forest-goers is variable; however, it appears to be relatively high. PMI will continue to promote consistent LLIN or LLIHN use throughout the night among forest-goers and households in target villages. However, PMI and CNM recognize that these nets are an imperfect vector control tool for forest-goers due to their sleeping habits and mobility and plan to provide topical repellents as additional protection for forest-goers during their time in the forest.

In late 2020 and early 2021, Cambodia launched a set of interventions, called the Last Mile for Malaria Elimination, with five key components, including TDA and IPTf. Data from last-mile project areas in 2022 showed that only 14 percent of forest-goers identified through a census of select villages had received IPTf, with rates varying considerably among provinces. Various reasons have been cited by implementing partners for this low level of uptake, including a lack of understanding of the intervention, fear of drug side effects, and low levels of support from

[8] Cambodia Malaria Survey (2017; 2020).
[9] PMI Formative Assessment (2020/2021).
[10] Ibid.
[11] Ibid.
[12] Ibid.
[13] PIM Mid-Term Review Report (2022).

community and local authorities. Some forest-goers have mentioned that they avoid the primary forest entry points at times to avoid receiving IPTf and malaria testing. As a result, SBC support to address these barriers to IPTf was cited as a critical need among the malaria implementing partners. PMI will support designing an SBC activity to enhance IPTf uptake and adherence. This design process should begin with a review of current research and evidence on related attitudes and behaviors. Any gaps in the evidence base could be filled by a rapid formative assessment.

Case Management

- Based on a PMI-supported formative assessment in 2020, 57 percent of forest-goers reported seeking care outside the home during their last febrile illness. Among those who sought care, 39 percent reported receiving care within 24 hours.
- The first source of care for fever among those who sought care was VMWs or MMWs (49 percent), public health facilities (27 percent), and private health facilities (16 percent).
- Only 44 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 (51 percent), use of home treatment first (14 percent), and being in the forest during the onset of symptoms (38 percent).
- The 2020 Cambodia Malaria Survey indicated that only 3 percent of general population respondents reported VMWs as a first point of consultation for fever. Among forest visitors, those who chose VMWs when sick while away from home or when staying in the forest was 40 percent. This suggests that VMWs were a significant source of care for malaria-related advice or treatment for forest visitors.

Conclusions/Recommendations

- Prompt testing of all symptomatic and high-risk asymptomatic individuals is the cornerstone of malaria case identification and management in Cambodia. SBC interventions are needed to reinforce demand-side issues related to appropriate testing for the most-at-risk individuals, such as forest-goers.
- SBC activities aimed at improving care-seeking behavior should include a focus on social norms, including normalizing the seeking of malaria testing every time someone exits the forest, as social norms were a significant determinant for seeking care within 24 hours.
- VMWs and MMWs are the most accessible malaria service providers for those at greatest risk of malaria (e.g., forest-goers), and they should receive continued support to ensure quality service delivery toward the goal of malaria elimination by 2025. SBC should continue to promote VMW and MMW channels as reliable sources of malaria prevention and treatment in the community and support these workers to provide effective consultation to suspected malaria patients.

Service Delivery

P. vivax radical cure

- G6PD testing among those eligible increased nationally from 42 percent in 2021 to 61 percent in the first half of 2022, but challenges remain in referring community members to public health facilities. The high successful referral rate (over 85 percent) in PMI areas is due to SBC counseling and to VMWs and MMWs accompanying eligible patients by motorbike to reach health facilities that are difficult to access. CNM emulated the PMI approach of VMWs and MMWs accompanying eligible patients to the health facilities for G6PD testing in 2022, which led to an increase in community referral rates to health facilities from 45 percent in August 2022 to nearly 100 percent by December 2022. From January to December 2022, 67 percent of eligible *P. vivax* patients received G6PD testing, and 77 percent of those patients completed radical cure treatment.
- Out of all patients diagnosed with *P. vivax*, 31 percent received and completed PQ radical cure.[14]
- The reasons for low rates of PQ initiation include low referral rate from VMWs, narrow eligibility criteria (e.g. treatment is currently available only for those weighing over 20 kg), and lack of available health-facility staff or G6PD testing materials in some areas experiencing a high-burden of cases.

Conclusions/Recommendations

- As *P. vivax* cases account for over 90 percent of total malaria cases, and as Cambodia aims to eliminate all human malaria by 2025, substantial efforts will be needed to increase the proportion of patients starting and completing *P. vivax* radical cure. SBC counseling to eligible *P. vivax* patients at all points of care, patient follow-up, and successful referral of cases from the community to health facilities are all important to ensure proper adherence to treatment guidelines.
- 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 inform SBC activities to improve uptake and adherence.
- Evidence points to VMWs being trusted and accessible points of contact for forest-goers, often their first point of consultation. SBC activities addressing service delivery should include VMWs as a key channel and influencer.

Elimination

All malaria activities in Cambodia, including SBC activities, are in an elimination context. Please refer to the different sections for details. In general, the activities seek to ensure adequate protection of populations at risk of malaria as well as early detection and treatment of cases.

[14] CNM Annual Report (2022).

Other Prevention:

Topical and spatial repellents

Indoor residual spraying is not currently an intervention in Cambodia. ITNs also have limitations as a personal protection tool for forest-goers in Cambodia due to the particular context and working conditions (e.g., working hours and challenges in using ITNs). As such, CNM, PMI, and partners are looking for other innovative tools to provide personal protection against mosquitoes for those working in the forest, including at night. CNM and partners have identified topical repellents as a viable option given that they are easy to use, portable, and effective in repelling mosquitoes. However, results from a 2020 formative assessment of forest-goer behavior showed that only 25 percent of all forest-goers surveyed (n=654) had ever heard about topical repellents and knew where to obtain them, and only 9 percent reported having used a topical repellent in the past three months.

Initial results from external studies on spatial repellents are promising. PMI will explore conducting program evaluations on the use of spatial repellents.

Recommendation

PMI will support the design of a set of SBC strategies/tools to help promote the use of both topical and spatial repellents, as applicable, as part of Cambodia's malaria elimination strategy.

6.2. Recent Progress (May 2022–April 2023)

Based on findings and recommendations from the PMI-supported 2020 formative assessment on forest-goers and input from CNM and malaria partners, PMI supported partners in 2022 to design and implement a malaria SBC activity in 50 target villages in Kampong Speu, Kampong Chhnang, and Pursat Provinces. The main goal of the activity was to encourage all forest-goers to visit VMWs and MMWs or health centers for malaria testing upon exiting the forest regardless of symptoms.

The malaria SBC activity consists of three core activities: (1) interpersonal communication activities, whereby trained VMWs conduct household visits to forest-goers and their families; (2) community-level interventions, including billboards and posters at the village entrances/exits to the forest along primary roads and in key locations (shops, meeting points, markets) where forest-goers usually gather in each village; and (3) community-level broadcasting of SBC messages via loudspeaker in each target village to remind forest-goers to seek a malaria test after exiting the forest. From May 2022 to April 2023, there were three rounds of VMW interpersonal communication visits to forest-goer households, resulting in 9,688 households reached at least one time by VMWs—a coverage rate of 86 percent of total households in 50 villages. This malaria SBC activity contributed to a 59 percent increase in malaria testing in the 50 target villages compared with the same period from the prior year (17,877 versus 11,239 tests). For comparison, data from villages in the same health facility

catchment areas that were not exposed to this malaria SBC activity only showed an increase in testing of 26 percent over the same period.

In six provinces supported by PMI (Battambang, Kampot, Kep, Koh Kong, Pailin, and Pursat), VMWs and MMWs reached 172,215 people through interpersonal communication and malaria outreach activities to provide key messages regarding malaria prevention.PMI also continued specific active outreach messaging for mobile and migrant populations targeted to forest-goers to improve malaria diagnosis and treatment for this group, reaching 28,913 people with malaria-related educational messages as part of health outreach efforts during FY 2023.

Based on programmatic learning, as well as routine monitoring and evaluation, PMI has started updating and revising certain elements of this SBC activity and tools to improve efficiency and impact and enhance emphasis on the behavioral determinants of perceived social norms and social support associated with malaria testing.

During the reporting period, PMI also supported CNM to organize two meetings of the SBC technical working group to improve coordination among malaria stakeholders.

In some remote areas, public health facilities are not able to provide outreach or SBC services. PMI funds community-based organizations based in hard-to-reach villages to work with the health center, local authority, and community leaders to address SBC service gaps. In 2022, the community-based organizations mapped 202 locations in high-burden areas identifying informal/temporary settlements sheltering forest-goers. To address these newly-mapped high-risk locations for malaria transmission, the organizations responded by establishing 136 contact points for malaria screening and provided malaria education campaigns to 4,448 mobile or migrant individuals while distributing 4,002 ITNs to them. As recognition for these efforts, PMI funded activities of CNM and the provincial health departments to celebrate World Malaria Day with the theme: “Harness innovation to reduce global malaria disease burden and save lives” in areas at high risk of malaria in the six supported provinces during 2023.

6.3. Plans and Justification with FY 2024 Funding

The FY 2024 funding tables contain a full list of SBC activities that PMI proposes to support in Cambodia.

SBC Elimination Activities

PMI plans to continue providing technical support to CNM and partners on SBC, including the SBC technical working group, which provides an effective forum for coordinating malaria-related SBC activities. PMI plans to continue implementing the theory-informed and evidence-based package of SBC activities and may expand the geographic scope of the current package of SBC activities to additional forest-fringe villages. Additionally, PMI will review existing evidence and conduct assessments as needed to explore the barriers and facilitators of *P. vivax* radical cure adherence and IPTf. These activities will inform the

development and implementation of SBC packages to promote uptake and adherence to the interventions.

Priorities

Table 4. Priority Behaviors to Address

Behavior	Target Population	Geographic Focus	Programming to Address Behavior
Care seeking, particularly test seeking following every visit to the forest	Forest-goers	Selected villages with high malaria caseload + forest-goers	● PMI is currently implementing the package of interventions focused on this behavior to remind forest-goers to seek testing and care. ● The activity will use three main channels: (1) installation of SBC tools and materials in each village; (2) house-to-house visits by VMWs; and (3) the use of a loudspeaker in the villages. The suite of tools and activities include interpersonal communication activities conducted by VMWs and supporting communication materials (calendars, posters, audio messages, banners, and billboards) designed around the theme “Don’t Wait for Symptoms!” and six emotive messages to encourage forest-goers to test for malaria after exiting the forest. PMI is also currently supporting the design of a social media component to complement the existing suite of tools. ● Soft copies of all tools and materials, as well as assistance around their use, will be made available to all malaria partners for use in Cambodia.
Uptake and adherence to IPTf	Forest-goers	Selected villages with high malaria caseload + forest-goers .	● PMI will support the design of a malaria SBC strategy and tools on IPTf. Potential activities include: ○ Conducting a rapid formative assessment of forest-goers to understand the barriers and facilitators of uptake and adherence to IPTf; ○ Using the findings of a formative assessment to design theory-informed, evidence-based SBC strategy and tools to promote uptake and adherence to IPTf; ○ Training of trainers for relevant CNM technical staff and partners on the strategy, tools, and steps for rolling out the SBC activity; and ○ Supporting relevant partners with supportive supervision and monitoring of their implementation of the SBC activity to promote uptake and adherence to IPTf. ● Soft copies of all tools and materials, as well as assistance around their use, will be made available to all malaria partners for use in Cambodia.

Uptake and adherence to *P. vivax* radical cure	Forest-goers who test positive for *P. vivax*	Selected villages with high malaria caseload + forest-goers	● PMI will support the design of a malaria SBC strategy and tools on *P. vivax* radical cure. Potential activities include: ○ Conducting a rapid formative assessment of forest-goers to understand the barriers and facilitators of uptake and adherence to *P. vivax* radical cure; ○ Using the findings of a formative assessment to design theory-informed, evidence-based SBC strategy and tools to promote uptake and adherence to *P. vivax* radical cure; ○ Training of trainers for relevant CNM technical staff and partners on the strategy, tools, and steps for rolling out the SBC activity; and ○ Supporting relevant partners with supportive supervision and monitoring of their implementation of the SBC activity to promote uptake and adherence to *P. vivax* radical cure. ● Soft copies of all tools and materials, as well as assistance around their use, will be made available to all malaria partners for use in Cambodia.
Proper use and disposal of topical repellents	Forest-goers in endemic areas, particularly with recent evidence of transmission	Selected villages with high malaria caseload + forest-goers	● PMI will support the design of a malaria SBC strategy and tools to promote the proper use and disposal of topical repellents.

IPTf = intermittent preventive treatment for forest-goers; SBC = social and behavioral change.

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 to assess the success of the entire package of SBC activities. Monitoring and evaluation activities will focus on intermediate outcomes (i.e., examining whether the package of SBC activities is resulting in the desired changes in behavioral determinants). The findings from these evaluations will be used to improve ongoing and future SBC activities.

PMI will also address gaps in SBC-related evidence, including formative research, monitoring, and evaluation in the following ways:

- Conduct an assessment to understand the facilitators and barriers to uptake and adherence to IPTf and *P. vivax* radical cure (potentially borrowing methodologies and experience from tuberculosis and HIV); and
- Develop and implement evidence-based, theory-informed SBC interventions to support G6PD testing (for providers and community members), adherence to the PQ regimen (for community members), and, if relevant and appropriate, to support the introduction of tafenoquine.

FY 2024 funding will be used in the following ways to bolster Cambodia's capacity for SBC design, implementation, monitoring, and evaluation:

- Continued support of CNM's Malaria SBC technical working group to ensure malaria SBC activities are designed to address the determinants of malaria-related behaviors and tailored to the specific population, and to encourage collaboration and consensus among partners.
- Support for national and subnational capacity strengthening of CNM and provincial health department/OD/health centers to implement SBC activities and to tailor SBC activities to their contexts.
- Promoting coordination between different entities (government and nongovernment) in support of various aspects of malaria elimination (e.g., case management, surveillance, and SBC).

7. Surveillance, Monitoring, and Evaluation

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 phones or tablets to complete 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 provincial health department/OD/health-facility 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 the identification of high-risk villages or transmission foci. CNM continues to strengthen this system's 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 to investigate, classify, and respond to malaria cases and foci to move toward malaria elimination and eventually prevention of re-establishment.

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 scaling up of an evidence-based elimination model piloted in Sampov Loun OD aimed at stemming indigenous malaria cases and preventing re-establishment. This model, which incorporated 1-3-7 surveillance and response along with AS-MQ directly observed therapy 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 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 manual defines a *focus* as an individual village that has been identified as the source of infection for a local case. The investigation of a new active focus is therefore triggered by a local case and completed within one week of case detection. The focus investigation includes four main parts:

1. Index case confirmation as a local case.
2. Conduct desk review of past reported cases to determine the number of cases of all classifications over the preceding 36 months. Assess seasonality and sociodemographic information of local cases to understand the potential receptivity and vulnerability of transmission of the focus.
3. Conduct a mobility assessment of all households in the village using a standardized questionnaire to determine the inhabitants' forest activity in the preceding year.
4. Conduct 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 and receptivity of the focus. *Vulnerability* refers to proximity to an area with high levels of malaria or an influx of infected individuals or infective vectors; *receptivity* refers to the presence of sufficient vectors or other ecological or climatic factors favoring malaria transmission. Once the focus is classified, a response plan that takes into consideration the species of the local case is prepared by the OD in consultation with CNM and provincial health department focal points.

In 2021, CNM began more aggressive targeting of the remaining active foci of *P. falciparum* with the implementation of the last-mile 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. Activities under this program include: (1) recruiting VMWs and MMWs to conduct community engagement, enumerate the target population size in the village, and identify potential forest-goers; (2) administering preventive drug administration strategies, such as the provision of two rounds of monthly TDA with AS-PYR for all males ages 15–49; (3) administering of IPTf with AS-PYR to a subset of the same population of forest-goers; (4) distributing LLINs to groups vulnerable to malaria transmission or adverse outcomes; and (5) periodic screening for active fever in the community for 12 months as part of active foci response.

All foci undergo annual reclassification into one of three groups:

1. **Active focus** is a village from which at least one positive case has been investigated and classified as a local case within the past 12 months.
2. **Residual focus** is a village from which at least one positive case has been investigated and classified as a local case 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 local cases have been detected in over 36 months.

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

As a result of the rapid identification of foci, testing rates, especially among VMWs and MMWs, have increased significantly. Malaria testing increased from 281,820 tests in 2018 to 974,311 tests in 2022, of which nearly 80 percent were conducted by MMWs and VMWs. In combination, these efforts have resulted in substantial declines in *P. falciparum* cases nationally, and *P. vivax* has become the predominant species, now causing nearly 90 percent of malaria cases in 2022. In response, CNM initiated a nationwide *P. vivax* radical cure program, including G6PD testing and 14 days of PQ treatment for nonpregnant patients with *P. vivax* and normal G6PD levels. Recently, CNM introduced plans for the national expansion of the *P. vivax* radical cure program to provide PQ treatment for seven days to patients with normal G6PD levels and to provide PQ once a week for eight weeks to all eligible patients with G6PD deficiency and nonpregnant women. These aggressive strategies support Cambodia's goals to eliminate *P. falciparum* by 2023 and *P. vivax* by 2025.

In Cambodia, malaria indicators as described in the MEAF 2021–2025 are generally derived from the Cambodia Malaria Survey, which is conducted every three to four years, typically with support from the Global Fund. Since the baseline survey in 2004, follow-up surveys were conducted in 2007, 2010, 2013, 2017, and 2020. The surveys in many previous years included household- and facility-based surveys but, considering the availability of the robust Malaria Information System, which includes geolocated case data, the 2020 survey only conducted a household survey that did not measure malaria prevalence. Table 5 outlines additional assessments and surveys have been performed.

CNM maintains its Malaria Information System to collect geolocated data linked to reported cases in real time. When a case is diagnosed, the VMW, MMW, or health-facility staff person reports the case through a web-based application connected to CNM's Malaria Information System. PMI does not currently provide any direct funding 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. Through its implementing partners, PMI supports health-facility 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 funds health facilities to ensure completion of the commodity stock data for monthly reviews. CNM often

requests that PMI's implementing partners test new modules that are being added to the Malaria Information System prior to implementation. Once implemented, PMI supports training and supervision of health-facility and OD staff on the use of these modules.

As of 2023, PMI has been provided improved access to the Malaria Information System and its data. PMI is working to get similar access for its implementing partners. CNM also provides a quarterly data download and finalized performance indicator tracking table shortly after the data deadline for health facilities to report. The improved access by PMI is allowing PMI to work with its partners to identify specific Malaria Information System strengthening activities. Another challenge in the Malaria Information System is that when an update to a case investigation is made, the notification date changes to the date of the update, making the notification appear to be delayed. PMI is working to fix this issue.

For over 10 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 the re-establishment of malaria in cleared foci.

7.2. Recent Progress (April 2022–April 2023)

PMI has achieved the following recent progress:

- Supported training of VMWs, MMWs, and health-facility 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, through which about 90 percent of cases were reported within one day during FY 2023 in six PMI focus provinces.
- Supported case investigation, ensuring that 100 percent of cases were investigated within three days of diagnosis, including in hard-to-reach areas, during FY 2023 in six PMI focus provinces.
- Supported response for 100 percent of newly identified cases (including LLIN top-up distribution and testing of febrile household contacts and co-travelers) within seven days during FY 2023 in six PMI focus provinces.
- Supported foci investigation within seven days and updated the foci register on a rolling basis.
- Documented the reporting of uptake of 14-day *P. vivax* radical cure to ensure maximum coverage and prevention of relapse treatment in as many patients as possible; nearly 100 percent of eligible patients with normal G6PD levels completed the radical cure regimen during FY 2023.
- Provided input to CNM at invited meetings to inform the update of surveillance guidelines.
- Supported annual risk stratification exercises to review and update the methodology and maps.

PMI continued to provide substantial support to CNM for surveillance, monitoring, and evaluation through activities at the provincial and community level in the six PMI focus provinces to ensure high-quality data are available to support the implementation and monitoring of the 1-3-7 surveillance system. PMI supported refresher training at regularly scheduled meetings for OD/health-facility staff and VMWs, which has significantly improved the timeliness, completeness, and accuracy of surveillance reports. PMI supported monthly meetings of VMWs with health-facility staff as well as quarterly meetings of the Provincial Special Malaria Elimination Team and the District Special Malaria Elimination Team in the six focus provinces.These meetings were led by provincial and operational district staff and attended by Ministry of Health staff and stakeholders with the specific task of providing updates on malaria elimination in their respective jurisdictions.

7.3. Plans and Justification with FY 2024 Funding

The FY 2024 funding tables contain a full list of surveillance, monitoring, and evaluation activities that PMI proposes to support in Cambodia.

At the national level, PMI plans to provide continued technical support to CNM to strengthen the existing surveillance system for detecting and immediately reporting all malaria cases and for investigating, classifying, and responding to *P. falciparum* cases and foci to move toward malaria elimination. At the local level, PMI supports the scaling up of an evidence-based elimination model that was first piloted in PMI-supported provinces and has now been adapted nationwide to eliminate indigenous malaria cases and prevent re-establishment. This model, which incorporates 1-3-7 surveillance and response along with directly observed therapy for all cases (including *P. vivax*), has produced substantial reductions in the number of *P. falciparum* and mixed cases in the six PMI-supported provinces, and many of these ODs have dropped to nearly zero cases.

PMI provides substantial support to CNM through activities at the provincial to community level to ensure good quality data to support the implementation and monitoring of the 1-3-7 surveillance system. Furthermore, in FY 2024, alternative approaches, such as 1-1-7, may be considered to further streamline malaria case investigation and response. In addition, PMI is currently working with partners to develop a POR strategy to be rolled out in ODs with zero malaria cases. Support for subnational verification at the provincial and OD level will also be rolled out, as applicable, along with support to prepare for national certification of elimination based on WHO requirements.

PMI will continue to provide substantial support to CNM for surveillance, monitoring, and evaluation through activities at the provincial to the community level in the six PMI focus provinces to provide high-quality data in support of the implementation and monitoring of the 1-3-7 surveillance system and the online modules of the malaria information system. PMI will also continue to support refresher training at regularly scheduled meetings for OD and health-facility staff and VMWs, which have significantly improved timeliness, completeness, and accuracy of surveillance reports. PMI will continue to support the iDES nationally in

Cambodia as a system that provides enhanced elimination surveillance and treatment efficacy information for policy decisions (see the case management section for additional details on iDES). See the FY 2024 PMI budget tables for a detailed list of proposed activities with FY 2024 funding.

Table 5. Available Malaria Surveillance Sources

Source	Data Collection Activity	2020	2021	2022	2023	2024	2025
Household Surveys	Demographic Health Survey		X*				
Household Surveys	Malaria Indicator Survey	X*					
Household Surveys	Multiple Indicator Cluster Survey (MICS)						
Household Surveys	EPI survey						
Health Facility Surveys	Service Provision Assessment						
Health Facility Surveys	Service Availability Readiness Assessment (SARA) survey						
Health Facility Surveys	Other Health Facility Survey						
Malaria Surveillance and Routine System Support	Therapeutic Efficacy Studies (TES)	X	X*				
Malaria Surveillance and Routine System Support	Integrated Drug Efficacy Surveillance (iDES)			X	X	P	P
Malaria Surveillance and Routine System Support	Support to Parallel Malaria Surveillance System						
Malaria Surveillance and Routine System Support	Support to HMIS	X*	X*	X*	X*	P*	P*
Malaria Surveillance and Routine System Support	Support to Integrated Disease Surveillance and Response (IDSR)						
Malaria Surveillance and Routine System Support	Electronic Logistics Management Information System (eLMIS)						
Malaria Surveillance and Routine System Support	Malaria Rapid Reporting System	X*	X*	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*			

* Non-PMI funded activities; X: completed activities; and P: planned activities.

8. Operational Research and Program Evaluation

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 the scaling up of cost-effective personal prevention measures. In addition, CNM described several steps to strengthen operational research for malaria, and it 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 coming years.

PMI has supported key operational research in line with CNM's goals to address key programmatic and policy needs in Cambodia. Prior 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 or nondeficient, and evaluating two different types of highly sensitive RDTs to diagnose subclinical malaria infection. Given the rapidly evolving situation as Cambodia pushes for elimination over the next two years, several new tools might undergo operational research in various settings, and PMI remains prepared to support this research, as warranted.

8.2. Recent Progress (April 2022–April 2023)

No operational research or program evaluation has taken place during 2022 or 2023. However, program evaluation of the utilization of topical repellents is being planned in 2023.

In CY 2020 and CY 2021, PMI supported an operational research 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 and in a health-facility setting. The data showed a strong correlation between the quantitative point-of-care analyzers and standard spectrophotometry. A manuscript is under development for publication in 2023.

Table 6. PMI-Funded Operational Research and Program Evaluation Studies in Cambodia

Recently Completed Operational Research/ Program Evaluation 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	Pending	Jan. 2020	Feb. 2021
Ongoing or planned operational research or program evaluation studies	Status	Start Date	End Date

Table 7. Non-PMI Funded Planned and Ongoing Operational Research and Program Evaluation Studies in Cambodia

Source of Funding	Implementing institution	Research Question/Topic	Current Status/ Timeline
University of Maryland	Institute Pasteur of Cambodia	Open-labeled randomized clinical trial to determine therapeutic efficacy of artesunate or artesunate + primaquine for *P. vivax* infection. To be conducted in Cambodia.	Ongoing
Global Fund Regional Artemisinin Initiative 3 Elimination grant	Burnet Institute Health Poverty Action	Personal protection packages for reducing residual malaria transmission in forest-going mobile and migrant populations in the Greater Mekong Subregion: Stepped-wedge trials with nested mixed-methods study. To be conducted in Cambodia, Laos, Myanmar, and Vietnam.	Ongoing
Global Fund Regional Artemisinin Initiative 3 Elimination grant	Burnet Institute Health Poverty Action	Global Optimizing 1-3-7 surveillance and response strategies to achieve malaria elimination across the Greater Mekong Subregion. To be conducted in Cambodia, Laos, Myanmar, Thailand, and Vietnam.	Ongoing
National Health and Medical Research Council, Australia	Menzies School of Health Research	To compare the effectiveness, safety, cost-effectiveness and feasibility of novel *P. vivax* radical cure options (tafenoquine and high-dose primaquine) in Cambodia, Indonesia, Ethiopia, and Pakistan.	Ongoing

8.3. Plans and Justification with FY 2024 Funding

No operational research or program evaluation activities are proposed with FY 2024 funding.

9. Capacity Strengthening

9.1. PMI Goal and Strategic Approach

As Cambodia approaches its elimination targets, CNM will increasingly need to integrate and develop sustainable systems and policies that will maintain gains and prevent the re-establishment of malaria after elimination. PMI activities will continue to strengthen local government capacity through TA, on-the-job training, coaching, supervision, and monitoring at all levels—CNM, provincial health department, OD, and village. In postelimination settings where sufficient capacity has been built, PMI will expedite the transition of responsibilities from project staff to provincial and district health staff to sustain program activities. PMI will apply MOP FY 2024 funding to support the transition from donor-funded vertical assistance to integrated programs that enable public health care providers to maintain skills, a reliable supply chain of malaria commodities, a responsive surveillance system, and high-quality laboratory capacity for accurate malaria diagnosis.

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

9.2. Recent Progress (April 2022–April 2023)

PMI continued to support the strengthening of the National Reference Laboratory at CNM through training and TA. Subnationally, PMI supported microscopy QA via new and refresher training and certification for microscopists to enhance malaria diagnostics at the provincial and district level. These two laboratory-strengthening activities complemented each other, with one primarily focused on the central level and another at the subnational level.

PMI also began strengthening the ability of provincial governments to budget and advocate for resources to sustain malaria elimination by estimating the cost of POR activities in one province where they will be implemented by PMI. This effort is in line with the Royal Government of Cambodia's decentralization policy aimed at transitioning central-level roles and authorities to subnational governments.

9.3. Plans and Justification with FY 2024 Funding

The FY 2024 funding tables contain a full list of capacity strengthening activities that PMI proposes to support in Cambodia.

PMI will continue its support of subnational laboratory capacity strengthening throughout the country based on the results of the assessment of laboratory and microscopy capacity that will be conducted in 2023. The assessment will determine which gaps in malaria diagnostics, laboratories, and staff capabilities across various levels of the health system are most urgent to address, and will then provide recommendations and plans to strengthen areas identified in

the assessment. Based on the results of the lab assessment, which will also determine polymerase chain reaction capabilities, PMI plans to support activities that will strengthen lab capacity for reaching and maintaining malaria elimination in line with WHO guidance.

This assessment is intended to provide insights into lab optimization and human resource capacity-strengthening and will assist CNM in developing and implementing a plan for capacity maintenance of lower-level laboratory cadres. While activities will be informed based on assessment results, there are already known gaps in lab services, including a lack of regular in-service professional development and refresher training, a dearth of adequate polymerase chain reaction capability for rapid identification of all species of malaria, and a failure of the national reference laboratory to meet WHO standards. These activities will be supported during FY 2024.

Building off funding that began 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. As malaria programs become more integrated within the Ministry of Health's existing public health systems, having Field Epidemiology Training Program graduates who are familiar with malaria outbreak response will be critical to sustaining current program gains and elimination, once reached.

PMI will continue to provide TA for the coordination of partners to promote the integration of vertical malaria systems into the broader national health system. PMI will continue to focus on VMW integration into existing community health structures and support costing and work planning to sustainably transition malaria interventions and health systems investments to the Ministry of Health. PMI will continue its investments in elimination sustainability through its support for POR systems, such as enhanced surveillance through the iDES module in the Malaria Information System. PMI will also fund the collation of documentation to ensure adherence to subnational verification plans.

10. Staffing and Administration

Currently, the Cambodia PMI in-country team comprises three full-time staff, including a USAID Resident Advisor, a CDC Resident Advisor, and a foreign service national malaria specialist. The single interagency team is led by the USAID Mission Director or a designee. 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 evaluating outcomes and impact, reporting results, and providing guidance and direction to PMI implementing partners.

Given Cambodia's achievements and progress toward malaria elimination, the USAID/Cambodia mission and PMI/Washington recognize the need to transition the staffing structure to align with the level of program funding and level of effort needed to manage the portfolio. During at least a portion of the implementation period for this MOP, the PMI team will

comprise three full-time health professionals, including an foreign service national malaria specialist, a PMI USAID resident advisor, and a CDC resident advisor. A USAID foreign service officer infectious disease team lead will continue to support the PMI team.

ANNEX: GAP ANALYSIS TABLES

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

Calendar Year	2023	2024	2025
Total country population	17,332,049	17,540,033	17,750,514
Total population at risk for malaria	9,936,379	4,565,476	2,314,697
PMI-targeted at-risk population	2,238,223	749,244	379,867
Population targeted for ITNs	895,716	726,605	368,389
Continuous distribution needs			
Channel 1: ANC	0	12,783	6,481
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			
LLINs	47,897	19,059	53,711
LLIHNs	0	9,529	26,855
Integrated hammock and net	13,452	10,668	6,616
Channel 4: Community type of ITN	Single Pyrethroid	Single Pyrethroid	Single Pyrethroid
Channel 5: MoIH, MoND, and MoT (distribution to MMP)			
LLINs	16,300	34,800	34,600
LLIHNs	3,880	14,000	14,000
Channel 5: Type of ITN	Single Pyrethroid	Single Pyrethroid	Single Pyrethroid
Estimated total need for continuous channels	81,529	100,839	142,263
Mass campaign distribution needs			
Mass distribution campaigns			
LLINs	198,214	281,440	0
LLIHNs	38,880	110,129	0
Mass distribution ITN type	Single Pyrethroid	Single Pyrethroid	
Estimated total need for campaigns	237,094	391,569	0
Total ITN need: Continuous and campaign	**318,623**	**492,408**	**142,263**
Partner contributions			
ITNs carried over from previous year			
LLINs	83,200	0	0
LLIHNs	1,600		

Integrated hammock and net	9,500		
Total ITNs carried over from previous year	94,300	0	0
ITNs from government	0	0	0
Type of ITNs from government			
LLINs from Global Fund	169,700	348,150	99,350
LLIHNs from Global Fund	39,400	0	0
Integrated hammocks and nets from Global Fund	10,000	10,700	6,650
ITNs from Global Fund	219,100	358,850	106,000
Type of ITNs from Global Fund	Single Pyrethroid	Single Pyrethroid	Single Pyrethroid
ITNs from other donors	0	0	0
Type of ITNs from other donors			
ITNs planned with PMI funding	0	0	170,000
Type of ITNs with PMI funding		Single Pyrethroid	
Total ITNs contribution per calendar year	**313,400**	**358,850**	**276,000**
Total ITN surplus (gap)	**(5,223)**	**(133,558)**	**133,737**
Gap classification by type of ITNs			
LLINs surplus (gap)	-9,511	68	4,558
LLIHNs surplus (gap)	-1,760	-133,658	-40,855
Integrated hammock and net surplus (gap)	6,048	32	34

Table A-2. RDT Gap Analysis Table

Calendar Year	2023	2024	2025
Total country population	17,332,049	17,540,033	17,750,514
Population at risk for malaria	9,936,379	4,565,476	2,314,697
PMI-targeted at-risk population	2,238,223	749,244	379,867
RDT needs			
Total number of projected suspected malaria cases	0	0	0
Annual blood examination rate (ABER) for routine cases (passive detection)	9%	10%	10%
Projected quantity of RDTs to be used in “blood examination” (passive detection)	894,274	456,548	231,470
Quantities required for testing during responses	0	365,238	115,735
Quantities required for ANC test	0	63,917	32,406
Quantities required for stock base (starter stock) at each new VMWs/MMWs	18,800	19,300	19,700
Quantities required for stock base at nonendemic area	12,120	12,120	12,120
Quantities required for stock base at MoND	3,000	3,000	3,000
RDT needs (tests)	**928,194**	**920,122**	**414,430**
Needs estimated based on other			
Partner contributions (tests)			
RDTs from government	0	0	0
RDTs from Global Fund	795,850	1,780,765	689,478
RDTs from other donors	0	0	0
RDTs planned with PMI funding	0	0	0
Total RDT contributions per calendar year	**795,850**	**1,780,765**	**689,478**
Stock balance (tests)			
Beginning balance	588,810	456,466	1,317,108
- Product need	928,194	920,122	414,430
+ Total contributions (received/expected)	795,850	1,780,765	689,478
Ending balance	**456,466**	**1,317,108**	**1,592,156**
Desired end of year stock (months of stock)	6	6	6
Desired end of year stock (quantities)	464,097	460,061	207,215
Total surplus (gap)	**(7,631)**	**857,047**	**1,384,941**

Table A-3. ACT Gap Analysis Table

Calendar Year	2023	2024	2025
Total country population	17,332,049	17,540,033	17,750,514
Population at risk for malaria	9,936,379	4,565,476	2,314,697
PMI-targeted at-risk population	2,238,223	749,244	379,867
ACT needs			
Total projected number of malaria cases	3,648	2,189	875
Total projected number of malaria cases for ped	8.35%	8.35%	8.35%
Projected consumption by malaria cases (ASMQ)	3,648	2,189	875
Projected consumption by malaria cases among children (quantity in AS-PYR sachets)	2,235	1,342	537
Stock base for ODs, HFs, VMWs/MMWs, other ministries	14,045	13,605	32,094
Stock base for ODs, HFs, VMWs/MMWs for Ped (AS-PYR granule) (Qty in sachet)	116,820	118,764	32,544
Total ACT needs (ASMQ, treatments)	**17,693**	**15,794**	**32,969**
Total ACT (AS-PYR) needs for ped (quantity in sachet)	**119,055**	**120,106**	**33,081**
Needs estimated based on other (specify in comments)			
Partner contributions (treatments)			
ACTs from government	0	0	0
ACTs from Global Fund (ASMQ) (treatments/blisters)	0	19,132	13,154
ACTs from Global Fund (AS-PYR granule) (sachets)	0	0	0
ACTs from other donors	0	0	0
ACTs planned with PMI funding—pyronaridine/artesunate 60/20 mg granules for suspension (sachets)	0	150,120	
Total ACTs (ASMQ [treatments]) contributions per calendar year	0	19,132	**13,154**
Total ACTs (*Pyramax* granule [sachets]) contributions per calendar year	**0**	**150,120**	**0**
Stock balance (treatments)			
Beginning balance (ASMQ; treatments)	54,974	51,326	68,270
Expected expiries			48,700
- Product need	17,693	15,794	32,969
+ Total contributions (received/expected) ASMQ	0	19,132	13,154
Beginning balance (*Pyramax* granule [sachets])	122,580	0	30,014
Expected expiries	120,531	0	0
- Product need	119,055	120,106	33,081
+ Total contributions (received/expected) *Pyramax* granule	0	150,120	0
Ending balance (ASMQ, treatments)	**51,326**	**68,270**	**31,848**

Ending balance (*Pyramax* granule, sachets)	**0**	**30,014**	**0**
Desired end of year stock (ASMQ) (months of stock)	3	3	3
Desired end of year stock (ASMQ) (quantities)	4,423	3,949	8,242
Desired end of year stock (*Pyramax* granule) (months of stock)	3	3	3
Desired end of year stock (*Pyramax* granule) (quantities)	29,764	30,027	8,270
Total surplus (gap) (ASMQ, treatments)	**46,903**	**64,321**	**23,606**
Total surplus (gap) (*Pyramax* granule, sachets)	**(29,764)**	**(13)**	**(8,270)**

Table A-4. Inj. Artesunate Gap Analysis Table

Calendar Year	2023	2024	2025
Injectable artesunate needs			
Projected number of severe cases	42	25	10
Projected number of severe cases among children	0	0	0
Average number of vials required for severe cases among children	0	0	0
Projected number of severe cases among adults	42	25	10
Average number of vials required for severe cases among adults	15	15	15
Projected consumption	635	381	152
Stock base for hospitals	3,990	0	2,685
Total injectable artesunate needs (vials)	**4,625**	**381**	**2,837**
Needs estimated based on other (specify in comments)			
Partner contributions (vials)			
Injectable artesunate from government	10,000	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	**10,000**	**0**	**0**
Stock balance (vials)			
Beginning balance	16,690	26,056	19,946
Expected expiries		5,729	9,683
- Product need	4,625	381	2,837
+ Total contributions (received/expected)	10,000	0	0
Ending balance	**26,056**	**19,946**	**10,111**
Desired end of year stock (months of stock)	6	6	6
Desired end of year stock (quantities)	2,312	190	1,419
Total surplus (gap)	**23,743**	**19,756**	**8,693**

Table A-5. Primaquine Gap Analysis Table

Calendar Year	2023	2024	2025
Total country population	17,332,049	17,540,033	17,750,514
Total population at risk for malaria	9,936,379	4,565,476	2,314,697
PMI-targeted at-risk population	2,238,223	749,244	379,867
Primaquine needs			
Total projected number of malaria cases	3,648	2,189	875
Total projected number of *P. falciparum* cases	425	0	0
Total projected number of *P. vivax* cases	3,223	2,189	875
Total projected number of mixed cases (*P. falciparum* + *P. vivax*)	n.a.	n.a.	n.a.
Projected consumption (tablets)	129,291	77,912	31,168
Stock base for ODs, VMWs/MMWs, other ministries	112,500	112,550	112,590
Total primaquine needs (tablets)	**241,791**	**190,462**	**143,758**
Needs estimated based on other			
Partner contributions (tablets)			
Primaquine from government	500,000	400,000	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	**500,000**	**400,000**	**0**
Stock balance (tablets)			
Beginning balance	485,550	603,032	848,059
Expected expiries	253,227	77,061	500,000
- Product need	241,791	190,462	143,758
+ Total contributions (received/expected)	500,000	400,000	0
Ending balance	**603,032**	**848,059**	**316,891**
Desired end of year stock (months of stock)	3	3	3
Desired end of year stock (quantities)	60,448	47,616	35,940
Total surplus (gap)	**542,584**	**800,443**	**280,951**

Table A-6. Pyramax® (AS-PYR) Gap Analysis Table

Calendar Year	2023	2024	2025
Total country population	17,332,049	17,540,033	17,750,514
Population at risk for malaria	9,936,379	4,565,476	2,314,697
PMI-targeted at-risk population	2,238,223	749,244	379,867
Pyronaridine-artesunate tabs needs			
Total projected population for foci response 1: Targeted drug administration (TDA) coverage	5,950	4,200	4,550
Total number of blisters for TDA 1 and 2	13,095	9,243	10,017
Total projected population for foci response 2: intermittent preventive treatment for forest goers (IPTf) coverage	6,308	8,108	10,058
Total number of blister for IPTf	83,268	107,028	132,768
Pyronaridine-artesunate tabs needs (blisters)	**96,363**	**116,271**	**142,785**
Needs estimated based on other			
Partner contributions (bottles)			
AS-PYR from government	0	0	0
AS-PYR from Global Fund	15,750	0	0
AS-PYR from other donors	0	0	0
AS-PYR planned with PMI funding	63,610	107,610	0
Total AS-PYR contributions per calendar year	**79,360**	**107,610**	**0**
Stock balance (blisters)			
Beginning balance	35,684	18,681	10,020
- Product need	96,363	116,271	142,785
+ Total contributions (received/expected)	79,360	107,610	0
Ending balance	**18,681**	**10,020**	**0**
Desired end of year stock (months of stock)	1	1	1
Desired end of year stock (quantities)	8,030	9,689	11,899
Total surplus (gap)	**10,651**	**331**	**(144,664)**

Table A-7. Repellents Gap Analysis Table

Calendar Year	2023	2024	2025
Total country population	17,332,049	17,540,033	17,750,514
Population at risk for malaria	9,936,379	4,565,476	2,314,697
PMI-targeted at-risk population	2,238,223	749,244	379,867
Repellent needs			
Total number of high-risk population	197,525	162,476	82,375
Percent of coverage of the high-risk population	20%	20%	20%
Number of bottles per person per year	12	12	12
Repellent needs (100 ml bottles)	**474,060**	**389,942**	**197,700**
Needs estimated based on other			
Partner contributions (bottles)			
Repellents from government	0	0	0
Repellents from Global Fund	0	0	0
Repellents from other donors	0	0	0
Repellents planned with PMI funding	0	568,872	0
Total repellents contributions per calendar year	**0**	**568,872**	**0**
Stock balance (bottles)			
Beginning balance	0	0	178,930
- Product need	474,060	389,942	197,700
+ Total contributions (received/expected)	0	568,872	0
Ending balance	**0**	**178,930**	**0**
Desired end of year stock (months of stock)	2	2	2
Desired end of year stock (quantities)	94,812	77,988	39,540
Total surplus (gap)	**(94,812)**	**100,941**	**(39,540)**