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**Ethiopia**

**Malaria Operational Plan FY 2023**

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This FY 2023 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 2023 appropriation from the U.S. Congress. Any updates will be reflected in revised postings.

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

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## ABBREVIATIONS

ACT	Artemisinin-based Combination Therapy
AHRI	Armauer Hansen Research Institute
AI	Active Ingredient
ANC	Antenatal Care
API	Annual Parasite Index
APTS	Auditable Pharmaceuticals Transactions and Services
BMGF	Bill and Melinda Gates Foundation
CDC	Centers for Disease Control and Prevention
CQ	Chloroquine
CY	Calendar Year
DHIS2	District Health Information Software 2
eCHIS	Electronic Community Health Information System
EFDA	Ethiopia Food and Drug Administration
EFETP	Ethiopia Field Epidemiology Training Program
EPI	Ethiopian Public Health Institute
EPSS	Ethiopian Pharmaceuticals Supply Service
EQA	External Quality Assessments
FMOH	Ethiopia Federal Ministry of Health
FY	Fiscal Year
Global Fund	Global Fund to Fight AIDS, Tuberculosis and Malaria
HEW	Health Extension Worker
HP	Health Post
HRP	Histidine-rich Protein
IDSR	Integrated Disease Surveillance and Response
IPTp	Intermittent Preventive Treatment for Pregnant Women
IRS	Indoor Residual Spraying
ITN	Insecticide-treated Mosquito Net
LSM	Larval Source Management
MACEPA	Malaria Control and Elimination Partnership in Africa
MIP	Malaria in Pregnancy
MOP	Malaria Operational Plan
NMCP	National Malaria Control Program
NMEP	National Malaria Elimination Program
NMSP	National Malaria Strategic Plan
OR	Operational Research
PBO	Piperonyl Butoxide
PE	Program Evaluation
PHEM	Public Health Emergency Management
PMI	U.S. President's Malaria Initiative
PQ	Primaquine
RCD	Reactive Case Detection
RDQA	Routine Data Quality Audit
RDT	Rapid Diagnostic Test

RHB	Regional Health Bureau
SBC	Social and Behavior Change
SMC	Seasonal Malaria Chemoprevention
SM&E	Surveillance, Monitoring, and Evaluation
SNNP	South Nations, Nationalities, and Peoples'
TA	Technical Assistance
tMDA	Targeted Mass Drug Administration
TES	Therapeutic Efficacy Study
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization

## EXECUTIVE SUMMARY

To review specific country context for Ethiopia, please refer to Ethiopia's [Country Malaria Profile](#), which provides an overview of Ethiopia's malaria situation, key indicators, the National Malaria Elimination Program (NMEP) strategic plan, and the partner landscape.

### **U.S. President's Malaria Initiative (PMI)**

Launched in 2005, [PMI](#) supports implementation of malaria prevention and treatment measures as well as cross-cutting interventions. PMI's 2021–2026 strategy, [End Malaria Faster](#), envisions a world free of malaria within our generation with the goal of preventing malaria cases, reducing malaria deaths and illness, and eliminating malaria in PMI partner countries. PMI currently supports 24 countries in sub-Saharan Africa and three programs across the Greater Mekong Subregion in Southeast Asia to control and eliminate malaria. Ethiopia began implementation as a PMI partner country in fiscal year (FY) 2008.

### **Rationale for PMI's Approach in Ethiopia**

PMI Ethiopia invests in core malaria interventions aligned with both PMI's *End Malaria Faster* strategy and the goals of Ethiopia's 2021–2025 National Malaria Strategic Plan (NMSP), which include: "By 2025, reduce malaria morbidity and mortality by 50 percent from baseline of 2020," and "By 2025, achieve zero indigenous malaria in districts with annual parasite incidence less than 10 and prevent re-introduction of malaria in districts reporting zero indigenous malaria cases." PMI supports a range of interventions in coordination with the Ethiopian Federal Ministry of Health (FMOH) and other global stakeholders including The Global Fund to Fight AIDS, Tuberculosis, and Malaria (Global Fund) with a focus on utilizing indoor residual spraying (IRS) of insecticides, the provision of insecticide-treated mosquito nets (ITNs), case management interventions in high burden areas, and building surveillance capacity in regions targeted for malaria elimination.

### **Overview of Planned Interventions**

The proposed FY 2023 PMI funding for Ethiopia is \$35 million. PMI will support the following intervention areas with these funds:

#### **1. Vector Monitoring and Control**

The NMSP recommends covering 100 percent of the population at risk of malaria with one type of globally recommended vector control intervention by 2021. PMI prioritizes

populations at higher malaria risk with one of the globally recommended vector control interventions (i.e., effective ITNs or IRS).

Proposed investment with FY 2023 funding:

- PMI will procure efficacious ITNs for distribution in high-malaria burden districts.
- PMI will support IRS implementation in 41 high-malaria burden districts and expand the community-based approach model.
- PMI will continue with entomological monitoring, including for *Anopheles stephensi*. In addition, PMI plans to expand implementation of *An. stephensi* control using larval source management (LSM).

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

The NMSP recommends that all pregnant women living in malaria endemic areas should sleep under an ITN and have access to malaria diagnosis and treatment.

Proposed investments with FY 2023 funding:

- PMI will continue to support the NMEP to implement quality vector control interventions in high-malaria burden districts in the western part of Ethiopia and maintain malaria case management services prioritizing pregnant women in more than 200 moderate- to high-malaria burden districts. This includes supporting weekly chloroquine (CQ) suppression for pregnant women diagnosed with *Plasmodium vivax* infection.

## **3. Drug-based Prevention**

The NMSP does not recommend intermittent preventive treatment for pregnant women (IPTp), intermittent preventive treatment in infants, or seasonal malaria chemoprevention (SMC).

There are no proposed investments with FY 2023 funding. However, refer to the **Operational Research (OR) section** below for relevant proposed investments.

## **4. Case Management**

The NMSP aims to conduct confirmatory testing for 100 percent of suspected malaria cases and treat all confirmed cases in all segments of the population including regular residents, refugees, internally displaced persons, and mobile and migrant populations, at both the community and health facility levels.

Proposed investments with FY 2023 funding:

- PMI plans to procure 51,260 doses of rectal artesunate, 4 million CQ tablets, and 298,350 vials of injectable artesunate, and it will continue to strengthen

malaria diagnosis and treatment in the public health facilities. In addition, PMI will continue supporting the FMOH to strengthen malaria diagnosis and treatment in the private sector.

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

The NMSP aims to improve the malaria supply chain and the quality of antimalarial commodities. PMI/Ethiopia supports the NMEP to procure, store, and distribute diagnostic and antimalarial treatment commodities to health facilities and ITNs to the community level. In addition, PMI provides technical assistance (TA) to the Ethiopian Pharmaceuticals Supply Service (EPSS) in supply planning and forecasting of malaria commodities.

Proposed investments with FY 2023 funding:

- PMI plans to procure and support the distribution of piperonyl butoxide (PBO) ITNs, rectal artesunate, injectable artesunate, and CQ tablets.
- PMI plans to provide TA to the EPSS in quantification, supply planning, drug management, requisition, drug exchange/transfer, and tracking/disposal.

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

The NMSP aims to achieve adoption of appropriate behavior and practices toward antimalarial interventions by 85 percent of households living in malaria-endemic areas by 2025. To achieve this objective, the NMEP will utilize health extension workers (HEWs), health development armies, and model family households to deliver SBC interventions.

Proposed investments with FY 2023 funding:

- PMI will focus on adoption of recommended malaria behaviors at household and family levels through community engagement, interpersonal communication, mass media, and mobilizing leaders, champions, and influencers. PMI will also work with civil society organizations to engage schools and communities in SBC activities.
- Integrated SBC and vector control activities for *An. stephensi* control will be supported.

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

The NMSP aims to improve malaria surveillance and response systems, especially in the context of malaria elimination districts. PMI supports the NMEP to strengthen Ethiopia's malaria SM&E systems as per the national strategic plan. In low and very low malaria transmission areas targeted for malaria elimination, the NMEP proposes to implement mass drug administration approaches, both targeted and reactive, once there is evidence to support this decision.



Proposed investments with FY 2023 funding:

- PMI will continue supporting the NMEP to strengthen the malaria SM&E systems through expanding the coverage and quality of the District Health Information Software 2 (DHIS2), electronic Community Health Information System (eCHIS), and the Public Health Emergency Management (PHEM) systems.
- PMI will support strengthening surveillance and response activities for malaria elimination in 54 PMI-supported districts. PMI will support the NMEP to strengthen the capacity of the malaria program at the district, health facility, and community levels to collect, analyze, and utilize data to achieve the goal of malaria elimination.
- PMI will support the NMEP to continue evaluating reactive drug administration compared to reactive case detection (RCD). PMI will support implementation of the most cost-effective interventions in PMI-supported elimination districts.

## **8. OR and Program Evaluation (PE)**

The draft National Malaria Guidelines recommend the use of preventive long-acting antimalarial drugs for migrant workers that work in high-malaria burden areas seasonally, particularly during the major malaria transmission season. However, there is no evidence to support this recommendation, so the NMEP recommends OR to study the feasibility and effectiveness of this approach.

Proposed investments with FY 2023 funding:

- PMI will collaborate with the NMEP, the Malaria Control and Elimination Partnership in Africa (MACEPA), and other key malaria stakeholders to conduct a study to evaluate the feasibility and effectiveness of an SMC-based approach targeting migrant workers.

## **9. Capacity Strengthening**

As outlined in the NMSP, substantial resources are needed to strengthen health systems and to provide capacity strengthening for malaria control and elimination in Ethiopia. PMI has historically strengthened the health systems in Ethiopia by creating competent health professionals, strengthening human resources for health management and regulation for improved distribution and performance of the health workforce, and improving malaria data collection, reporting, analysis, and utilization at all levels. Both the Advanced and Ethiopian Field Epidemiology Training Program (EFETP) Frontline cadres are key in achieving and expanding malaria elimination *woredas*, which is a major priority for the NMEP and PMI.

Proposed investments with FY 2023 funding:

- PMI will continue to support the Ethiopia Food and Drug Administration (EFDA) to ensure quality malaria medications in the public and private sectors. In addition, PMI will landscape private Giemsa solution-producing factories in Ethiopia and support good manufacturing practices to address persistent challenges with poor quality Giemsa solution.
- PMI will continue to support workforce development, which aims to strengthen individual and institutional capacity to improve the quality of pre-service education to create competent health professionals and strengthen human resources for health management and regulation for improved distribution and performance of the health workforce.
- PMI will continue to support the Advanced and EFETP residents by conducting malaria training, providing technical expertise to support malaria research and outbreak response, supporting small grants to conduct malaria projects, and mentoring residents to improve national capacity for malaria prevention, control, and elimination.
- PMI will support the EFETP Frontline which targets lower-level health care workers (20 district surveillance officers per cohort) to identify and respond in a timely and effective way to malaria hot spots and index cases.

# I. CONTEXT AND STRATEGY

## 1. Introduction

Ethiopia began implementation as a U.S. President's Malaria Initiative (PMI) partner country in fiscal year (FY) 2008. This FY 2023 Malaria Operational Plan (MOP) presents a detailed implementation plan for Ethiopia, based on the strategies of PMI and the National Malaria Elimination Program (NMEP). It was developed in consultation with the NMEP and with the participation of national and international partners. The activities that PMI is proposing build on investments made by partners, including the Global Fund to Fight AIDS, Tuberculosis, and Malaria (Global Fund), to improve and expand malaria-related services. This document provides an overview of the strategies and interventions in Ethiopia, describes progress to date, identifies challenges and relevant contextual factors, and provides a description of activities planned with FY 2023 funding. For more detailed information on the country context, please refer to the Country Malaria Profile, which provides an overview of the country's malaria situation, key indicators, the NMEP strategic plan, and the partner landscape.

## 2. PMI

PMI is led by the U.S. Agency for International Development (USAID) and implemented together with the U.S. Centers for Disease Control and Prevention (CDC). Launched in 2005, PMI supports implementation of malaria prevention and treatment measures—insecticide-treated mosquito nets (ITNs), indoor residual spraying (IRS), 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 (SM&E); social and behavior change (SBC); and capacity strengthening. PMI's 2021–2026 strategy, [End Malaria Faster](#), envisions a world free of malaria within our generation with the goal of preventing malaria cases, reducing malaria deaths and illness, and eliminating malaria in PMI partner countries. PMI currently supports 24 countries in sub-Saharan Africa and three programs in the Greater Mekong Subregion in Southeast Asia to control and eliminate malaria. Over the next five years, PMI aims to save lives, reduce health inequities, and improve disease surveillance and global health security.

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

- Reduce malaria mortality by 33 percent from 2015 levels in high-burden PMI partner countries, achieving a greater than 80 percent reduction from 2000.
- Reduce malaria morbidity by 40 percent from 2015 levels in PMI partner countries with high and moderate malaria burden.

- 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 Ethiopia

#### 3.1. Malaria Overview for Ethiopia

According to the Ethiopian National Malaria Strategic Plan (NMSP), the population of Ethiopia was 102.8 million in 2020. Of this population, about 52 percent lives in areas at risk of malaria. The highest malaria burden regions are usually areas of intense malaria transmission with altitudes below 1,000 meters located mainly in areas of Gambela, Benishangul-Gumuz, Western Oromia, Amhara, some parts of South Nations, Nationalities and Peoples' (SNNP), and Tigray regions.

In Ethiopia, malaria remains one of the major public health and socioeconomic problems despite its dramatic reduction in the last two decades. Over the last ten years, reports show that malaria cases decreased from 3.8 million to about 1.2 million in 2021. The number of deaths also reduced from 261 in 2010 to 132 in 2021. However, the 2020 District Health Information Software 2 (DHIS2) report shows that malaria cases in Ethiopia had increased by 34 percent compared to the 2019 data (the number of confirmed malaria cases in 2019 was 904,405, whereas in 2020 it was 1,389,750). Data triangulation with previous Public Health Emergency Management (PHEM) and malaria micro-planning reports indicate that more than 80 percent of the malaria burden in Ethiopia is among adults and children who are at least five years of age.

In Ethiopia, malaria is highly seasonal and unstable with epidemic-prone transmission patterns in many parts of the country. *Plasmodium falciparum* (~65 percent) and *Plasmodium vivax* (~35 percent) are the major malaria parasites. *An. arabiensis* is the primary malaria vector in Ethiopia, with *An. funestus*, *An. pharoensis*, and *An. nili* as

secondary vectors. Recent evidence suggests that *An. coustani* may also play a role as a vector. *An. stephensi*, an invasive, urban vector mainly breeding in artificial containers, has been identified as well. Peak malaria transmission occurs between September and December, after the main rainy season from June to August. Because of the unstable nature of malaria in Ethiopia, adults and children are equally at risk for malaria infection and disease.

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

### **3.2. Key Challenges and Contextual Factors**

As of 2022, Ethiopia has reported an increase in malaria cases in some parts of the country. According to DHIS2, there were 253,056 cases in the first quarter (January to March) of 2022 compared to 195,984 cases in the same quarter of 2021. This has been attributed mainly to disruption of malaria interventions notably in the regions of Tigray, Afar, and Amhara in 2020 and 2021 due to widespread conflict. Additionally, a new, invasive vector of malaria, *An. stephensi*, has been detected in 45 sites in Ethiopia. Results from the entomological surveys conducted in Ethiopia indicated that the vector is widely distributed in urban, peri-urban, and rural areas in the eastern, central and northeastern parts of the country along the transportation corridor that connects Ethiopia with Djibouti (Balkew 2021). Ethiopia is also challenged with an emerging parasite deletion in a gene that encodes for a histidine-rich protein 2 (HRP-2) which is the primary target for rapid diagnostic tests (RDTs). This deletion combined with deletion of HRP-3, which can cross-react, makes the parasite unable to be detected by HRP-2-based RDTs. The other major challenge facing Ethiopia is the return of seasonal migrant workers harboring malaria infection to low or eliminated malaria areas. Every year, mostly young men seek jobs in large, lowland agricultural areas where malaria is endemic, placing them at higher risk of infection. When these seasonal migrant laborers return home, they bring the infection back to low-malaria burden areas, which poses a challenge to achieving and maintaining malaria elimination in Ethiopia.

The NMSP proposes to reduce malaria morbidity and mortality by 50 percent from the 2020 baseline and eliminate malaria in districts with an annual parasite index (API) less than 10 by 2025. According to the 2020 stratification, there were 565 districts with API of less than 10. By March 2022, a total of 565 districts were selected for elimination in Ethiopia, the average API of these districts is 4.6. The Ethiopia Federal Ministry of Health (FMOH) has developed a malaria elimination technical document to guide the implementation of malaria elimination activities.

Ethiopia mainly relies on Global Fund resources to procure the majority of ITNs, ACTs, RDTs, and insecticides for government-supported IRS. Global Fund also supports gaps

in case management. PMI/Ethiopia supports gaps in malaria commodities, including ITNs and antimalarials for severe malaria and *P. vivax*, and provides coordination and technical assistance (TA) for supply chain management and SM&E. In addition, PMI/Ethiopia supports implementation of IRS in western Ethiopia with high rates of malaria and supports malaria case management strengthening in selected facilities throughout Ethiopia. In March 2022, PMI/Ethiopia launched malaria elimination activities with the purpose of improving the quality of implementation of targeted malaria elimination interventions through improvement in the identification, investigation, classification, and management of malaria cases by health facilities and community platforms. It is envisioned that the 67 selected elimination districts will have the capacity to implement recommended malaria elimination interventions and serve as a scalable model of malaria elimination that will be developed in other non-PMI malaria elimination targeted districts.

The recent conflict situation in the northern part of Ethiopia, as well as continuing armed conflicts in the Oromia, SNNP, and Benishangul-Gumuz regions, have resulted in increased humanitarian needs and discontinuation of essential health services. In general, PMI/Ethiopia is working to ensure improved program management and leadership at district and subdistrict levels to ensure a well-functioning primary health care system. In the short term, PMI/Ethiopia responded to the conflict by supporting the FMOH through the NMEP to conduct post-conflict assessments to identify the needs for post-conflict recovery and to develop a post-conflict plan for the health sector. PMI/Ethiopia together with partners have supported the NMEP to implement the post-conflict recovery plan. In the long term, PMI/Ethiopia is working with the NMEP, regional health bureaus (RHBs), district health teams, and implementing partners to adapt malaria services to increase resilience against shocks such as conflict.

Under vector control, PMI/Ethiopia is strategizing to transition most of the district-based IRS to community-based IRS—which in recent years has kept vector control interventions resilient in the face of shocks such as conflict and COVID-19—and mosquito collections to community-based mosquito collectors. In addition, ITN distribution, mobilization, tracking, and monitoring will be conducted by the health extension workers (HEWs) with oversight from the district health office. In case management, PMI/Ethiopia is working in six regions to train, mentor, and equip HEWs to improve case management at the community level. To achieve malaria elimination targets, PMI/Ethiopia is focusing on strengthening capacity at the community level to improve surveillance systems for case detection, reporting, investigation, and timely and effective responses.

Following detection of *An. stephensi* in several areas in Ethiopia, PMI supported the NMEP to develop an action plan to guide the enhanced surveillance and control of *An.*

*stephensi* in Ethiopia for the next five years. This strategic plan outlined the list of viable vector control methods that are ready for immediate use and, for those that require further investigation, to generate local data on their feasibility and cost-effectiveness before rolling them out. Larval source management (LSM) was selected for immediate deployment for the control of *An. stephensi* in Ethiopia based on the best available data globally and in the country. In 2022, PMI will implement LSM in eight towns, namely Meki and Ziway towns in Oromia, Semera-Logya and Awash in Afar, and Deghabour, Kebridehar, and Godey in Somali, and Dire Dawa city administration. In addition, PMI will compare the residual efficacy of three larvicide products (Sumilarv 0.5g, Sumilarv 2MR, and Bti) in three towns, namely, Dire Dawa, Kebri Dehar, and Awash.

HRP-2/3 gene deletions in parasite genes have been detected in Ethiopia and threaten the ability of health providers to appropriately diagnose and treat people with *P. falciparum* malaria where deletions exist. PMI/Ethiopia along with other donors, including the Bill and Melinda Gates Foundation, have supported surveillance to identify areas with high HRP-2/3 deletion prevalence. The data were used to formulate a policy brief that will be used to implement a phased change from using current HRP-2-based RDTs to using non-HRP-2-based RDTs. Regarding migrant workers, PMI/Ethiopia is working with other partners to develop community-based innovative approaches for early identification, diagnosis, and treatment of migrant workers. In addition, PMI is proposing to conduct an operational research (OR) study with the objective of evaluating if seasonal malaria chemoprevention (SMC) is feasible and effective for migrant workers.

### **3.3. Key Changes in This MOP**

PMI/Ethiopia continues to build upon the success and progress from targeted malaria control and prevention with a focus on expanding malaria elimination and shrinking the malaria map. As mentioned, Ethiopia has suffered a devastating conflict from November 2020 to the present, which has had a significant impact on health services overall and malaria services specifically. PMI/Ethiopia has responded with emergency ACT procurements and is now working with the health sector on post-conflict recovery; however, there are major gaps and PMI/Ethiopia is prioritizing with limited resources what would have the most impact (i.e., mobile clinics, laboratory equipment/supplies, and supportive supervision).

PMI/Ethiopia is also focusing on malaria elimination as the 2021–2025 NMSP incorporates this as a major focus and Ethiopia has set the ambitious goal of achieving nationwide malaria elimination by 2030. PMI/Ethiopia continues to strengthen surveillance as a key intervention to drive down malaria transmission through timely and effective case identification, investigation, and response through reactive case detection

(RCD). PMI will continue to build upon the successes and lessons learned achieved by earlier surveillance strengthening activities in Oromia region and work with the NMEP, RHBs, and *woredas* to move the needle on malaria elimination in Ethiopia.

Finally, Ethiopia's significant progress in malaria control is jeopardized by the emergence of the highly efficient and invasive vector, *An. stephensi*. PMI/Ethiopia has worked with the NMEP and universities with enhanced surveillance to document the spread and vector capacity in malaria transmission. PMI/Ethiopia also supported an investigation led by the Armauer Hansen Research Institute (AHRI) into a significant malaria outbreak (150-fold increase in malaria incidence) in Dire Dawa which was directly linked to *An. stephensi*. Given the ability of *An. stephensi* to "amplify" malaria in very low-malaria burden urban areas, PMI/Ethiopia is prioritizing mitigation and control centered on initiating larvicide implementation in eight towns with evaluation of three larvicides in three towns as quickly as possible to respond to this imminent threat.



## II. OPERATIONAL PLAN FOR FY 2023

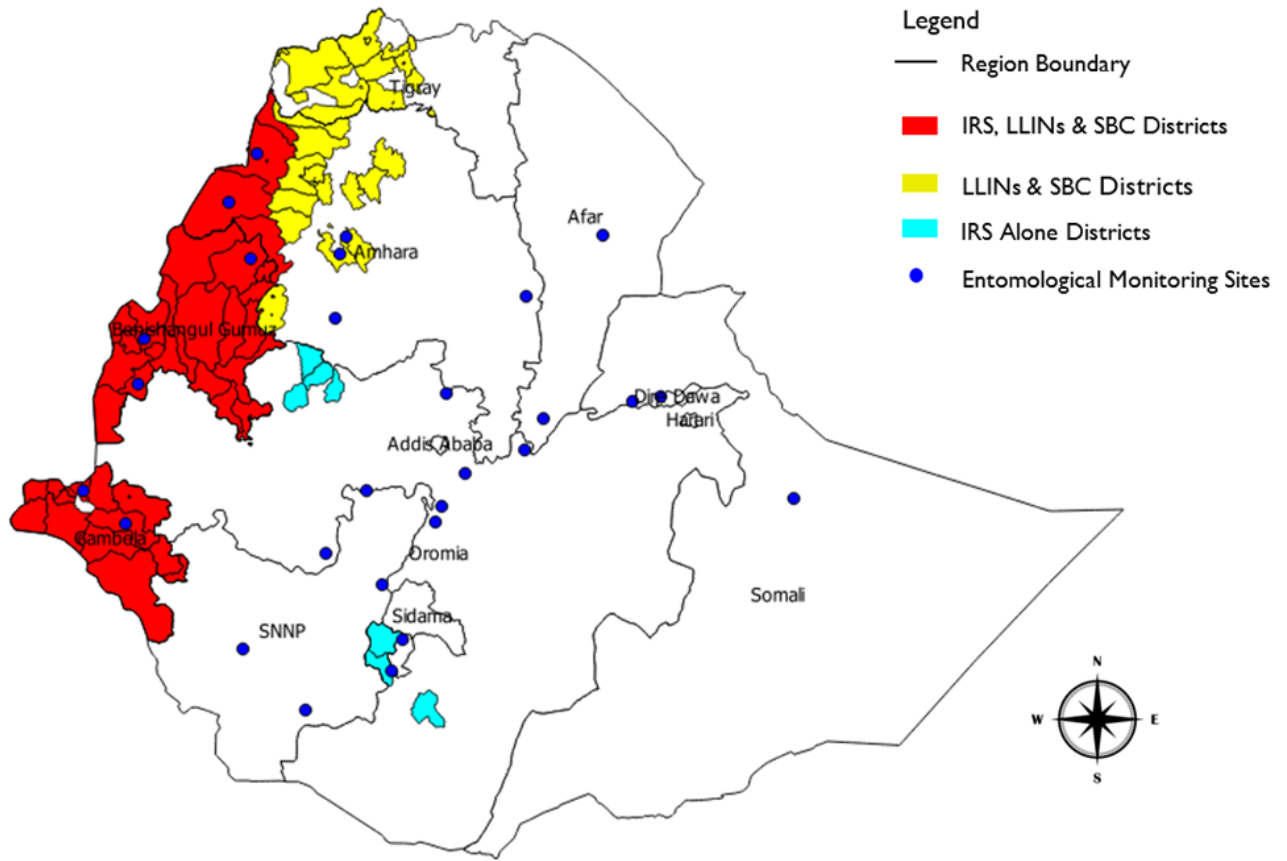
### 1. Vector Monitoring and Control

#### 1.1. PMI Goal and Strategic Approach

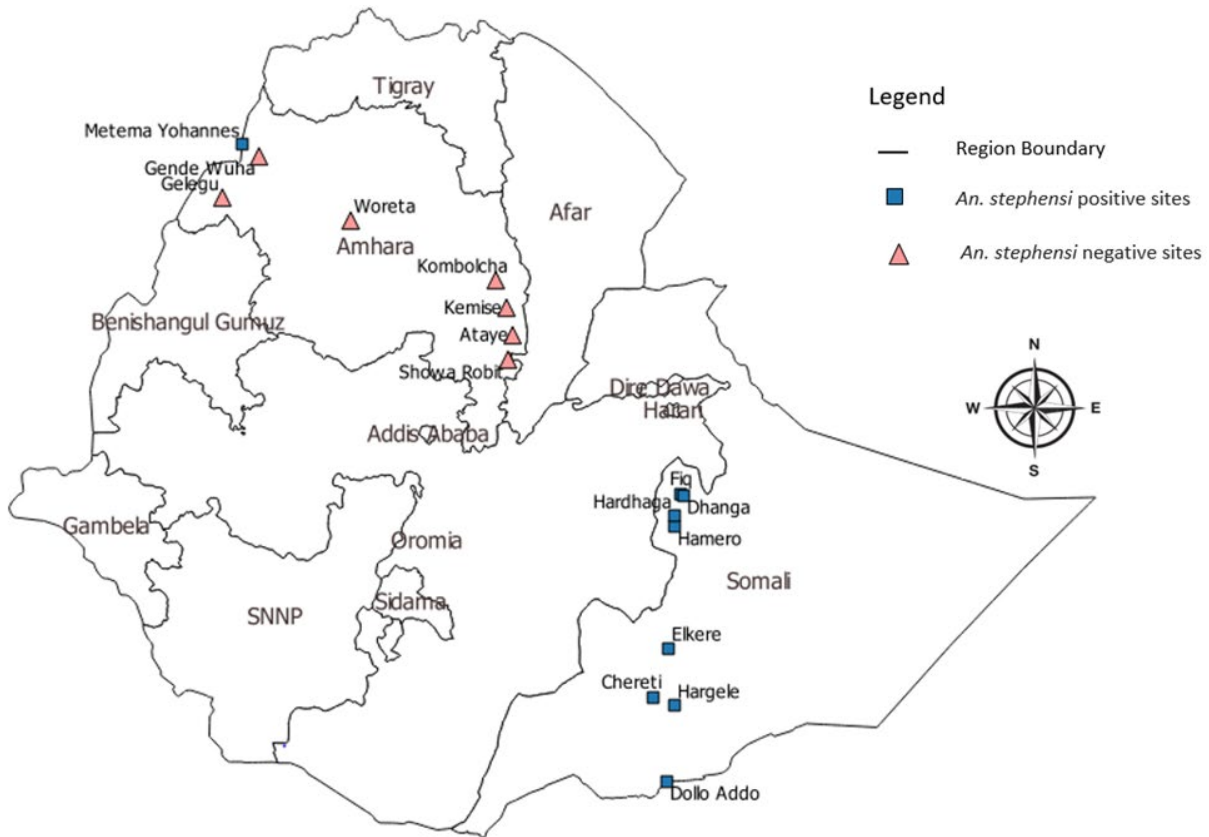
According to the NMEP's 2021–2025 Strategic Plan, ITNs and IRS are the two major vector control interventions in Ethiopia while LSM was considered a supplementary tool. The vector control interventions are guided by entomological monitoring, surveillance, and insecticide resistance management. PMI supports entomological monitoring in 28 sites across the country to generate evidence for decision-making. The major strategic vector control objective of the NMEP is to cover 100 percent of the population at risk of malaria with one type of globally recommended vector control intervention.

PMI supports the main vector control activities, including distribution of ITNs and targeted IRS according to the national vector control guidelines. The NMEP plans to cover all malaria risk areas with ITNs through community-level mass campaigns every three years regardless of the magnitude of the risk. PMI is working with the NMEP, stakeholders, and partners to further prioritize or refine target areas for ITN distribution since Ethiopia is facing major ITN procurement gaps and historically low net use in low and very low burden areas. Since there is low use of ITNs in low and very low areas, PMI advocates for enhanced surveillance and foci investigation in such areas instead of routine ITN distribution. Along with implementation of IRS and distribution of ITNs, PMI is supporting entomological monitoring to inform the NMEP on vector distribution, seasonality, behavior, density, susceptibility of vectors to insecticides, residual efficacy of insecticides, sporozoite infection rates, and blood meal sources. Following the detection of the invasive *An. stephensi* in Ethiopia in 2016, LSM is now planned to be implemented in eight towns to control *An. stephensi*. In addition, PMI will start a pilot field evaluation in 2022 of different larvicides to advise the NMEP on the efficacy and residual life of the larvicides to determine the frequency of application under local conditions.

Figure 1A. Map of Vector Control Activities in Ethiopia



**Figure 1B. *Anopheles stephensi* Positive and Negative Sites Surveyed in 2021**



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

- Supported entomological monitoring in different regions of the country in collaboration with nine local universities. Monitoring activities included insecticide resistance (21 sites including 6 sites for *An. stephensi*), vector bionomics (7 sites), and insecticide residual efficacy tests (9 sites). PMI planned *An. stephensi* surveys in 23 target areas along 4 transects on the main transportation routes that start from Djibouti and extend to Afar, Amhara, Tigray, Oromia, and Somali regions. Due to security problems, only 16 sites were investigated; however, of those, 9 were positive for *An. stephensi*. *An. stephensi* was found for the first time in western Ethiopia in the Amhara region in Metema Yohannes town bordering Sudan. All 8 investigated sites in the Somali Region (Fik, Dhanga, Hardhaga, Hamero, Elkere, Chereti, Hargele, and Dollo Addo) were positive for *An. stephensi*. At this point *An. stephensi* has been detected in 45 sites in Ethiopia. For more information about entomological monitoring, please refer to the [2021 Entomological Monitoring Report](#).
- Supported community-based entomology activities in eight districts. PMI/Ethiopia supported community mosquito collectors, mostly female, who received training that enabled them to collect mosquitoes using CDC light traps, identify mosquitoes to genus level, and then label, preserve, and send

- them to the designated center for species identification. In two of these eight districts (Meki and Semera), in addition to identifying the adult mosquitoes, community mosquito collectors identified potential mosquito breeding sites, differentiated malaria vector's larvae from non vectors, and then labeled, preserved, and sent the larvae to the closest laboratory for species identification.
- Provided TA to nine local universities, Amhara Regional Public Health Institute, and AHRI for entomological monitoring. In addition, materials and technical support were provided to the local universities to strengthen the capacities of their insectaries. This enabled them to participate in the entomological monitoring in their respective regions. PMI/Ethiopia also procured different entomological materials for the Adama Malaria Research and Training Center, managed by AHRI.
  - Provided TA for planning of the 2021 ITN mass distribution campaign, which distributed standard ITNs to target populations in the districts eligible for ITN replacement. The activity was in collaboration with the NMEP and respective regional and district health offices.
  - Procured and distributed 2.8 million ITNs in 119 districts of Somali, Dire Dawa, Harari, Amhara, and Oromia regions in 2021. Furthermore, over 338,000 ITNs were procured and distributed for emergency response in 19 districts of SNNP, Oromia, Amhara, and Afar. PMI also procured and distributed 179,000 piperonyl butoxide (PBO) ITNs in selected areas for the PBO net study with the aim to evaluate the impact of PBO ITNs alone versus IRS plus standard ITNs on disease burden and entomological indices. The result of the evaluation is expected to inform the future use of PBO ITNs in the country.
  - Supported national- and community-level SBC activities to improve demand for ITNs, ensure correct and consistent use, and promote care. For more information, please refer to the **SBC section** below.
  - Supported the planning, implementation, and evaluation of the 2021 IRS campaign in 37 districts, covering 604,000 structures and protecting 1,640,000 people from May to July, 2021. Originally 792,891 structures were targeted across 48 districts in the four regions, but the target was reduced due to security issues. For more information, please refer to the most recent End of Spray Report [here](#). In addition, PMI supported the training and engagement of community members and other cadres in 37 districts to support IRS mobilization and spray activities as well as minor IRS material support to 70 IRS graduated districts.

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

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

- With FY 2023 funds, PMI/Ethiopia will continue a similar level of vector control and entomological monitoring support.
- PMI will procure about 2.16 million PBO ITNs based on resistance data. In consultation with the NMEP, PMI plans to support the distribution of ITNs in the high-malaria burden districts.
- PMI will continue to support safe and effective IRS implementation within 41 high-malaria burden districts in the Amhara, Benishangul-Gumuz, and Gambela regions in addition to continuing to provide limited IRS support to 70 graduated districts in the Oromia region.
- PMI will continue supporting NMEP with entomological monitoring in selected sites, including *An. stephensi* surveillance and control.
- In addition, PMI will continue working closely with the FMOH, RHBs, AHRI, Ethiopian Public Health Institute (EPHI), and local universities on entomological monitoring including *An. stephensi* surveillance and control.
- The result of the currently ongoing PBO net evaluation against IRS plus standard nets is hoped to guide the future PBO net implementation in the country.
- Piloting dual active ingredient (AI) nets to generate country-specific data is planned as a potential alternative. Approximately 50,000 dual AI nets are planned to be procured and distributed for piloting.
- Based on the results of rapid LSM implementation and larvicide evaluation in 2022, PMI, in consultation with the NMEP, will support the implementation of preferred larvicide to control *An. stephensi* in selected sites in Ethiopia. PMI will collaborate with partners, stakeholders (Global Fund, WHO, etc.), research institutions, and the community in all efforts to combat the threats posed by *An. stephensi*.

### **1.3.1. Entomological Monitoring**

PMI will continue to support entomological monitoring in 28 sites that represent different eco-epidemiology zones of the country as per the new approaches proposed for entomological monitoring. PMI will also continue its support of a two-arm study (non-inferiority) evaluating the relative impact of PBO nets alone with the combined intervention of IRS plus standard pyrethroid ITNs on malaria case incidence and the density of *Anopheles* mosquitoes in five districts of Amhara region. Support will also continue for activities to understand the habitat, spread, biting, and resting behavior of *An. stephensi* and susceptibility to different insecticides. PMI plans to maintain its funding allocation for entomological monitoring to continue to strengthen entomological monitoring—behavioral monitoring, insecticide resistance surveillance, insecticide residual efficacy monitoring, wall bioassays tests to monitor residual efficacy of different insecticides used for IRS in different regions on different wall types, and activities related to *An. stephensi*. PMI will also continue supporting the coordination of insecticide resistance surveillance and provide TA to strengthen the capacity of local research institutes and universities.

## Summary of Distribution and Bionomics of Malaria Vectors in Ethiopia

The presence of 17 *Anopheles* species in seven entomological monitoring sentinel sites have been reported from across the country. PMI/Ethiopia no longer supports the use of human landing collections, so CDC light traps, pyrethrum spray collections, and Prokopack collections were deployed for adult mosquito collections, and the most productive collection method was CDC light traps. The majority of collections are *An. arabiensis*, the primary malaria vector, followed by *An. coustani* and *An. funestus*. Secondary malaria vectors include *An. funestus*, *An. pharoensis*, and *An. nili*. Overall, the majority of *An. arabiensis* are collected outdoors using CDC light traps, although outdoor and indoor collection vary between sentinel sites. Malaria vector density starts building up from July and the timing of peak density varies between different sites. For example, the peak density was attained in August for Bambasi while the peak density for Lare was in October. In Abaya and Gelana, the human blood index was 0.54 and 0.83, respectively, while in Bennatsemay and Jabitehnan, 0.29 and 0.19, respectively. In Bennatsemay and Jabitehnan, *An. arabiensis* showed a high tendency to feed on cattle. Sporozoite analysis shows *An. arabiensis* carrying infective *P. falciparum* sporozoites. *An. coustani* from Bambasi have tested positive for *P. vivax* sporozoites where the species represented 51 percent of *Anopheles* collected and may be a potential malaria vector in Ethiopia. *An. stephensi* is an invasive malaria vector in Ethiopia and wild *An. stephensi* have also tested positive for *P. falciparum* and *P. vivax* sporozoites and may be considered a serious threat to malaria elimination. For more information, refer to the 2021 Annual Entomological Monitoring Report.

## Status of Insecticide Resistance in Ethiopia

Susceptibility tests for *An. arabiensis* show susceptibility to pirimiphos-methyl in all the 15 sites tested, and 9 out of 10 sites tested for propoxur. However, *An. arabiensis* was found to be resistant to deltamethrin in 14 out of 15 sites and in all 10 sites tested for alpha-cypermethrin and permethrin. The intensity of resistance of *An. arabiensis* to alpha-cypermethrin is high (10X) in Batu, Fentale, Goro, Kallu, and Misrak Badawacho. Intensity of resistance to permethrin and deltamethrin is high (10X) in Batu, Misrak Badawacho, Jawi, and Dera. PBO synergist assays on populations of *An. arabiensis* were conducted for deltamethrin, permethrin, and alpha-cypermethrin in different sites and pre-PBO exposure restored full susceptibility of *An. arabiensis* to deltamethrin in 10 sites: Amibara, Dera, Fentale, Fogera, Jabitehnan, Jawi, Kalu, Metema, Omonada, and Quara; and partial susceptibility in Abobo, Batu, Erer, Goro, and Misrak Badawacho. Similarly pre-PBO exposure followed by alpha-cypermethrin restored mortality of *An. arabiensis* in Amibara, Batu, Fentale, Goro, Kalu, and Omonada, and partial susceptibility in Batu, Erer, and Misrak Badawacho. Further, PBO restored full susceptibility of *An. arabiensis* to permethrin in Abobo, Amibara, Batu, Fentale, Goro,

Jabitehnan, Kalu, and Omonada, and partial susceptibility of *An. stephensi* to alpha-cypermethrin in Misrak Badawacho. In general, this monitoring indicates the involvement of cytochrome P450 mono-oxygenase enzymes as mechanisms of resistance in some sites, and it is not the only one in other sites.

*An. arabiensis* was found to be fully susceptible to clothianidin and chlorfenapyr. *An. stephensi* showed full susceptibility to both clothianidin and chlorfenapyr in all four areas tested: Awash, Batu, Meki, and Modjo; however, the species has been found to be resistant to pyrethroids, carbamates, and organophosphates from Awash, Gode, Meki, and Metehara. A PBO synergist assay was conducted on *An. stephensi* and pre-PBO exposure restored full susceptibility of *An. stephensi* to permethrin in all three sites tested: Degehabur, Dire Dawa, and Semera-Logia. PBO partially restored susceptibility of *An. stephensi* to alpha-cypermethrin or deltamethrin in all three sites.

### 1.3.2. ITNs

PMI will continue to support procurement and distribution of ITNs through community-based health extension programs. PMI will provide technical support to the country's 2024 mass distributions through participation on a national task force, national ITNs distribution plan, and field supervision. PMI also supports some durability activities including bioassay and chemical content analysis on PBO and standard ITNs distributed as part of the PBO and IRS/standard ITN study in Amhara region.

PMI will continue to support improved targeting of ITN distribution in the country, SBC interventions to improve correct and consistent ITN use, and ITN care. ITN SBC interventions will focus at the community, household, and family levels and work in collaboration with HEWs, Women's Development Armies, and community volunteers. This helps to expand the reach of SBC in the communities and increase the number of recipients receiving targeted SBC. Consistent and correct ITN use and care of ITNs are priority behaviors for PMI/Ethiopia SBC interventions. Efforts to ensure strong coordination between SBC and vector control implementing partners will be a focus to ensure alignment of supply and demand efforts, especially during ITN distribution campaigns. Please see the **SBC section** below for details on challenges and opportunities to improve intervention uptake or maintenance.

### ITN Distribution in Ethiopia

In Ethiopia, ITNs are distributed via rolling annual mass campaigns to replace nets every three years. The majority of ITNs in Ethiopia are distributed through Global Fund support with PMI-funded ITNs addressing gaps in the distribution plan. Starting in 2024, distribution of PMI-funded ITNs will be prioritized for high-malaria burden areas of the country. PMI supports the distribution of ITNs down to health posts (HPs) where they

are distributed by HEWs who track the households receiving the ITNs. Those data are then submitted to the health facilities who report it to the *woreda* health offices for aggregation.

In 2024, PMI plans to procure 2.16 million PBO ITNs. Additionally, PMI is planning to do a pilot distribution of dual AI ITNs to generate country-specific durability data for consideration as the need arises. The dual AI nets will be monitored for their physical integrity, bioefficacy, and insecticide content. Approximately 50,000 dual AI nets will be procured and distributed in select district(s). For more details on planned quantities and distribution channels, please refer to the **ITN Gap Analysis Table** in the [annex](#).

### **1.3.3. IRS**

PMI will continue supporting IRS in districts of the western part of the country where malaria burden is high. The western lowland areas of the country are known for attracting people from different parts of the country as migrant temporary labor force. Mostly the migrant workers stay in poorly constructed shelters which are not generally considered eligible for spraying. The shelters could be made of corrugated iron sheet wall, thatched grass, or sparsely casted wood or bamboo. As a result, IRS coverage is highly based on eligible structures definition. In 2021, PMI graduated three low-malaria burden districts from Oromia from PMI IRS support and expanded to six high-malaria burden districts in Amhara region. PMI will continue providing minimal support to graduated districts to sustain their gains. In collaboration with the NMEP and partners, PMI will intervene as needed if malaria upsurges are detected in recently graduated districts. PMI will graduate four more districts from the Oromia region from FY 2023 IRS operations. Community-based IRS was shown to be non-inferior to district-based IRS in terms of coverage and quality of spraying. In security-compromised settings community-based IRS was found to be the most appropriate approach. Considering sustainability and cost effectiveness of community-based IRS, PMI will advocate for expanding community-based IRS to the extent possible in PMI-supported districts.

With FY 2023 funding, PMI will support the planning, implementation, and evaluation of the 2024 IRS operations in 41 districts using organophosphate and neonicotinoid insecticides alongside SBC activities to mobilize the community and entomological monitoring to ensure efficacy of the intervention. Furthermore, PMI will provide TA to the NMEP and district health officers in Global Fund–supported districts. PMI plans to continue implementation and technical support in the same geographic areas with FY 2023 funding. The refugee settlements in Gambela and Benishangul Gumuz areas are emerging as hot spots for malaria transmission requiring further intervention. In FY 2023 and beyond, with further discussion and results of on the ground assessments, PMI is



considering refugee settlements for IRS as graduation of districts occurs. PMI plans to maintain its funding allocation for IRS and entomological monitoring.

**Table 1. PMI-supported IRS Coverage**

Calendar Year	District*	Structures Sprayed (#)	Coverage Rate (%)	Population Protected (#)	Insecticide
2021	Gambela (14), Benishangul Gumuz (9), Oromia (7), and Amhara (6)	604,921	94.5	1,618,765	Actellic (Gambela and Amhara), Sumishield (Horo Guduru Oromia, and Benishangul Gumuz), and Fludora Fusion (Guji Oromia)
2022	Gambela (14), Benishangul Gumuz (21), Oromia (7), and Amhara (6)	763,766	TBD	1,974,799	Pirimiphos-methyl CS, clothianidin, and clothianidin/deltamethrin
2023**	Gambela (14), Benishangul Gumuz (21), Oromia (3), and Amhara (6)	783,600	TBD	2,026,000	Pirimiphos-methyl CS, clothianidin, and clothianidin/deltamethrin
2024**	Gambela (14), Benishangul Gumuz (21), and Amhara (6)	804,000	TBD	2,078,000	Pirimiphos-methyl CS, clothianidin, and clothianidin/deltamethrin

\*\*Planned

### IRS Insecticide Residual Efficacy in Ethiopia

Assessment of IRS quality and insecticide decay rate was conducted monthly through wall cone bioassay on different insecticides and different wall types following 2021 IRS operations. Cone bioassay tests were conducted on Actellic 300CS in six districts where PMI supports IRS operations. The draft VectorLink 21–22 annual report shows Actellic 300CS sustained its residual efficacy through eight months in Dera and Fogera, six months in Jawi, five months in Quara, and four months in Metema districts of Amhara region, while it was efficacious only for three months in Lare district of Gambela region. On the other hand, cone bioassay tests were conducted on SumiShield in Menge and Abe Dongoro districts and Fludora Fusion in Abaya and Gelana districts. The result shows the efficacy of SumiShield through five months in Menge, and the test was interrupted on the third month in Abe Dongoro district due to security problems. However, the mortality from the bioassay test was increasing from T0 to T3, possibly as bioavailability of the insecticide increased. The residual efficacy of Fludora Fusion in Abaya district was maintained for 10 months on various wall types—cement and mud—whether painted or not. In Gelana district, residual efficacy of Fludora Fusion went through 10 months on painted and non-painted mud, while its residual efficacy on dung wall persisted only for six months. Considering the three months’ residual life of Actellic 300CS in Lare district of Gambela region, IRS with Actellic may not provide the necessary protection throughout the transmission season of August to November when

spraying takes place in May to June. As a result, starting from 2022, the IRS insecticide for Gambela region was switched to the newer insecticide, Fludora Fusion, as this insecticide exhibited longer residual life in Abaya and Galana.

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

### **2.1. PMI Goal and Strategic Approach**

The Ethiopia Malaria Elimination Strategic Plan, 2021–2025 recommends that all pregnant women living in malaria endemic areas should sleep under an ITN and have access to malaria diagnosis and treatment. ITNs are distributed in mass campaigns and malaria diagnosis and treatment services are provided at HPs, health centers, and hospitals. Private health institutions also provide malaria diagnosis and treatment services. The draft revised National Malaria Guidelines 2022 recommend provision of weekly chloroquine (CQ) suppression for pregnant women with *P. vivax* infection until delivery and breastfeeding are completed. Ethiopia has also revised its guidelines to treat pregnant women in their first trimester with *Plasmodium falciparum* infection with artemether-lumefantrine.

Complete antenatal care (ANC) attendance is not optimal in Ethiopia. A mini Demographic and Health Survey in 2019 showed 74 percent of women 15 to 49 years of age with a live birth in the previous five years before the survey received ANC from a skilled provider for their most recent birth, 43 percent of women had at least four ANC visits during their most recent pregnancy, and 28 percent of women had ANC during their first trimester. PMI/Ethiopia is working with the USAID Health Team and Maternal and Child Health Directorate to increase ANC attendance. The National Malaria Strategic Plan does not recommend IPTp in Ethiopia due to the low-malaria burden. PMI supports mass distribution of ITNs in Ethiopia which includes pregnant women. PMI also provides support to improve the quality of malaria diagnosis and treatment in ANC clinics and adult outpatient departments of health facilities and in HPs.

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

- In 2021, PMI distributed 2.9 million nets in Dire Dawa, Harari, Somali, Amhara, and Oromia regions to 6,372,896 people, of which 3.4 percent (216,678) are expected to be pregnant women.
- There were 258,961 malaria cases in 344 PMI-supported health facilities of which 3,628 (1.4 percent) were pregnant women. In FY 2021, 220 of 286 (77 percent) visited health facilities and were provided malaria diagnosis and treatment services in ANC.
- The draft National Malaria Guidelines 2022 was updated to recommend weekly CQ prophylaxis for pregnant women with *P. vivax* to prevent relapses until the end of delivery and breastfeeding.

- In 2021, through integrated and focused ANC programs using radio programs and the Hulu Betena mobile application, PMI reached an estimated 2.6 million individuals, including pregnant women and their family members.

### 2.3. Plans and Justification for FY2023 Funding

The FY 2023 funding tables contain a full list of MIP activities that PMI proposes to support in Ethiopia with FY 2023 funding. Please visit [www.pmi.gov/resources/malaria-operational-plans-mops](http://www.pmi.gov/resources/malaria-operational-plans-mops) for these FY 2023 funding tables.

- PMI proposes to maintain the same level of funding targeting malaria case management for pregnant women in 200 moderate- to high-malaria burden districts. There is also ongoing TA and program management support from the federal to district levels, enabling the system to provide malaria diagnosis and treatment services to pregnant women. PMI will also support Ethiopia to implement weekly CQ prophylaxis for *P. vivax* case management in pregnant and breastfeeding women who cannot take primaquine (PQ).
- PMI Ethiopia/PMI/Ethiopia will continue to support integrated SBC interventions. Integration with maternal, newborn, child health and nutrition efforts will help ensure malaria in pregnancy MIP and key prevention approaches are adequately addressed during ANC visits. More specifically, PMI will provide support to ensure HEWs and service providers are trained and provided with the effective and impactful tools and skills needed to communicate with pregnant women on ITN use during pregnancy and prompt treatment seeking for fever as part of an ANC package. Please see the **SBC section** below for details on challenges and opportunities to improve intervention uptake or maintenance.

### 3. Drug-based Prevention

PMI does not support seasonal malaria chemoprevention (SMC) or other proactive drug-based prevention in Ethiopia. Refer to the OR section on proposed OR on SMC in migrant workers.

### 4. Case Management

#### 4.1. PMI Goal and Strategic Approach

The Ethiopia Malaria Elimination Strategic Plan for 2021–2025 states that early diagnosis and prompt treatment of malaria cases will be implemented nationwide for all segments of the population including regular residents, refugees, internally displaced persons, and mobile and migrant populations, at both the community and health facility levels. Treatment of malaria cases is based on quality assured parasitological diagnosis and the *Plasmodium species* identified. RDTs are used at community-level HPs and microscopy is used in health centers and hospitals. In 2021, 33 percent to 37 percent of confirmed malaria cases were managed at the HP level (DHIS2).

Ethiopia uses multispecies RDTs to diagnose malaria. The HRP-2 antigen is used to diagnose *P. falciparum* and *P. vivax* and the LDH antigen is used to diagnose *P. vivax*. However, HRP-2-based RDTs are unable to detect *P. falciparum* malaria infection when HRP-2/3 gene deletions are present. Recent studies have confirmed high rates of HRP-2/3 deletions in Eritrea and Sudan, thus PMI/Ethiopia incorporated testing for HRP-2/3 deletions in therapeutic efficacy study (TES) samples collected in September 2017. TES-based analyses showed the presence of HRP-2/3 double deletions in 3 out of 20 samples (15 percent). In addition, a collaborative effort between WHO and EPHI conducted a larger survey of several health facilities to investigate the occurrence of HRP-2/3 deletions in districts in the Gambela, Tigray, and Amhara regions bordering Sudan and Eritrea. Accordingly, 13 percent (350/2,704) of malaria suspected, self-presenting patients were discordant when screened by PfHRP-2/PvLDH and HRP-2/PfLDH RDTs. In this study, the district-specific results ranged from 5 percent to 30 percent. Incorporating RDT and PCR results, it was estimated that 9.7 percent (95 percent CI 8.5-11.1) of all *P. falciparum* infections across all the study sites would have false negative HRP-based test results owing to HRP deletions. WHO recommends a nationwide change to an RDT that includes non-HRP-2 target antigens for *P. falciparum* when the lower 95 percent confidence interval of the prevalence of symptomatic patients carrying PfHRP-2-deleted parasites (causing false-negative HRP-2 RDT results) is  $\geq 5$  percent.

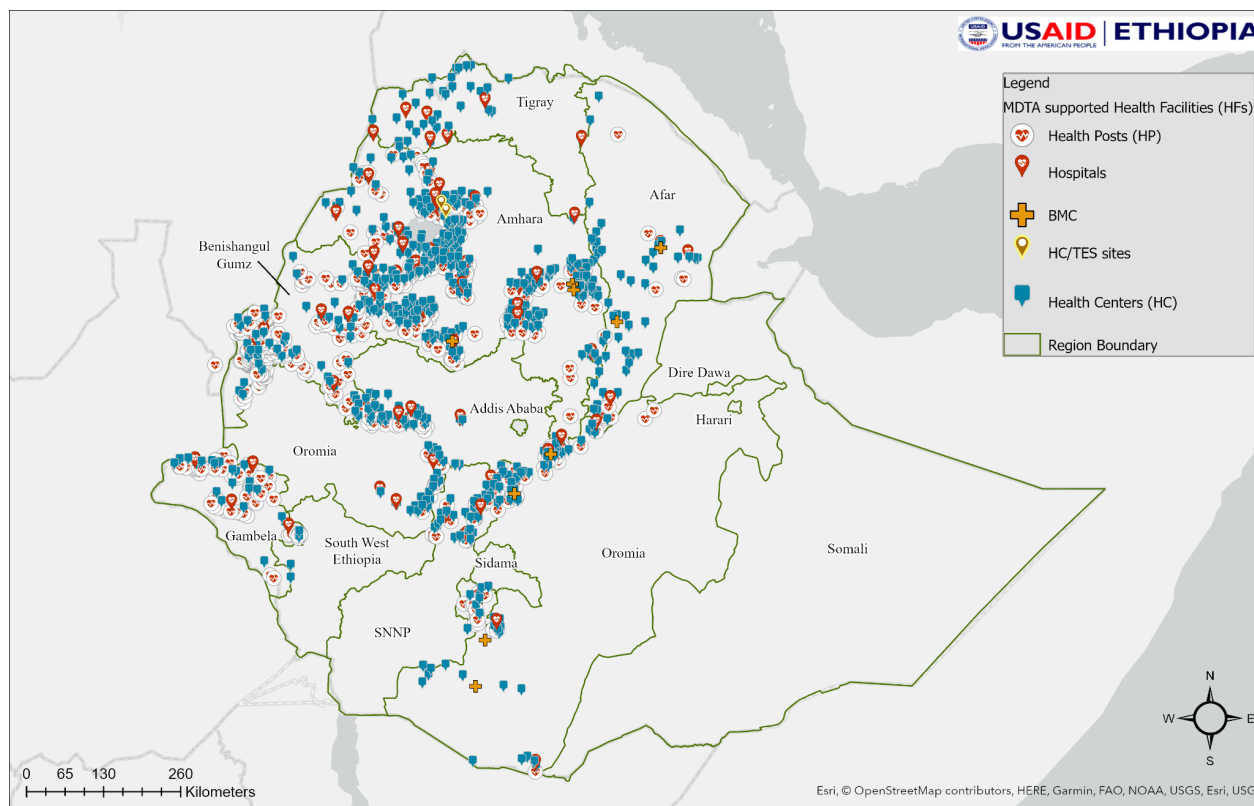
PMI supports all aspects of the malaria case management approach proposed in the strategic plan through financing of national-level policy and programmatic activities, commodity procurement, and improvement of facility- and community-levels health worker performance. PMI, in partnership with the Global Fund, is also procuring essential commodities and pharmaceuticals for malaria diagnosis and treatment. Historically, PMI has funded procurement of CQ, injectable and rectal artesunate while Global Fund procures malaria RDTs, ACTs, and PQ. This division of responsibilities will likely continue in FY 2023. PMI also finances mentoring and supportive supervision activities in 212 districts in 8 regions while the remaining 637 malarious districts are supported through Global Fund.

PMI supports capacity-strengthening of the NMEP, EPHI, Ethiopian Pharmaceuticals Supply Service (EPSS), regional laboratories, RHBs, and districts to manage and monitor the malaria case management program effectively. At the national level, PMI funds help support the updating of national malaria case management guidelines, training materials, and job aids so that they remain in accordance with the WHO and the local context. This also includes training and mentoring of HEWs, midwives, clinicians, pharmacists, and laboratory professionals on the current malaria case management guidelines. It also supports supervision and mentoring of health workers to improve the

quality of malaria diagnosis and treatment, including integrated community case management and community case management of malaria for all age groups at the community level. Salaries for HEWs are paid by the Government of Ethiopia. PMI also strengthens the capacity of *woreda* health offices to monitor malaria case management in their catchment health facilities. A *woreda* is graduated or transferred from PMI to the RHB for routine support based on a standard transition scorecard that has set criteria for clinical services, lab, and reporting, monitoring, and supervision. All facilities in a PMI-supported *woreda* should achieve greater than 80 percent of the set criteria before graduating from PMI.

Bottlenecks or challenges that have slowed and prevented implementation of case management strengthening activities include the relatively large number of health facilities in Ethiopia along with inadequate health system capacity, conflict in implementation-targeted districts, inadequate access to malaria case management services in mobile and migrant populations, and inadequate support to the private health facilities in malaria case management. Additionally, there are also gaps in the timely supply of quality reagents (e.g., Giemsa solution) and laboratory supplies. Other challenges include maintaining the quality of services in graduated health facilities and low adherence of health workers to standard protocols (e.g., testing all febrile patients, providing radical cure PQ, inadequate recording and reporting of treated malaria cases, overdiagnosis of severe malaria, and over-utilization of artesunate injection).

**Figure 2. Map of Case Management, Community Health and Malaria in Pregnancy Service Delivery Activities in Ethiopia**



BMC: Biomedical Centers, maintaining medical equipment. HC/Therapeutic Efficacy Study: Health Center, Therapeutic Efficacy Study

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

### National-level Case Management Activities

- Assisted in the development and printing and distribution of 1,000 malaria clinical and program mentorship guidelines.
- Provided biomedical mentorship support for 26 out of 30 targeted subnational biomedical centers and supported training of trainers for 24 instructors and 159 graduating students in four biomedical engineering teaching universities. Additionally, 183 biomedical engineers and technicians were trained on equipment maintenance of five types of equipment (microscopes, centrifuges, freezers, biosafety cabinets, and incubators.)
- Trained 3,410 laboratory technologists/technicians in basic malaria microscopy diagnostic training courses.
- Trained 3,198 health workers in malaria case management in-service training.
- Convened a lessons-learned workshop to scale up external quality assessments (EQAs) of malaria microscopy and improve best practices in Oromia, which included 109 participants from 77 districts.

## Commodities

- Placed small procurement of non-HRP-2-based RDTs to support Ethiopia's new policy. National needs to procure and distribute malaria RDTs are usually covered by the Global Fund.
- Procured and distributed 258 microscopes.
- Procured and distributed clinical and lab equipment/supplies (e.g., stethoscopes, slides, Giemsa stock solution, etc.).
- Financed the emergency procurement and distribution of 537,000 treatment doses of ACTs for conflict-affected areas in Amhara, Afar, Oromia, and Tigray. National ACT needs are usually covered by the Global Fund.
- Procured and distributed 372,495 vials of injectable artesunate.
- Procured and distributed 24,014 rectal artesunate suppositories.

## Facility-level Case Management Activities

- Performed EQAs for malaria microscopy in 611 out of 2,486 health facilities in malarious areas. The proportion of facilities participating in blind rechecking and scoring above 80 percent increased from 4 percent at baseline to 60 percent. The FMOH and EPHI have scaled up malaria microscopy EQA using Global Fund resources with PMI providing TA.
- Provided case management supportive supervision integrated with maternal and child health to 65 hospitals, 654 health centers, and 1,724 HPs.
- Conducted 1,168 clinical mentorship visits reaching 611 health facilities.
- Conducted 1,092 mentorship visits for laboratory technicians/technologists reaching 611 HFs.
- Provided training to 2,318 health workers on malaria diagnosis with RDTs or microscopy and trained 2,720 clinicians on fever case management.
- Treated malaria according to the national case management guidelines in the fourth quarter of FY 2021—of the 286 PMI-supported health facilities, 92 percent of clinical providers treated malaria.
- Improved PQ prescription in PMI-supported sites. Of the 286 health facilities mentored during the fourth quarter of FY 2021, 97 percent provided single-dose PQ for *P. falciparum* and 95 percent provided 14 days PQ for radical treatment of *P. vivax*.
- Provided job aids, guidelines, and surveillance charts to 379 supported health centers and hospitals.

## Community-level Case Management Activities

- Conducted 1,073 on-site trainings for HEWs on the diagnosis of malaria using RDTs and treatment of malaria reaching 1,128 HPs and 2,256 HEWs.
- Provided job aids and surveillance charts to 1,192 supported HPs.

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

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

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

#### National-level Case Management Activities

- PMI will continue to provide TA and program management support in malaria diagnosis and treatment to the FMOH, NMEP, RHBs, zonal health departments, woreda health offices, and targeted health facilities. In addition, PMI will train laboratory, clinical professionals, biomedical engineers/technicians, and program management staff.
- PMI will continue to provide financial support to national and subnational biomedical centers and biomedical engineering teaching universities to improve the availability of functional equipment for malaria case management.
- PMI will continue to facilitate malaria case management policy considerations to better accommodate hard-to-reach mobile and migrant workers in public and private health facilities.

#### Commodities

PMI will continue to procure injectable artesunate, artesunate suppositories, and CQ to address the national need. The need for injectable artesunate is expected to decrease when the new national malaria guidelines are fully implemented as severe malaria will be treated at the hospital level with health centers only providing the first dose of injectable artesunate for severe malaria cases before referring them to a hospital. However, although uncertain, the possibility of an emergency ACT procurement persists since conflicts leading to internal displacements are frequent in Ethiopia.

Please refer to the **ACT, RDT, injectable artesunate, artesunate suppository, and Chloroquine Gap Analysis Tables** in the [annex](#) for more details on planned quantities and distribution channels.

#### Facility-level Case Management Activities

- PMI will continue to contribute financially and technically to national EQA activities and finance on-site evaluations for malaria microscopy and clinical mentoring of health facilities in 150 targeted districts. PMI will provide support to improve clinical data quality focusing on data validity at the facility level.
- In addition, PMI will work directly with private clinics (including on-site farm/workplace clinics) to improve malaria diagnosis and treatment among mobile and migrant populations.



## Community-level Case Management

- PMI will support community case management for all age groups and will conduct case management and RDT mentorship visits to approximately 3,500 HPs out of a total of 12,815 located in malaria-endemic areas. Global Fund support through the NMEP will cover HPs not funded by PMI.

## Monitoring Antimalarial Efficacy

**Table 2. Ongoing and Planned Therapeutic Efficacy Studies**

Ongoing Therapeutic Efficacy Studies			
Year	Site Name	Treatment Arm(s)	Plan for Laboratory Testing of Samples
2021–2022	Maksegnit and Enfranz in the Amhara Region	Pf:AL or Pyramax+1 dose of PQ Pv/CQ or Pyramax+14 days of PQ	In-country (AHRI) & CDC-Atlanta
Planned Therapeutic Efficacy Studies (funded with previous or current MOP)			
Year	Site Name	Treatment Arm(s)	Plan for Laboratory Testing of Samples
2023–2024	TBD	Pf/AL+1 dose of PQ Pv/CQ+14 days of PQ	In-country (AHRI) at CDC Atlanta

AL=artemether-lumefantrine; CQ=chloroquine; PQ=primaquine; CDC=Centers for Disease Control and Prevention; TBD=to be determined

## 5. Health Supply Chain and Pharmaceutical Management

### 5.1. PMI Goal and Strategic Approach

PMI’s goal is to ensure continuous availability of quality products needed for malaria control and elimination at health facilities and in the community. This is in line with Ethiopia’s NMSP which “aims to ensure that antimalarial commodities are procured, cleared, and distributed to health facilities ensuring that malarious areas of the country do not face stockouts of antimalaria commodities.” PMI’s principal supply chain investments support this strategy through the procurement and distribution of antimalarial pharmaceuticals, diagnostics, and ITNs, building capacity for the collection and utilization of logistics’ system and survey data. In addition, PMI provides site-level support to address supply chain concerns as well as reduce service delivery point stockouts to reach PMI’s Stockout Reduction Strategy targets. Additional information regarding PMI’s support for Ethiopia’s integrated health supply chain can be found in the Country Profile.

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

- In 2021, PMI strengthened ITN campaign coordination through support provided to malaria program and logistics managers on distribution planning, microplanning, campaign actors training, logistics, and campaign tracking activities.
- PMI supported the revision of tools, standard operating procedures, and orientation for the scale-up of auditable pharmaceuticals transactions and

- services (APTS), a dispensary-level inventory management intervention, to 84 hospitals.
- PMI provided site-level support to over 1,400 health facilities on stock management, rational dispensing, Logistics Management Information System, and requests for antimalarial commodities and RDTs. Facility-level reporting has shown a reduction in stockouts of both ACTs and RDTs from 12.1 percent and 10.3 percent in the beginning of 2021 to 7.8 percent and 3.2 percent, respectively, in March of 2022.
  - PMI supported the Ethiopia Food and Drug Administration (EFDA) to conduct and expand post-market surveillance, provided TA, including a training of trainers, to improve inspection-capacity and good manufacturing practices for pharmaceutical manufacturers, and supported the training and implementation of an online Medicines Risk-based Surveillance (MedRS) tool that allows performing a risk-based post-market surveillance. In addition, technical support was provided for regional laboratories to decentralize the post-market surveillance activities.

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

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

- PMI will continue to support the NMEP's goal of improving the malaria supply chain and the quality of antimalarial commodities. PMI plans to fill the national commodity gap by procuring and supporting the distribution of PBO ITNs, severe malaria pharmaceuticals, and CQ tablets. PMI will continue to provide TA to EPSS in quantification, drug management, requisition, drug exchange/transfer, and tracking/disposal. Support will be provided in TA for APTS, and PMI will continue to support EPSS's capacity to procure and distribute malaria commodities.
- PMI will continue to support the EFDA to ensure quality malaria medications in the public and private sectors through targeted post-market surveillance and updating drug policy to mandate and incorporate post-market surveillance. In addition, PMI will provide support focusing on registration, inspection, and testing the quality of Giemsa solution. Furthermore, PMI will support the mapping of private companies involved in Giemsa solution production and provide good manufacturing practices capacity-building that will alleviate the gaps in the quality of Giemsa solutions produced in the country.

## 6. SBC

### 6.1. PMI Goal and Strategic Approach

The Ethiopian NMSP's first strategic objective aims to achieve adoption of appropriate behavior and practices toward antimalarial interventions by 85 percent of households living in malaria-endemic areas by 2025.

Through the use of SBC interventions aligned with the [Ethiopian Advocacy, Communication and Social Mobilization \(ACSM\) guide](#), PMI supports activities to increase the uptake of correct and consistent use of malaria interventions, thereby improving the overall quality of malaria prevention and control efforts that will contribute to reductions in malaria morbidity and mortality.

PMI will continue to support SBC activities related to ITN use and care, IRS acceptance, larviciding-related activities, health care-seeking behavior, and elimination-related messaging and community participation.

PMI has been supporting two local organizations' community-based malaria SBC activities as part of the USAID/Ethiopia Local Capacity Development program complementing the integrated malaria SBC activities through capacity-building of selected schools and faith-based organizations in high-malaria transmission areas. PMI's support for integrated SBC activities focuses on building malaria communication capacity at national and subnational levels, messaging and implementation of SBC activities through integrated platforms, and monitoring and evaluation of malaria SBC.

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

PMI continued school-based malaria SBC activities focusing on development corridor areas in the Amhara region. School- and community-based malaria communication interventions were implemented in 141 *kebeles* and 220 schools in the targeted 36 malarious districts, implementing peer education as a model. Achievements of this activity include the following:

- PMI supported malaria training on SBC for 100,590 individuals and produced and disseminated 132,747 SBC materials (audio, video, and print).
- PMI-supported SBC community outreach targeted migrant workers with SBC messaging, service communication, and community mobilization interventions. Students and community volunteers were able to track and trace 26,684 migrant workers and provide referrals for malaria testing. Of those referred, 26,285 (93 percent) were tested and 10,741 (40 percent) were found positive for malaria and received treatment.
- ITN ownership and utilization status was assessed in PMI-supported community- and school-based targeted *woredas*. PMI/Ethiopia supported 66 schools' malaria mini-media clubs which are furnished with megaphones and

- radios. These materials helped the school malaria mini-media clubs engage in social mobilization activities at the schools and surrounding communities.
- PMI conducted joint supportive supervision in 12 priority *woredas*. High levels of knowledge were found across all respondents (both exposed and unexposed to messages) about the use of bed nets to prevent malaria. Knowledge on the proper use and care of ITNS of bed nets was significantly higher among respondents exposed to malaria messages than those who were unexposed (98 percent versus 89.7 percent) ( $P < 0.001$ ). Similarly, households that had hanging bed nets at the time of interview reported higher exposure to messages compared with those who were unexposed (65.8 percent versus 57.1 percent).

In addition to progress made during this period, there were challenges related to message delivery of SBC interventions for increased ITN use due to the impact of conflict and the COVID-19 pandemic. Similarly, the conflicting messages to promptly seek treatment for malaria and to stay at home for COVID-19 impacted demand creation for health care-seeking behaviors (case management) along with the unpredictable conflicts in some PMI SBC intervention areas. In addition, during this period, service delivery (provider behavior) was challenged due to the high priority given to COVID-19 prevention, vaccine roll-out, and conflict mitigation as well as facilities being affected by the impact of the conflict. Provider behaviors related to adherence to case management guidelines and patient counseling or service communication are the expected behavioral interventions during this period.

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

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

- PMI will support implementation of malaria SBC interventions at the community level in ITN use and care, IRS acceptance, larviciding-related activities, health care-seeking behavior, and elimination-related messaging and community participation. In addition, PMI will support school-based SBC interventions to improve care-seeking behavior, especially among migrant populations, and utilization of nets and other malaria-related interventions.
- Previously, PMI supported capacity-strengthening activities at national and subnational levels. In FY 2023, PMI will focus on capacity-strengthening of SBC interventions at district and community levels. The proposed capacity-strengthening efforts at the district and community levels will focus on ownership by the community to ensure sustainability. A malaria behavioral survey will be conducted in CY 2023 to understand determinants of health for malaria intervention service acceptance, uptake, and use. In addition, the malaria behavioral survey will highlight factors associated with community culture and social norms.

- PMI will support coordination between SBC and service delivery actors to strengthen service communication through service providers during ANC visits and routine case management activities, and through community health workers.
- PMI will support development of the SBC approach for addressing *An. stephensi* informed by the results of a calendar year (CY) 2022 LSM pilot in coordination with literature review findings.

## Priorities

While PMI supports SBC activities that promote the uptake and maintenance of all key malaria interventions, the following behaviors will be prioritized with FY 2023 funds (see Table 3):

1. Use ITNs correctly and consistently and properly care for them.
2. Seek prompt and appropriate care for fever.

**Table 3. Priority Behaviors to Address**

Behavior	Target Population	Geographic Focus	Programming to Address Behavior
Correct and consistent ITN use and care	Urban dwellers, semi-urban settlers, and rural communities in high-malaria risk regions	Benishangul-Gumuz, Gambela, Amhara, and other high-malaria burden regions	<ul style="list-style-type: none"> <li>• Conduct community- and household-level interpersonal communication informed by data in ITNs use and care.</li> </ul>
Prompt care-seeking for fever	Urban dwellers, semi-urban settlers, migrant laborers, and rural communities in high-malaria risk regions	Benishangul-Gumuz, Gambela, Amhara, and other high-malaria burden regions	<ul style="list-style-type: none"> <li>• Conduct community- and household-level interpersonal communication informed by data in prompt care-seeking for fever.</li> <li>• Strengthening community health action groups to contribute to improved quality of care by providing feedback to the health facilities and district health offices.</li> <li>• Provide TA to media stations for production and airing of radio shows and spots to promote prompt care-seeking.</li> </ul>

## Additional Support Activities

- Identification of human behaviors currently being promoted and propose actions to reduce *An. stephensi* populations.
- Identification of context-specific factors or barriers affecting ITNs use and determine appropriate channels to reach specific communities.
- Routine audience monitoring activities for reach and recall of malaria messages and monitoring of self-efficacy attitudes and norms for uptake of malaria products and services.

- Formative research (audience segmentation), choice of appropriate channels for ITNs use, care-seeking, and *An. stephensi* behavioral interventions in targeted districts.

## 7. Surveillance, Monitoring, and Evaluation

### 7.1. PMI Goal and Strategic Approach

In Ethiopia, PMI collaborates with the NMEP, EPHI, and regional and district malaria focal persons in providing TA, resources, and capacity-building for SM&E activities. In support of the NMSP, PMI and the NMEP have prioritized interventions such as expanding SM&E coverage of Demographic Health Information Software 2 (DHIS2), electronic Community Health Information System (eCHIS), and PHEM systems and improving data quality and use at all levels including timeliness and completeness. PMI/Ethiopia has also worked to strengthen surveillance as an intervention for malaria elimination by developing malaria elimination registers and reporting forms, real-time analyses and stratification of data at the *kebele* level for malaria identification and response, supporting quarterly data review meetings to increase data use at the peripheral levels, and adapting and targeting malaria intervention tools efficiently to change malaria epidemiology.

PMI has supported the roll-out and scale-up of DHIS2 nationwide. PMI has also supported the development and roll-out of eCHIS which is implemented at the HP level and incorporates a malaria module with elimination indicators such as foci investigation testing and treatment and possible elimination interventions. Current priorities include improving data quality through routine data quality audits (RDQAs) and data review meetings at the districts, improving DHIS2 timeliness and completeness, and creating a data use “culture,” especially in elimination districts to monitor malaria hot spots and respond immediately.

There are major challenges regarding data quality and access in Ethiopia. Limitations exist at various levels with the capacity to analyze, interpret, and use the available data, although PMI and partners have worked to improve data analysis and reporting through forms, wall charts, and quarterly review meetings. PMI is also supporting elimination through empowering the districts, health centers, HPs, and communities to strengthen real-time malaria surveillance to identify any confirmed malaria index cases and conduct foci investigations within 24 hours with test and treatment of households. Additional elimination interventions, such as ITNs, targeted IRS, and reactive drug administration are being considered, if required.

PMI has also supported the Ethiopian EFETP with residents in advanced cohorts that have significantly improved malaria surveillance through strengthening and using the weekly PHEM system which is comparable to Integrated Disease Surveillance and

Response (IDSR). The PHEM system is implemented out of EPHI and numerous surveillance and external data evaluations have shown the benefits of PHEM data in terms of completeness, timeliness, and quality over DHIS2. PHEM data are especially useful in possible malaria elimination districts with low malaria incidence to identify and respond timely within days rather than a month for DHIS2 to malaria index cases. PHEM data also underlie a novel malaria early warning system (EPIDEMIA) which also incorporates climate data to provide alerts about potential future case increases with high reliability which would be impossible without quality PHEM data. PMI continues work with partners to strengthen health management information systems (HMISs), such as DHIS2, PHEM, eCHIS, prioritize data quality through RDQAs, data charts, dashboards, and data review meetings. PMI will continue to bring staff to capacity at all levels on data analysis and use especially in low to very low malaria *woredas* targeted for malaria elimination to identify and respond timely and effectively to malaria surges.

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

- PMI provided substantial support for SM&E strengthening activities, including the training of health workers from NMEP, EPHI, and RHB on data quality, data analysis, real-time data transfer, and strengthening routine surveillance systems. Accordingly, 2,352 health workers from 485 health centers and 3,256 HEWs from 2,031 HPs were trained on data quality assessment and data utilization. PMI's support provides national coverage, but focused intensive support to 100 *woredas* (62 high burden and 38 targeted for elimination). PMI also supported surveillance systems-strengthening, including the DHIS2 expansion and climate data integration. A real-time malaria dashboard has also been developed within DHIS2 for national- and regional-level analyses and data use.
- PMI worked with implementing partners and other malaria stakeholders in developing a malaria module of eCHIS for reporting malaria cases from the HP to the health centers and case notification and investigation in low transmission districts. eCHIS was implemented in 178 health centers in seven *woredas* with plans to scale up with other partner support.
- Leveraging other health programming, PMI supported the Health Commodity Management Information System and the launch of Dagu 2.1 at an additional 330 health facilities. Dagu 2.1 is a web-based logistics system that provides real-time consumption data at the health facility level which aims to strengthen last-mile delivery and ensure adequate stock on hand by providing automated alerts.
- PMI developed a malaria elimination assessment tool and conducted a baseline assessment through EPHI in its malaria elimination "targeted" districts. The assessment data will be used to develop a costed malaria elimination plan with tangible benchmarks.

- PMI also supported training for health staff at different levels and provided job aids and register books. PMI provided supportive supervision and mentorship and conducted quarterly review meetings in collaboration with RHBs.
- PMI's PHEM support was targeted on digitization to enhance reporting, to enable reporting of indicators on a weekly basis, and to build capacity at district and health facility levels to generate quality data that can be analyzed and used for decision-making.
- PMI also supported:
  - Malaria surveillance-related activities in 91 *woredas* in Oromia region and initiated case and foci investigation in Chiro *woreda* of West Hararghe zone and Dhera *woreda* of Arsi zone as learning centers.
  - Data quality improvement in 91 project-supported *woredas* which demonstrated significant improvements in selected data quality indicators.
  - Introduction of malaria surveillance monitoring charts with four core and six quality indicators which were adopted by the Oromia RHB and NMEP.
  - Start of a PBO ITN alone versus IRS + standard ITN inferiority three-year study looking at both entomological and epidemiological parameters.
- Due to COVID-19 restrictions, PMI supported the strengthening of the virtual mentorship program, which included 568 virtual mentorship sessions reaching all supported *woredas* every month. PMI supported RDQAs at all project-supported *woredas*—some conducted by zonal focal persons with technical and logistical support from the project.
- PMI expanded surveillance for malaria elimination support to 54 new districts to eliminate malaria by improving the quality of surveillance and response.

**Table 4. Available Malaria Surveillance Sources**

Source	Data Collection Activity	2019	2020	2021	2022	2023	2024
Household Surveys	Demographic and Health Survey				P <sup>^</sup>		
Household Surveys	Malaria Indicator Survey (MIS)		X			P	
Household Surveys	Multiple Indicator Cluster Survey						
Household Surveys	Expanded Program on Immunization survey						
Health Facility Surveys	Service Provision Assessment				P		
Health Facility Surveys	Service Availability Readiness Assessment survey						
Health Facility Surveys	Other Health Facility Survey						



Source	Data Collection Activity	2019	2020	2021	2022	2023	2024
Malaria Surveillance and Routine System Support	Therapeutic Efficacy Studies	X		X		P	
Malaria Surveillance and Routine System Support	Support to Parallel Malaria Surveillance System						
Malaria Surveillance and Routine System Support	Support to Health Management Information System/Electronic Community Health Information System	X	X	X	P	P	P
Malaria Surveillance and Routine System Support	Support to Integrated Disease Surveillance and Response/Public Health Emergency Management Systems	X	X	X	P	P	P
Malaria Surveillance and Routine System Support	Electronic Logistics Management Information System)	X	X	X	P	P	P
Malaria Surveillance and Routine System Support	Malaria Rapid Reporting System						
Other	End-use Verification (	X	X	X	P	P	P
Other	School-based Malaria Survey						
Other	Knowledge, Attitudes, and Practices Survey, Malaria Behavior Survey				P		
Other	Malaria Program Review		*X				
Other	Entomologic Monitoring Surveys	X	X	X	P	P	P

\*Asterisk denotes non-PMI funded activities, X denotes completed activities and P denotes planned activities. ^ denotes delay due to conflict and lack of funding.

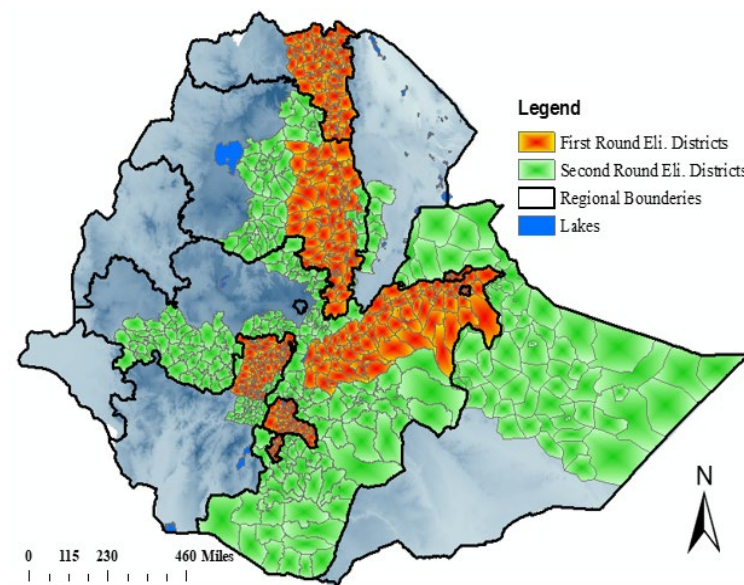
### 7.3. Plans and Justification with FY 2023 Funding

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

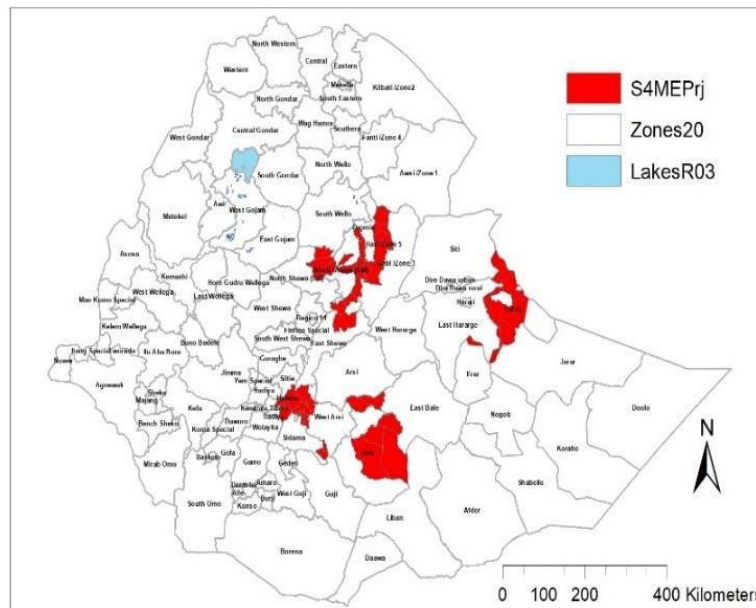
- Collaborate with the FMOH's data use partnership which brings together the diverse partners working across the health information systems spectrum in Ethiopia.
- Expand current SM&E support to 150 districts, which will scale up HMIS, both DHIS2 and eCHIS, as well as train health workers from the new health facilities and districts from the expansion districts on quality data collection, analysis, reporting, and use. Of the total 150 supported districts, 67 are elimination districts.

- Initiate surveillance-based elimination implementation activities with focused malaria elimination surveillance and response support in 67 districts (see Figure 6), including foci and case investigation in about 500 selected health facilities in PMI-supported districts using the nationally developed protocol. NMEP is supporting 565 malaria elimination districts through Global Fund financing (see Figure 5). PMI will work with the *woredas*, regions, and NMEP to identify best practices in surveillance and response and scale them up in other malaria elimination districts to shrink the malaria map by expanding malaria elimination.
- Continue to expand deployment of eCHIS malaria modules in agrarian *woredas* and complete the development of a malaria module for pastoralist and urban eCHIS.
- Strengthen RDQA to improve malaria data quality (national, regional and *woreda* levels) including completeness, timeliness, and consistency of service coverage and disease reports. Support cascade training through both workforce and SM&E support of revised malaria indicators and recording and reporting tools (i.e., tablets, dashboards, alerts) that improve data collection, real-time analysis, and timely response. Regularly conduct data triangulation between service/disease report and supply chain report and produce insights for better decision-making.
- Support EPHI to continue to digitize PHEM to improve completeness and timeliness of weekly malaria reporting through PHEM to enable patient-level tracking with concurrent support from Global Health Security Agenda.
- Build capacity of malaria program teams at *woreda* and health facility levels to analyze and use malaria data for decision-making through supervision and mentorship, both in person and virtually.

**Figure 3: NMEP-selected *Woredas* for Malaria Elimination, 2020–2021**



**Figure 4: PMI-supported Malaria Elimination Woredas, 2022**



## 8. OR and Program Evaluation (PE)

### 8.1. PMI Goal and Strategic Approach

Priority areas for PMI/Ethiopia OR are informed by the PMI strategy and the PMI OR priorities with input from the NMEP and their NMSP 2021–2025. The NMSP identified the following priority areas for OR studies: to detect insecticide and antimalarial drug resistance; to evaluate appropriate antimalarial interventions for seasonal migrant workers and design relevant intervention for these populations; and to improve the effectiveness of antimalarial interventions, while anticipating program needs related to elimination activities. PMI has also sponsored various conferences involving universities, EPHI (the lead agency for public health research within FMOH), and partners to learn about ongoing research and to harmonize PMI/Ethiopia’s OR priorities with FMOH research goals.

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

- Current OR to evaluate the hematologic outcomes to assess the safety of the PQ radical cure for *P. vivax* without testing for G6PD has been completed in health centers in Amhara, Oromia, and SNNP regions and have noted no serious adverse events. A total of 600 *P. vivax* and mixed patients were recruited. The analysis of the study participants showed no detected G6PD deficiency, good adherence, and feasibility.

- The surveys for the MOP-funded cluster randomized controlled trial to evaluate targeted mass drug administration (tMDA) compared to RCD on malaria transmission and elimination in Oromia was conducted in 48 *kebeles* of East Hararghe zone. The study was completed and results disseminated in a workshop in Addis on May 20, 2022. Preliminarily, all arms (tMDA, RCD, and control) showed significant declines in API during the study period. Further data analysis and laboratory analyses are pending. Both PQ safety and tMDA/RCD studies were funded from the FY 2015 MOP budget.
- PMI/Ethiopia is supporting PE to monitor the impact of PBO nets compared to IRS with standard ITNs in terms of a non-inferiority study which will include entomological and epidemiological outcomes. The first year of the study has been completed, preliminarily showing a similar impact on entomological indicators between the PBO and the IRS+ standard nets arms. Epidemiological indicators are being analyzed and the study will continue for another two years. The PBO net study was funded from the FY 2020 MOP budget.
- PMI had envisioned an evaluation of different larvicide treatments (SumiLarv 2MR and VectoBac) on controlling the emerging vector, *An. stephensi* in eight towns. This concept has evolved to focus on evaluating implementation in the communities, impact, and assessing the durability of the different larvicides which did not require PMI OR committee review. The revised concept note and protocol are finalized, larvicides are in-country, and the study began in June 2022. This evaluation would complement other research activities in the country, such as Sumitomo’s plans to evaluate Sumilarv formulations in the laboratory and semi-field systems.
- Leveraging existing OR resources from Swedish International Development Agency (SIDA) and Norwegian Agency for Development Cooperation (NORAD), PMI through TA and its routine vector surveillance activities supported an outbreak investigation of increased malaria cases reported in Dire Dawa in early 2022. The entomological investigations have revealed that the majority of mosquitoes collected are *An. stephensi* and they have been found to be positive for sporozoites. A cross-sectional study was conducted and a case-control study is ongoing to assess the risk factors for malaria infection.

**Table 5. PMI-funded Operational Research/Program Evaluation Studies in Ethiopia**

Recently Completed OR/PE Studies	Status of Dissemination	Start Date	End Date
PQ radical cure safety and tolerability study	Manuscript Pending	2019	2021
RCD versus tMDA in malaria elimination districts	Analysis of Samples; Manuscript Pending	2020	2022
Ongoing or Planned OR/PE Studies	Status	Start Date	End Date
PBO versus IRS and standard nets efficacy study	First year completed	March 2021	March 2024

**Table 6. Non-PMI-funded Operational Research/Program Evaluation Studies Planned/Ongoing in Ethiopia**

Source of Funding	Implementing institution	Research Question/Topic	Current status/timeline
WHO	EPHI	HRP-2/HRP-3 deletions	Laboratory analysis pending
Bill & Melinda Gates Foundation (BMGF)	AHRI	HRP-2/3 deletion surveillance and evaluation of next generation PfLDH/PvLDH-based RDTs	Data collection ongoing
BMGF	Malaria Control and Elimination Partnership in Africa (MACEPA)/UCSF	Planning targeted surveillance and response in high-risk population; malaria risk factor analysis in high-risk population; monitoring malaria transmission and intervention coverage in high-risk populations	2–3 years
Global Fund	NA	Health need assessment in migrant population	TBD (planned in Global Fund application)
National Institutes of Health (NIH)	Baylor University	Tracking the spread of a south asian malaria vector in the Horn of Africa: a genetic approach	Sep. 2020–Aug. 2023
SIDA, NORAD, USAID	AHRI	Epidemiology of malaria in selected urban, peri-urban, and rural localities of the East Shewa zone: implication for prevention, control, and elimination	May 2019–Apr. 2023
BMGF	University of California San Francisco/University of Notre Dame	Entomological Surveillance Planning Tool (ESPT) in Ethiopia	Jun. 2022–Dec. 2023
Wellcome Trust	Liverpool School of Tropical Medicine/AHRI	Controlling emergent <i>An. stephensi</i> in Ethiopia and Sudan (cease) project	Jan. 2021–Dec. 2024
Sumitomo	Jimma University	Evaluation of the efficacy and residual activity of larvicide formulations (SumiLarv™ 2MR, SumiLarv™ 0.5G, and Abate® 1SG) for the control of an invasive mosquito species, <i>An. stephensi</i> liston (Diptera: Culicidae) in Ethiopia	Jan. 2022–Dec. 2023

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

The FY 2023 funding tables contain a full list of OR/PE activities that PMI proposes to support in Ethiopia with FY 2023 funding. Please visit [www.pmi.gov/resources/malaria-operational-plans-mops](http://www.pmi.gov/resources/malaria-operational-plans-mops) for these FY 2023 funding tables.

- PMI will work with other malaria stakeholders, specifically the NMEP and Malaria Control and Elimination Partnership in Africa (MACEPA) to conduct a study in migrant workers to test the feasibility and efficacy of possible SMC strategies. Discussions with the NMEP and relevant stakeholders have

commenced and PMI will build on FY 2022 investments to support Year 2 activities with FY 2023 funding.

## 9. Capacity Strengthening

### 9.1. PMI Goal and Strategic Approach

Through coordination with the FMOH and in-country malaria stakeholders, PMI/Ethiopia supports the strengthening of the health system workforce, improving routine data systems, building the capacity of the EFDA, and other cross-cutting priorities in line with the [National Malaria Strategic Plan](#), which envisions a strengthened health system, including an adequate number of well-qualified and committed health workers to support malaria control efforts nationwide. In line with the NMEP's approach, PMI/Ethiopia supports both pre- and in-service training of health workforce staff and addressing the shortage of malariologists and epidemiologists through the implementation of the EFETP.

### 9.2. Recent Progress (between January 2021 through April 2022)

- EFETP residents have conducted numerous malaria research projects in Ethiopia, providing data for decision-makers, and have made significant contributions to the PHEM surveillance system. In its current structure, EFETP includes over 400 residents from eight different universities, with PMI providing malaria-related mentorship, training, and TA to create malaria expertise to a targeted subset of fellows among these future public health leaders. EFETP also receives support from Global Health Security Agenda and is advocating for more Global Fund support through the COVID-19 response mechanism. Currently, five malaria track advanced residents are being supported by PMI. They are conducting their research on the impact of population movement on the spread of malaria and *An. stephensi*.
- PMI and the FMOH conducted joint supportive supervision of three branch laboratories, verifying the results of the self-assessment, identified additional gaps, and developed a branch-specific roadmap toward International Organization for Standardization/International Electrotechnical Commission 17025:2017 accreditation. Additionally, 20 standard operating procedures were developed for each lab, which will help improve their quality management system and support accreditation.
- Although Peace Corps volunteers have helped with ITN distributions in some communities, and have helped promote ITN use through programs aimed at school-aged children historically, all Peace Corps volunteers were evacuated worldwide in March 2020. Peace Corps Ethiopia plans to introduce new Peace Corps cohorts in early 2024.
- To improve the health workforce, PMI supported higher education institutions to align malaria courses with the current global recommendations and national guidelines. This has ensured utilization of malaria national guidelines in clinical education and practice.



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

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

- PMI will continue to support workforce development through pre-service education of six cadres of health care professionals (medical doctors, health officers, nurses, midwives, laboratory and pharmacy professionals).
- PMI will continue to support advanced EFETP residents, four residents per year, by conducting malaria training, providing technical expertise to support malaria research and outbreak response, supporting small grants to conduct malaria projects, and mentoring residents to improve national capacity for malaria prevention, control, and elimination.
- PMI will support EFETP Frontline, which targets lower-level health care workers (20 district surveillance officers per cohort) to identify and respond timely and effectively to malaria hot spots and index cases.
- Pending the return of Peace Corp volunteers, PMI will support volunteers to conduct malaria SBC activities at the community level.

### **10. Staffing and Administration**

Six health professionals oversee PMI in Ethiopia. The single interagency team led by the USAID mission director or their designee consists of a resident advisor representing USAID, a resident advisor representing CDC, and four locally hired experts known as foreign service nationals. The PMI interagency team works together to oversee all technical and administrative aspects of PMI, including finalizing details of the project design, implementing malaria prevention and treatment activities, monitoring and evaluation of outcomes and impact, reporting of results, and providing guidance and direction to PMI implementing partners.

**ANNEX: GAP ANALYSIS TABLES**



**Table A-1. ITN Gap Analysis Table**

Calendar Year	2022	2023	2024
Total country population	105,166,000	107,900,316	110,705,724
Total population at risk for malaria	54,791,486	56,216,065	57,677,682
PMI-targeted at-risk population	54,791,486	56,216,065	57,677,682
Population targeted for ITNs	40,839,131	41,900,948	42,990,373
<b>Continuous Distribution Needs</b>			
Channel 1: ANC			
Channel 1: ANC Type of ITN			
Channel 2: EPI			
Channel 2: EPI Type of ITN			
Channel 3: School			
Channel 3: School Type of ITN			
Channel 4: Community			
Channel 4: Community Type of ITN			
Channel 5:			
Channel 5: Type of ITN			
Estimated Total Need for Continuous Channels	0	0	0
<b>Mass Campaign Distribution Needs</b>			
Mass distribution campaigns	24,900,295	3,117,028	15,382,487
Mass distribution ITN type	Single Pyrethroid	Single Pyrethroid	PBO and Single Pyrethroid
Needs for potentially uncovered populations in the mass campaign	-	14,888,099	4,347,856
Estimated Total Need for Campaigns	24,900,295	18,005,127	19,730,343
<b>Total ITN Need: Continuous and Campaign</b>	<b>24,900,295</b>	<b>18,005,127</b>	<b>19,730,343</b>
<b>Partner Contributions</b>			
ITNs carried over from previous year	0	0	0
ITNs from Government	1,046,512	0	0
Type of ITNs from Government	Single Pyrethroid		
ITNs from Global Fund	6,000,000	10,666,666	0
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	2,965,684	2,990,605	2,160,000
Type of ITNs with PMI funding	Single Pyrethroid	Single Pyrethroid	PBO
<b>Total ITNs Contribution Per Calendar Year</b>	<b>10,012,196</b>	<b>13,657,271</b>	<b>2,160,000</b>
<b>Total ITN Surplus (Gap)</b>	<b>(14,888,099)</b>	<b>(4,347,856)</b>	<b>(17,570,343)</b>

**Table A-2. RDT Gap Analysis Table**

<b>Calendar Year</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>
Total country population	105,166,000	107,900,316	110,705,724
Population at risk for malaria	54,791,486	56,216,065	57,677,682
PMI-targeted at-risk population	54,791,486	56,216,065	57,677,682
<b>RDT Needs</b>			
Total number of projected suspected malaria cases	10,298,233	9,955,039	9,846,975
Percent of suspected malaria cases tested with an RDT	55%	55%	55%
<b>RDT Needs (tests)</b>	6,815,055	7,050,773	7,248,713
Needs Estimated based on HMIS Data	6,815,055	7,050,773	7,248,713
<b>Partner Contributions (tests)</b>			
RDTs from Government	0	0	0
RDTs from Global Fund	5,869,710	5,668,018	
RDTs from other donors	0	0	0
RDTs planned with PMI funding	0	150,000	0
<b>Total RDT Contributions per Calendar Year</b>	<b>5,869,710</b>	<b>5,818,018</b>	<b>0</b>
<b>Stock Balance (tests)</b>			
Beginning Balance	12,298,400	11,353,055	10,120,300
- Product Need	6,815,055	7,050,773	7,248,713
+ Total Contributions (received/expected)	5,869,710	5,818,018	0
<b>Ending Balance</b>	<b>11,353,055</b>	<b>10,120,300</b>	<b>2,871,587</b>
Desired End of Year Stock (months of stock)	12	12	12
Desired End of Year Stock (quantities)	6,815,055	7,050,773	7,248,713
<b>Total Surplus (Gap)</b>	<b>4,538,000</b>	<b>3,069,527</b>	<b>(4,377,126)</b>

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

<b>Calendar Year</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>
Total country population	105,166,000	107,900,316	110,705,724
Population at risk for malaria	54,791,486	56,216,065	57,677,682
PMI-targeted at-risk population	54,791,486	56,216,065	57,677,682
<b>ACT Needs</b>			
Total projected number of malaria cases	2,646,851	2,397,471	1,979,583
<b>Total ACT Needs (treatments)</b>	<b>4,609,946</b>	<b>4,056,751</b>	<b>3,273,062</b>
Needs Estimated based on Consumption Data	<b>4,609,946</b>	<b>4,056,751</b>	<b>3,273,062</b>
<b>Partner Contributions (treatments)</b>			
ACTs from Government	0	0	0
ACTs from Global Fund	3,087,690	2,709,320	
ACTs from other donors	0	0	0
ACTs planned with PMI funding	0	0	0
<b>Total ACTs Contributions per Calendar Year</b>	<b>3,087,690</b>	<b>2,709,320</b>	<b>0</b>
<b>Stock Balance (treatments)</b>			
Beginning Balance	6,461,778	4,939,522	3,592,091
- Product Need	4,609,946	4,056,751	3,273,062
+ Total Contributions (received/expected)	3,087,690	2,709,320	0
<b>Ending Balance</b>	<b>4,939,522</b>	<b>3,592,091</b>	<b>319,029</b>
Desired End of Year Stock (months of stock)	12	12	12
Desired End of Year Stock (quantities)	4,609,946	4,056,751	3,273,062
<b>Total Surplus (Gap)</b>	<b>329,576</b>	<b>(464,660)</b>	<b>(2,954,033)</b>

**Table A-4. Inj. Artesunate Gap Analysis Table**

<b>Calendar Year</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>
<b>Injectable Artesunate Needs</b>			
Projected number of severe cases	93,963	85,110	70,275
Projected number of severe cases among children	19,450	17,618	14,547
Average number of vials required for severe cases among children	6	6	6
Projected number of severe cases among adults	74,513	67,492	55,728
Average number of vials required for severe cases among adults	12	12	12
<b>Total Injectable Artesunate Needs (vials)</b>	<b>594,837</b>	<b>438,181</b>	<b>447,525</b>
Needs Estimated based on Consumption Data	594,837	438,181	447,525
<b>Partner Contributions (vials)</b>			
Injectable artesunate from Government	0	0	0
Injectable artesunate from Global Fund	0	0	0
Injectable artesunate from other donors	0	0	0
Injectable artesunate planned with PMI funding	574,926	314,293	298,350
<b>Total Injectable Artesunate Contributions per Calendar Year</b>	<b>574,926</b>	<b>314,293</b>	<b>298,350</b>
<b>Stock Balance (vials)</b>			
Beginning Balance	8,898	0	0
- Product Need	594,837	438,181	447,525
+ Total Contributions (received/expected)	574,926	314,293	298,350
<b>Ending Balance</b>	<b>(11,013)</b>	<b>(123,888)</b>	<b>(149,175)</b>
Desired End of Year Stock (months of stock)	12	12	12
Desired End of Year Stock (quantities)	594,837	438,181	447,525
<b>Total Surplus (Gap)</b>	<b>(605,850)</b>	<b>(562,069)</b>	<b>(596,700)</b>

**Table A-5. RAS Gap Analysis Table**

<b>Calendar Year</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>
<b>Artesunate Suppository Needs</b>			
Number of severe cases expected to require pre-referral dose (or expected to require pre-referral dose based on number of providers for the service)	9,725	8,809	7,274
<b>Total Artesunate Suppository Needs (suppositories)</b>	<b>51,260</b>	<b>51,260</b>	<b>51,260</b>
Needs Estimated based on # of providers offering pre-referral services	51,260	51,260	51,260
<b>Partner Contributions (suppositories)</b>			
Artesunate suppositories from Government	0	0	0
Artesunate suppositories from Global Fund	0	0	0
Artesunate suppositories from other donors	0	0	0
Artesunate suppositories planned with PMI funding	58,947	44,179	65,356
<b>Total Artesunate Suppositories Available</b>	<b>58,947</b>	<b>44,179</b>	<b>65,356</b>
<b>Stock Balance (suppositories)</b>			
Beginning Balance	10,928	18,615	11,534
- Product Need	51,260	51,260	51,260
+ Total Contributions (received/expected)	58,947	44,179	65,356
<b>Ending Balance</b>	<b>18,615</b>	<b>11,534</b>	<b>25,630</b>
Desired End of Year Stock (months of stock)	6	6	6
Desired End of Year Stock (quantities)	25,630	25,630	25,630
<b>Total Surplus (Gap)</b>	<b>(7,015)</b>	<b>(14,096)</b>	<b>0</b>

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

<b>Calendar Year</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>
Total Country Population	105,166,000	107,900,316	110,705,724
Total population at risk for malaria	54,791,486	56,216,065	57,677,682
PMI-targeted at-risk population	54,791,486	56,216,065	57,677,682
<b>Primaquine Needs</b>			
Total projected number of malaria cases	2,646,851	2,397,471	1,979,583
Total projected number of Pf cases	2,091,012	1,894,002	1,563,871
Total projected number of Pv cases	529,370	479,494	395,917
Total projected number of mixed cases (Pf + Pv)	26,469	23,975	19,796
<b>Total Primaquine Needs (tablets)</b>	<b>11,864,700</b>	<b>12,700,500</b>	<b>13,536,400</b>
Needs Estimated based on Consumption Data	<b>11,864,700</b>	<b>12,700,500</b>	<b>13,536,400</b>
<b>Partner Contributions (tablets)</b>			
Primaquine from Government	0	0	0
Primaquine from Global Fund	0	16,442,000	
Primaquine from other donors	0	0	0
Primaquine planned with PMI funding	0	0	0
<b>Total Primaquine Contributions per Calendar Year</b>	<b>0</b>	<b>16,442,000</b>	<b>0</b>
<b>Stock Balance (tablets)</b>			
Beginning Balance	35,948,400	24,083,700	27,825,200
- Product Need	11,864,700	12,700,500	13,536,400
+ Total Contributions (received/expected)	0	16,442,000	0
<b>Ending Balance</b>	<b>24,083,700</b>	<b>27,825,200</b>	<b>14,288,800</b>
Desired End of Year Stock (months of stock)	12	12	12
Desired End of Year Stock (quantities)	11,864,700	12,700,500	13,536,400
<b>Total Surplus (Gap)</b>	<b>12,219,000</b>	<b>15,124,700</b>	<b>752,400</b>

**Table A-7. Chloroquine Gap Analysis Table**

<b>Calendar Year</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>
Total country population	105,166,000	107,900,316	110,705,724
Population at risk for malaria	54,791,486	56,216,065	57,677,682
PMI-targeted at-risk population	54,791,486	56,216,065	57,677,682
<b>Chloroquine Needs</b>			
Total projected number of malaria cases	2,646,851	2,397,471	1,979,583
Total projected number of P. f. malaria cases	2,117,481	1,917,977	1,583,666
Total projected number of P.v malaria cases	529,370	479,494	395,917
<b>Total Chloroquine Needs (tablets)</b>	5,293,702	4,794,942	3,959,166
Needs Estimated based on HMIS Data	5,293,702	4,794,942	3,959,166
<b>Partner Contributions (tablets)</b>			
Chloroquine tablets from Government	0	0	0
Chloroquine tablets from Global Fund	0	0	0
Chloroquine tablets from other donors	0	0	0
Chloroquine tablets planned with PMI funding	0	0	4,000,000
<b>Total Chloroquine Contributions per Calendar Year</b>	0	0	4,000,000
<b>Stock Balance (tablets)</b>			
Beginning Balance	15,920,000	10,626,298	5,831,356
- Product Need	5,293,702	4,794,942	3,959,166
+ Total Contributions (received/expected)	0	0	4,000,000
Ending Balance	10,626,298	5,831,356	5,872,190
Desired End of Year Stock (months of stock)	6	6	6
Desired End of Year Stock (quantities)	2,646,851	2,397,471	1,979,583
<b>Total Surplus (Gap)</b>	<b>7,979,447</b>	<b>3,433,885</b>	<b>3,892,607</b>