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Ethiopia

Malaria Operational Plan FY 2024

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This FY 2024 Malaria Operational Plan has been approved by the U.S. Global Malaria Coordinator and reflects collaborative discussions with national malaria control programs and other partners. Funding available to support outlined plans relies on the final FY 2024 appropriation from U.S. Congress. Any updates will be reflected in revised postings.

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ABBREVIATIONS

ACT	Artemisinin-based combination therapy
AHRI	Armauer Hansen Research Institute
AI	Active ingredient
AL	Artemether-lumefantrine
An.	*Anopheles*
ANC	Antenatal care
CDC	Centers for Disease Control and Prevention
DHIS2	District Health Information Software 2
eCHIS	Electronic Community Health Information System
EFETP	Ethiopian Field Epidemiology Training Program
EPHI	Ethiopian Public Health Institute
EPSS	Ethiopian Pharmaceuticals Supply Service
EQA	External quality assurance
FMoH	Federal Ministry of Health
FY	Fiscal year
Global Fund	Global Fund to Fight AIDS, Tuberculosis and Malaria
GoE	Government of Ethiopia
HEW	Health extension worker
HIS	Health information system
HRP	Histidine rich proteins
IRS	Indoor residual spraying
ITN	Insecticide-treated mosquito net
LSM	Larval source management
MIS	Malaria Indicator Survey
MOP	Malaria Operational Plan
MPR	Malaria program review
NMEP	National Malaria Elimination Program
NMSP	National Malaria Strategic Plan
OR	Operational research
PBO	Piperonyl-butoxide
PHEM	Public Health Emergency Management
PMI	U.S. President's Malaria Initiative
RDT	Rapid diagnostic test
RDQA	Routine data quality audits
RHB	Regional health bureau
SBC	Social and behavior change
SNNP	South Nations, Nationalities, and Peoples'
TA	Technical assistance
TES	Therapeutic Efficacy Studies
tMDA	Targeted mass drug administration

USAID	United States Agency for International Development
WHO	World Health Organization

EXECUTIVE SUMMARY

To review specific country context for Ethiopia, please refer to the country malaria profile, which provides an overview of the country's malaria situation, key indicators, the Ethiopia National Malaria Elimination Program strategic plan, and the partner landscape.

U.S. President's Malaria Initiative

Launched in 2005, the U.S. President's Malaria Initiative (PMI) supports implementation of malaria prevention and treatment measures as well as cross-cutting interventions. PMI's 2021–2026 strategy, *End Malaria Faster*, envisions a world free of malaria within our generation with the goal of preventing malaria cases, reducing malaria deaths and illness, and eliminating malaria in PMI partner countries. PMI currently supports 27 countries in Sub-Saharan Africa and 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

Malaria affects around 76 million Ethiopians (69% of the population) with varying risks of exposure, and remains a significant public health issue despite reduced cases from 3.8 million in 2010 to 994,000 in 2019. Cases have rebounded to 1.6 million in 2022 due to partially sub-optimal and under-resourced implementation of vector control interventions; conflict-related disruptions to interventions; and other challenges such as mosquito resistance to pyrethroid insecticides, high rates of histidine rich protein 2/3 gene deletions in malaria parasites, and the invasion of *Anopheles stephensi*. A full malaria program review in March 2023 led to an early revision of the National Malaria Strategic Plan (NMSP) and to key recommendations, including improving data access, addressing historically underserved groups, deploying non-pyrethroid nets, and promoting community engagement.

Overview of Planned Interventions

The proposed FY 2024 PMI funding for Ethiopia is $35 million. PMI will support the following intervention areas with these funds through the following:

1. Vector Monitoring and Control

The NMSP focuses on an integrated vector management (IVM) strategy, which includes vector surveillance, insecticide resistance management, indoor residual spraying (IRS), distribution of effective insecticide-treated nets (ITNs), and larval source management implementation for *An. stephensi*. With FY 2024 funds, PMI Ethiopia will procure and distribute 1.85 million dual active ingredient ITNs in high and moderate malaria burden areas, while supporting targeted ITN

deployment in low malaria burden areas. In calendar year 2024, PMI will graduate seven districts in Oromia from IRS, while ensuring continuation of gains; and will continue IRS implementation in 41 high-malaria burden districts which do not receive non-pyrethroid ITNs, while working to expand community-based IRS. PMI will also continue supporting the National Malaria Elimination Program (NMEP) with longitudinal entomological monitoring in seven selected sites. In 2023, PMI Ethiopia will continue to evaluate the effectiveness of different larvicides and plans to work with local authorities to start transitioning larval source management implementation to local governments and communities to ensure sustainability of this intervention. PMI will procure larvicides and provide technical assistance as needed with FY 2024 funding to support this transition, and expand to additional sites when possible.

2. Malaria in Pregnancy

The NMSP advises that pregnant women in malaria-endemic regions use ITNs and have access to malaria diagnosis and treatment. PMI supports malaria in pregnancy objectives in Ethiopia through ITN mass distribution campaigns, improving the quality of malaria diagnosis and treatment, and collaborating with the United States Agency for International Development Family Health Team and the Federal Ministry of Health (FMoH) Maternal and Child Health Directorate to enhance antenatal care attendance. PMI aims to maintain funding for malaria case management in pregnant women, focusing on moderate- to high-malaria burden districts. PMI Ethiopia will also continue to support social and behavior change (SBC) interventions, ensuring providers are equipped to support pregnant women to overcome the barriers to ITN use and prompt care seeking.

3. Drug-Based Prevention

PMI does not support seasonal malaria chemoprevention or other drug-based prevention in Ethiopia.

4. Case Management

The NMSP promotes a comprehensive case management strategy, including quality-assured parasitological testing of all suspected uncomplicated malaria cases and prompt treatment with a recommended antimalarial for all confirmed uncomplicated cases. For severe malaria or fever cases, the NMSP recommends pre-referral treatment and/or definitive management. At the national level, PMI will continue to provide technical assistance and program management support to the FMoH through the NMEP in addition to offering training to laboratory staff, clinical professionals, biomedical engineers/technicians, and program management staff in malaria diagnosis and treatment policies and guidelines. PMI plans to contribute to addressing the national case management commodity gaps by procuring and distributing 37,164 doses of rectal artesunate, 300,000 vials of injectable artesunate, and 10 million chloroquine tablets. At the facility level, PMI will continue to contribute financially and technically to national external

quality assurance activities and support on-site evaluations for malaria microscopy and clinical mentoring for health facilities providers. In addition, PMI will work to improve malaria diagnosis and treatment in private clinics as well as for mobile and migrant populations. At the community level, PMI will support community case management for all age groups and will conduct case management and rapid diagnostic test mentorship visits to selected health posts. SBC efforts related to case management will focus on promoting prompt care seeking.

5. Health Supply Chain and Pharmaceutical Management

The NMEP and PMI's main objective in supply chain and pharmaceutical management is to ensure continuous availability of quality products needed for malaria control and elimination at health facility and community levels. With FY 2024 funds, PMI will continue to provide technical assistance to the FMoH and Ethiopian Pharmaceuticals Supply Service for the timely procurement and distribution of malaria commodities and the continued improvement of logistics management information systems. This includes support in quantification, supply planning, forecasting, drug management, requisition, drug exchange/transfer, and tracking/disposal.

6. Malaria Vaccine

In 2022, the FMoH formed a panel of malaria experts to perform an ongoing analysis and determine Ethiopia's eligibility for the malaria vaccine at the sub-national level. PMI will continue to track vaccine availability and additional resource needs, if any, for Ethiopia.

7. Social and Behavior Change

The NMSP aims to achieve adoption of appropriate behaviors and practices related to malaria by 85 percent of households living in malaria-endemic areas. To achieve this objective, the NMEP uses health extension workers, volunteer community mobilisers, and community leaders to deliver SBC interventions. With FY 2024 funding, PMI will continue to support the implementation of malaria SBC interventions at individual, household, and community levels to address the barriers to ITN use and care, prompt care-seeking for fever, and IRS acceptance, as well as to promote community participation in *An. stephensi* control and community-based surveillance activities.

8. Surveillance, Monitoring, and Evaluation

PMI supports the National Health Information System Strategy 2021-2025's aim to improve evidence-based decision-making through the availability, access, and use of quality data. To this end, PMI strengthens quality data reporting through the District Health Information Software 2 and the electronic community health information system; while aiming to minimize discrepancies between data sources, optimize the inclusion of private health facility data, and

promote a data use culture. With FY 2024 funding, PMI plans to strengthen surveillance in 57 elimination targeted districts and select 6 districts among these to conduct elimination surveillance and response activities. In addition to supporting the expansion of these reporting systems, PMI will increase support for weekly malaria data reported in the Public Health Emergency Management system and used in the Epidemic Prognosis Incorporating Disease and Environmental Monitoring for Integrated Assessment malaria early warning tool, leveraging other United States government investments.

9. Operational Research and Program Evaluation

Priority areas for PMI Ethiopia operations research are informed by the PMI strategy and the PMI operations research priorities with input from the NMEP and the NMSP. PMI will continue the study to assess the effects of piperonyl-butoxide-treated ITNs compared to IRS with standard ITNs. Building on earlier investments, PMI plans to address the issue of migrant workers moving between low transmission and high transmission areas by studying the feasibility and efficacy of different prevention and case management strategies for this population.

10. Capacity Strengthening

The NMSP aims to strengthen the health system by increasing the number of qualified health workers for malaria control and other health efforts. PMI supports capacity strengthening for universities and at various levels of the health system to address the shortage of malariologists, epidemiologists, and entomologists; and works on reinforcing ministerial institutions like the NMEP, Ethiopian Public Health Institute, and Armauer Hansen Research Institute. With FY 2024 funding, PMI will continue these efforts by supporting the development of a curriculum to train public health entomologists, funding a local organization to conduct community based surveillance, and initiating support for the Ethiopian Field Epidemiology Training Program Frontline track to expand epidemiology and entomological capacity at the district level. Additionally, PMI plans to support Peace Corps malaria SBC activities as volunteers are expected to return in early 2024.

11. Staffing and Administration

PMI in Ethiopia is overseen by six health professionals, including U.S. Agency for International Development and a Centers for Disease Control and Prevention resident advisors, and four locally hired foreign service nationals. This interagency team collaborates on all technical and administrative aspects of the initiative.

I. CONTEXT & STRATEGY

1. Introduction

Ethiopia began implementation as a PMI partner country in Fiscal Year (FY) 2008. This FY 2024 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 to improve and expand malaria-related services, including the Global Fund to Fight AIDS, Tuberculosis, and Malaria (Global Fund). This document provides an overview of the strategies and interventions in Ethiopia, describes progress to date, identifies challenges and relevant contextual factors, and provides a description of activities that are planned with FY 2024 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. U.S. President's Malaria Initiative

The U.S. President's Malaria Initiative (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. 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 of pregnant women, and drug-based prevention – as well as cross-cutting interventions such as surveillance, monitoring and evaluation; social and behavior change; 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 27 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- countries, PMI will work with national malaria programs and partners to accomplish the following objectives by 2026:

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

3. Bring at least 10 PMI partner countries toward national or subnational elimination and assist at least one country in the Greater Mekong Subregion to eliminate malaria.

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

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

3. Rationale for PMI's Approach in Ethiopia

3.1. Malaria Overview for Ethiopia

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

In Ethiopia, malaria is highly seasonal and unstable with epidemic-prone transmission patterns in many parts of the country. The NMEP's 2023 malaria stratification estimates that 69% of Ethiopia's estimated population of 109.8 million are exposed to varying risk of malaria infections. This amounts to about 76 million people, living in 75% of the landmass, whose risk of contracting malaria depends on geography, climate, hydrological processes, human settlement patterns, and other socioeconomic activities. In general, areas above an altitude of 2,500 meters, and with frequent temperatures below 16 degrees Celsius, are considered malaria free; whereas the highest malaria burden regions are areas with altitudes below 1,500 meters and temperatures between 24 and 30 degrees Celsius, located mainly in the regions of Gambella, Benishangul-Gumuz, as well as the Western parts of Amhara, South Nations, Nationalities, and Peoples' (SNNP), and Tigray.

Overall, malaria remains one of the major public health and socioeconomic problems in Ethiopia despite its dramatic reduction in the last two decades. According to the Federal Ministry of Health's annual reports, malaria cases dropped from 3.8 million in 2010 to about 994,000 in 2019. However, over the past three years, Ethiopia has started to see a rebound in malaria cases, which went back up to 1.6 million in 2022. The malaria case numbers are grossly under-reported as they do not include the Tigray Region and other conflict areas where health information has been inaccessible for the past couple of years.

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. *Plasmodium (*P.*) falciparum* (~65 percent) and *P. vivax* (~35 percent) are the major malaria parasites. *Anopheles (An.) arabiensis* is the primary malaria vector in Ethiopia and *An. funestus*, *An. pharoensi*s, and *An. nili* are secondary vectors. Recent evidence suggests that *An. coustani* may also play a role as a vector. *An. stephens*i, an invasive urban vector mainly breeding in artificial containers, is also confirmed to play a role in malaria transmission in Ethiopia. Peak malaria transmission occurs between September and December, after the main rainy season which occurs from June to August.

3.2. Key Challenges and Contextual Factors

The recent increase in malaria cases has been attributed to a convergence of regional threats exacerbating chronic underlying issues.

Ethiopia has established complete mosquito resistance to pyrethroid insecticides. Preliminary bioefficacy data through cone bioassay tests for ITNs from a PMI-funded study in the Amhara region shows that new standard pyrethroid ITNs are killing zero wild mosquitoes, confirming their inefficacy. ITNs in Ethiopia are distributed through a rolling mass campaign serving each region every three years. ITN durability monitoring data found that over 30 percent of these nets are no longer usable after a year.[1] Ethiopia also is challenged with high rates of histidine rich proteins (*hrp)* gene deletions in malaria parasites, rendering conventional malaria rapid diagnostic tests inferior at detecting infections. A survey conducted in 2017 by the World Health Organization (WHO) and the Ethiopian Public Health Institute (EPHI) in Gambella, Tigray, and Amhara regions estimated that 9.7 percent of malaria rapid diagnostic tests (RDTs) have false negative results due to *hrp2/hrp3* gene deletions. The district specific rate of *hrp2/hrp3* gene deletions ranged from 5 percent to 30 percent.

In addition to these chronic issues, conflicts in Tigray, Amhara, Afar, and parts of Oromia regions between 2020 and 2022 led to the disruptions of malaria interventions and the degradation of surveillance systems. In Amhara, IRS operations have been inconsistently implemented over the past two years due to delays in procuring insecticides and variableness in areas sprayed. In Gambella, refugees, which comprise 45 percent of the population, have been excluded from vector control interventions (ITNs and IRS). Ethiopia's malaria elimination efforts also are challenged by the movements of seasonal migrant workers who travel to lowlands—where malaria is endemic—to seek seasonal jobs. When they return home to lower burden areas, they bring the parasite back with them, setting back elimination gains. Lastly, *An. stephensi*, an invasive malaria vector that thrives in urban and arid settings and was detected in Ethiopia in 2016, is now widely distributed in 45 locations in the eastern, central, and northeastern part of the country. In 2022, *An. stephensi* was directly linked to the dramatic

[1] Honelgn Nahusenay Hiruy et al., "Durability of Long-Lasting Insecticidal Nets (LLINs) in Ethiopia," Malaria Journal 22, no. 1 (March 26, 2023), https://doi.org/10.1186/s12936-023-04540-3

increases in malaria cases in Dire Dawa, where malaria increased by 10-fold compared to 2021.

3.3. PMI's Approach for Ethiopia

Considering the recent changes in the malaria epidemiology in Ethiopia, and contributing factors including unforeseen geopolitical challenges, the NMEP and its strategic partners unanimously agreed to conduct a full Malaria Program Review (MPR) in March 2023, despite having over two years left in the implementation of the National Malaria Strategic Plan (NMSP) 2021-2025. PMI supported this decision and was fully engaged in this MPR, including supporting the participation of two external reviewers from the Centers for Disease Control (CDC) Atlanta to assist in the validation of the review findings. Results from the MPR informed the draft Ethiopian National Malaria Strategic Plan (NMSP), which covers 2024–2027.

Key recommended strategies following this review included ensuring the availability and access to quality malaria data at the *woreda* (district) level for timely decision making; establishing strategies for addressing malaria in historically underserved groups such as migrant workers and refugees; improving the quality of laboratory diagnostic commodities, particularly giemsa stain solution; strategically deploying more costly non-pyrethroid nets to ultimately achieve maximum impact; and ensuring decision makers engagement and community ownership in all malaria related planning and implementation through appropriate community sensitization and mobilization channels. MPR findings informed the ongoing revision of the NMSP, starting with a revised malaria risk stratification that now identifies 161 districts as malaria free (15 percent compared to 23 percent in 2020), 253 districts as very low risk for malaria (23 percent compared to 46 percent in 2020), 285 as low risk (26 percent compared to 8 percent on 2020), 294 as moderate risk (27 percent compared to 17 percent in 2020), and 89 as high risk (8 percent compared to 6 percent in 2020). In light of rising malaria rates in districts previously selected for elimination, the MPR also confirmed the need to revisit the national malaria elimination strategy, and provisionally tailor elimination ambitions while working on burden reduction and surveillance strengthening.

PMI is fully aligned with this new proposed strategic direction. While awaiting the finalization of the revised NMSP, PMI has taken steps to intensify entomological and epidemiological surveillance efforts to fill gaps in crucially needed evidence, and to improve case management in order to keep deaths down. PMI is also planning strategies to shift program ownership for activities e.g., IRS implementation and larval source management (LSM) in response to *An. stephensi* to the community level, where activities can be maintained more sustainably. After consistent advocacy efforts, PMI and the Global Fund are planning a progressive shift to procure non-HRP 2/3 based RDTs. Similarly, PMI is shifting to procure non-pyrethroid only nets while advocating for a national transition in this direction. Acknowledging the significant coverage gap resulting from the exclusion of the refugee population in the previous IRS campaign, PMI and the NMEP consented to include the refugee population in Gambella in the 2023 IRS campaign. PMI and the NMEP will negotiate a more permanent solution for

protecting the refugee population in Gambella and elsewhere with organizations mandated to safeguard refugee welfare. Finally, to address the question of migrant workers, PMI is planning to conduct a study to evaluate effective and feasible malaria prevention and control approaches for this population.

3.4. Key Changes in this Malaria Operational Plan

In order to address the recent increase in cases and put Ethiopia back on the path to malaria elimination, PMI will focus on improving the efficacy and impact of vector control interventions. This will translate into procuring more efficacious nets and prioritizing their distribution to higher burden and former IRS areas. In low burden areas, the strategy will be to implement targeted distribution of ITNs as a response to outbreaks. In order to consolidate IRS implementation, PMI will withdraw IRS from seven districts in Oromia, where spraying has been ongoing for seven years. These districts are isolated from the other PMI-supported IRS areas and are no longer considered high burden according to the new malaria risk stratification. To mitigate the risk of an upsurge in those districts, PMI will work with the NMEP and the Oromia Regional Health Bureau (RHB) to closely monitor the shift and ensure that the graduated districts are covered with dual active ingredient (AI) ITNs and accompanying social and behavior change (SBC) and both entomological and epidemiological surveillance are strengthened. PMI will also ensure that sufficient diagnostic and treatment commodities are available in these districts. In line with WHO recommendations, PMI will no longer support co-deployment of IRS and ITNs. For larval source management sustainability, efforts are focused on shifting ownership of larval source reduction and larviciding activities to local authorities with PMI support for training and larvicide procurement.

PMI's priority for case management will be to work with the Global Fund to cover the large commodity gap, progressively increase the procurement of non-HRP2 RDTs, and ensure that these RDTs are prioritized to test symptomatic cases. PMI will treat surveillance as a core intervention with a focus on reducing discrepancies and improving triangulation between the various logistics, epidemiological, and entomological data platforms, as well as leveraging existing Federal Ministry of Health (FMoH) sentinel sites and the Ethiopian Field Epidemiology Training Program (EFETP) achievements for improved coverage and coordination. Relatedly, elimination activities will be limited to selected elimination ready districts, while support for other districts will aim to improve surveillance capacity at all levels for data use and prompt outbreak response. In line with localization efforts, PMI will support a local organization for community-based malaria case detection and social behavior change.

II. OPERATIONAL PLAN FOR FY 2024

1. Vector Monitoring and Control

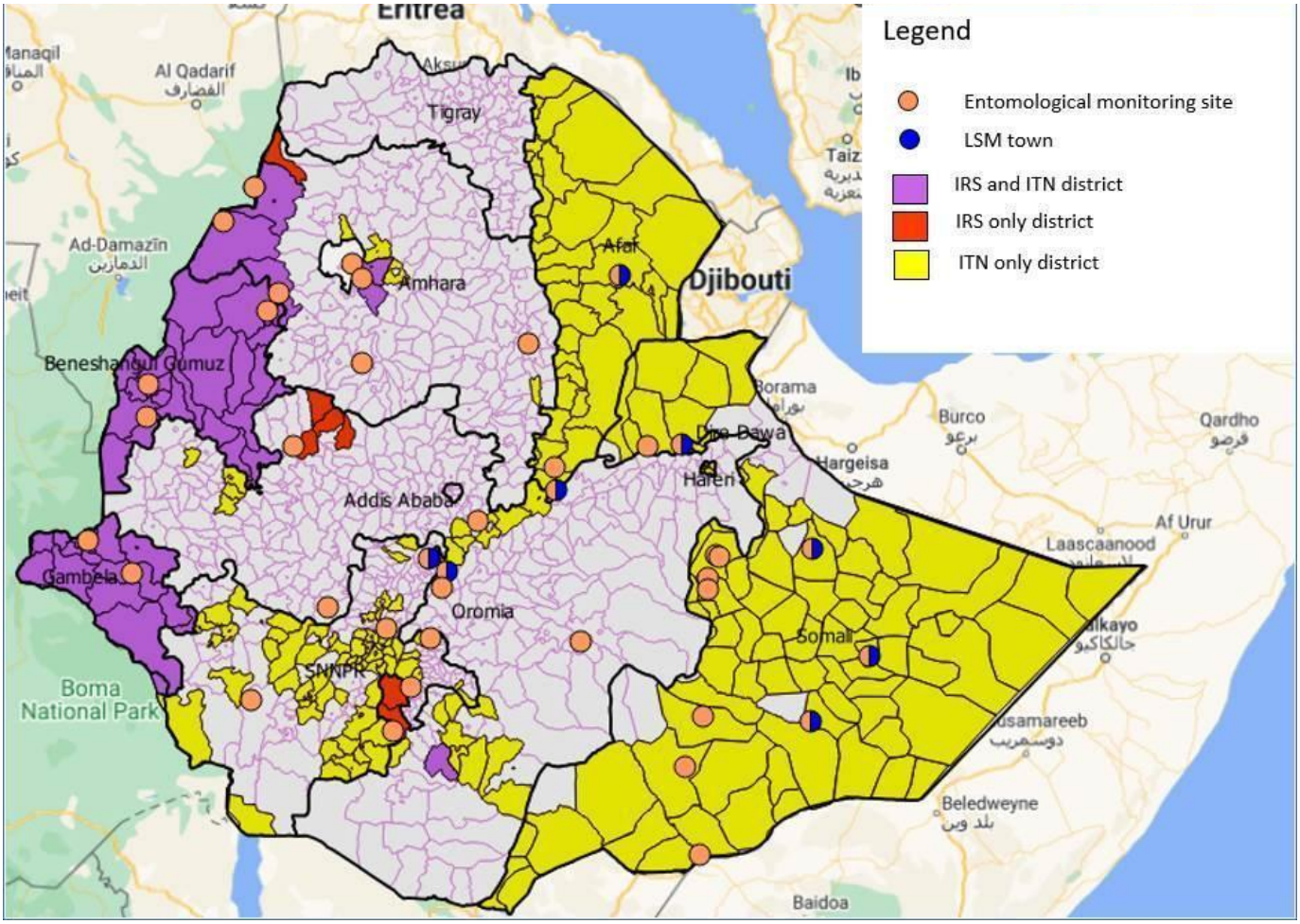
1.1. PMI Goal and Strategic Approach

The NMEP in Ethiopia promotes an integrated vector management strategy, including vector surveillance, insecticide resistance management, mass distribution of ITNs, geographically targeted IRS, and LSM. The NMEP does not currently support the continuous distribution of ITNs on the basis of logistical challenges. PMI/E continue to highlight the importance of continuous ITNs distribution. The draft Ethiopian NMSP 2024–2027 proposes to protect 100 percent of targeted populations living in high, moderate, and low malaria risk areas with one WHO-recommended vector control intervention. In districts with more than half of kebeles with an annual parasite index over 50, the NMSP 2024-2027 proposes to prioritize IRS. ITNs will be distributed in other areas with priority given to kebeles with an annual parasite index above 10, and targeted ITNs deployed in response to outbreaks.The draft NMSP also recommends larviciding to be systematically implemented in urban and peri-urban areas, to control *An. stephensi*, as well as in malaria elimination areas; and to implement source reduction in all malaria endemic areas where feasible.

PMI works with the NMEP and the Global Fund to support the deployment of these evidence-based vector control tools with the aim to achieve universal coverage. This includes support for rolling mass ITN distribution campaigns and IRS implementation in 41 districts. As part of capacity building, PMI also provides technical assistance (TA) to the NMEP and RHBs to ensure quality implementation in Global Fund-supported IRS districts. Additionally, PMI supports entomological monitoring in 44 sites across the country to inform the NMEP and its partners on vector distribution, seasonality, behavior, density, susceptibility to insecticides, sporozoite infection rates, and blood meal sources, as well as residual efficacy of insecticides. Evidence from entomological monitoring guides vector control interventions including insecticide selection and timing of IRS.

Since 2018, PMI Ethiopia has conducted surveillance for *An. stephensi* in 90 sites and the invasive vector was detected in 51 sites. In early 2022, *An. stephensi* was implicated in the increase of malaria cases in Dire Dawa. Larval source management was identified as an additional effective intervention against *An. stephensi* based on the vector's feeding and resting behaviors and insecticide susceptibility test findings. Since August 2022, PMI has been supporting pilot implementation of LSM in eight towns in the central and eastern part of the country where *An. stephensi* was detected. Currently, PMI is leading discussions on how best to transition LSM activities to local authorities and communities to ensure sustainability. In addition, PMI is working with the NMEP to ensure a well-coordinated, efficient larval source management program in government-supported districts.

Figure 1. Map of Current PMI-supported Vector Control Activities in Ethiopia



1.2. Recent Progress (April 2022–April 2023)

- PMI supported the NMEP to plan and implement an IRS campaign between May and July 2022 in 42 districts in Gambella (14), Benishangul-Gumuz (15), Oromia (7), and Amhara (6) Regions. The campaign covered almost 700,000 structures and protected over 1.7 million people from malaria (End of Spray Report).
- PMI supported the NMEP and RHBs to plan and supervise an ITN campaign, which was implemented in early 2023. For this campaign, PMI procured and distributed 2.9 million standard ITNs to target populations in Afar, Benishangul-Gumuz, Gambella, SNNP Regions, and Sidama regions.
- PMI procured 4,612 units of larvicide and supported the NMEP to pilot LSM in eight towns in response to *An. stephensi*. This pilot started in June 2022 and will be completed in June 2023 in six out of the eight towns. In Awash and Dire Dawa, the pilot will extend through December 2023. Preliminary results show a significant downward trend in positive larval sites in all sites, confirming the entomological effect of this intervention when coverage is optimized. PMI is also assessing the residual efficacy of

the three larvicides in Dire Dawa: SumiLarv 2MR, Sumilarv 0.5G, and VectoBac; from January to June 2023.

- In 2022 PMI supported the NMEP to conduct entomological monitoring in 21 sentinel sites in eight regions (Afar, Amhara, Benishangul-Gumuz, Gambella, Oromia, Sidama, SNNP and Somali Regions) and one city administration (Dire Dawa) in collaboration with six local institutions, including Assosa, Debre Markos, Jimma, Gondar and Arbaminch universities as well as the Amhara Public Health Institute. In addition, PMI supported community-based entomological activities for routine vector collection in Gelana District and trained over 300 community mosquito collectors in the towns implementing LSM to differentiate malaria vectors to the genus level. In Amhara, where PMI is implementing a study in five districts to compare the effect of piperonyl-butoxide (PBO) ITNs versus standard ITNs with IRS, PMI trained 60 community members to conduct entomological monitoring. Please refer to the 2021-2022 Ethiopia Entomology report here for further information.

1.3. Plans and Justification for FY 2024 Funding

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

With FY 2024 funds, PMI will:

- Support the NMEP to implement the vector control interventions proposed in the draft NMSP 2024-2027. Following evidence that shows complete resistance to pyrethroid insecticides in Ethiopia, PMI will procure and distribute 1.85 million dual AI ITNs, prioritizing their distribution to high and moderate malaria burden areas.
- Continue to support environmentally compliant, safe, and effective IRS implementation in 41 high-malaria burden districts in the Amhara, Benishangul-Gumuz, and Gambella Regions. The support will include procurement of IRS commodities and insecticides. In addition, PMI Ethiopia will continue to provide limited IRS support to the 63 districts that were graduated from IRS between 2012 and 2016 in the Oromia Region, in addition to seven districts that will be graduated after the 2023 IRS campaign. This support will consist of providing technical assistance and procuring limited quantities of IRS commodities, excluding insecticides.
- Continue to support the NMEP with entomological monitoring, including *An. stephensi* surveillance in selected sites.
- PMI Ethiopia plans to continue conducting enhanced surveillance for *An.stephensi* in new sites in the north, west, and south western locations in Ethiopia and repeat surveys in locations where it was previously not detected since some sites have turned positive after a few years (e.g., Hawassa was negative in 2019 but positive in 2022). By continuing expansion of surveys and repeating surveys, the spread or containment of *An. stephensi* over time can be closely monitored. These data can be used to advise NMEP on rapid response control strategies where *An. stephensi* is detected to mitigate

the threat of malaria. Further, PMI plans to continue to provide technical assistance and training on *An. stephensi* surveillance, control, and data collection tools to the NMEP and regional health bureau staff to strengthen local capacity.

- Work with local authorities in towns piloting LSM to smoothly transition LSM implementation to the community. PMI Ethiopia will assist this transition by procuring larvicides and providing TA where necessary and feasible.
- Support reactive vector control responses (e.g., ITNs and entomological assessments/ foci investigations) in malaria elimination districts. Based on foci investigation recommendations, ITNs will be deployed in hotspot areas in malaria elimination settings. Stocks of ITNs designated for reactive response will be held at an accessible Ethiopian Pharmaceuticals Supply Service (EPSS) hub for selected malaria elimination districts. In addition, weekly foci investigation reports and recommendations from the districts health team will be used to transfer ITNs to the appropriate districts and later to the beneficiaries through health extension workers.
- Support Jimma University to implement their curriculum for training public health entomologists to manage district entomological activities. This is in response to recommendations from the 2023 MPR, which identified entomological capacity as one of key gaps in malaria control and elimination efforts in the country.

1.3.1. Entomological Monitoring

PMI will conduct entomological monitoring in sentinel sites representing the country's different eco-epidemiological settings to generate key entomological data and assist vector control decision making. Entomological monitoring targets sites that include districts receiving dual AI ITNs and districts that receive IRS. These activities include insecticide resistance and vector bionomics monitoring, as well as insecticide residual efficacy monitoring through wall bioassays in nine sites. The data generated will feed into other monitoring and evaluation activities and will help develop a better understanding of the effect of IRS and dual AI ITNs, and of vector-human interactions. In addition, PMI will continue to conduct entomological surveys to determine the distribution and behavior of *An. stephensi* in the southwest, central, western, and northwest parts of the country.

Summary of Distribution and Bionomics of Malaria Vectors in Ethiopia

The most recent report from longitudinal entomological monitoring in seven sites confirms the presence of 17 *Anopheles* species. The predominant species from 8,210 *Anopheles* collected was *An. arabiensis* (49 percent), followed by *An. coustani* (26 percent), and *An. funestus* (8 percent). Other secondary malaria vectors include *An. pharoensis* and *An. nili*. The report shows that species composition varies from place to place and *An. arabiensis* is dominant in five out of the seven sentinel sites.

Peak vector density is from September to December. *An. arabiensis'* preferred biting location varies from site to site. Based on the CDC light trap collection method, *An. arabiensis* indoor

collection was higher in four out of seven sites. Similarly, blood meal sources vary from site to site. In Gelana and Abaya, humans are the preferred blood source at 83 and 54 percent, respectively, while in Jabitehnan and Benatsemay, bovine blood source is preferred at 88 and 59 percent, respectively. *An. stephensi* is an emerging vector, whose presence has now been established in 51 sites in the country. Its resting location and biting time preference also varies from site to site according to behavioral monitoring reports.

Status of Insecticide Resistance in Ethiopia, April 2021–August 2022

The primary malaria vector in Ethiopia, *An. arabiensis,* was found to be resistant to deltamethrin in 14 out of 15 sites tested and to alphacypermethrin and permethrin in all 10 sites tested. PBO restored full susceptibility of *An. arabiensis* to deltamethrin, alphacypermethrin, and permethrin in 10 out of 15 sites, 6 out 10 sites, and 8 out of 9 sites, respectively. For *An. stephensi*, PBO restored full susceptibility only to permethrin, while partial susceptibility restoration to deltamethrin and alphacypermethrin was observed. On the other hand, both *An. arabiensis* and *An. stephensi* were fully susceptible to clothianidin in all four sites tested. *An. stephensi* was also fully susceptible to chlorfenapyr in two sites tested.

In Amhara, entomological results to date, comparing the effect of PBO ITNs versus IRS plus standard ITNs show that entomological indicators are comparable in both intervention arms; however, PBO content is below the acceptable range five months after deployment and standard ITNs at the same time point do not lead to any mortality in wild-caught mosquitoes.

1.3.2. Insecticide-Treated Nets

In line with evidence confirming the inefficacy of standard ITNs and the rapid decline of PBO content in PBO ITNs, PMI will support the procurement of dual AI ITNs and their distribution to the last mile through the community-based health extension program. PMI will provide technical support to the country's 2024 mass distributions by participating in a national task force and providing TA for the planning and supervision processes. At the national level, ITN use still remains below target in Ethiopia. As a result, PMI continues to support community-level SBC activities to improve demand for ITNs, increase appropriate use, promote care, and mitigate against misuse. Please see below for details on challenges and opportunities to improve intervention uptake or maintenance.

Insecticide-treated Net Distribution in Ethiopia

In Ethiopia, ITNs are distributed via rolling mass campaigns to replace nets every three years. PMI and Global Fund resources are the main source for ITNs in Ethiopia with the Government of Ethiopia also procuring and distributing ITNs. Global Fund covers the majority of the national ITN needs while PMI covers the gap. Based on the draft NMSP, the country plans to transition from standard to dual AI ITNs. Pyrethroid resistance is well documented in Ethiopia and a PMI-supported study showed that new deltamethrin treated standard ITNs resulted in zero

percent mortality of wild malaria vectors. Based on these findings, and other reports from the field, the NMEP is planning to distribute efficacious nets to the extent possible instead of covering more people with less effective nets that only provide a physical barrier due to pyrethroid resistance.

Please refer to the ITN Gap Table in annex for more detail on planned quantities and distribution channels.

1.3.3. Indoor Residual Spraying

Starting in calendar year 2024, PMI proposes to graduate seven IRS districts in Oromia where PMI has been spraying for seven years and malaria has been significantly reduced. There are growing security concerns and the districts are remote from other IRS areas, complicating logistics. PMI will target dual AI nets and ensure increased SBC for correct and consistent use of dual AI nets. In addition PMI will strengthen routine surveillance in these districts and ensure sufficient diagnostics and treatment commodities are available. With FY 2024 funds, PMI will support the planning, implementation, and evaluation of the 2025 IRS campaign in 41 districts using organophosphate and neonicotinoid insecticides. Furthermore, PMI will provide TA to the NMEP to plan, implement, and supervise IRS in Global Fund-supported IRS districts. In collaboration with the NMEP and other stakeholders, PMI will ensure that refugee camps in PMI-supported districts are covered with one recommended vector control intervention. To increase the sustainability and cost effectiveness of IRS programs, PMI will advocate for the expansion of community-based IRS to the extent possible in PMI-supported districts.

Table 1. PMI-Supported Indoor Residual Spray Coverage

CY	District*	Structures Sprayed (#)	Coverage Rate (%)	Population Protected (#)	Insecticide
2022	Gambella (14), Benishangul- Gumuz (15), Oromia (7), and Amhara (6)	684,490	97.5	1,792,145	Pirimiphos-methyl CS, clothianidin, and clothianidin/ deltamethrin
2023	Gambella (14), Benishangul-Gumuz (16), Oromia (7), and Amhara (6)	875,953	TBD	2,376,506	Pirimiphos-methyl CS, clothianidin, and clothianidin/ deltamethrin
2024**	Gambella (14), Benishangul- Gumuz (21), and Amhara (6)	779,758	TBD	2,022,253	Pirimiphos-methyl CS, clothianidin, and clothianidin/ deltamethrin
2025**	Gambella (14), Benishangul- Gumuz (21), and Amhara (6)	800,032	TBD	2,074,830	TBD

*If more than 10 districts, list regions/provinces.
** Planned
CS: capsule suspension; TBD: to be determined.

Indoor Residual Spraying Insecticide Residual Efficacy in Ethiopia

Wall bioassays were conducted monthly on different wall types following the 2022 IRS campaign at five sites and showed a six month residual efficacy for Actellic 300CS at four sites in Amhara Region, while residual efficacy of the same insecticide at one site in Gambella Region was only three months. The residual efficacy of SumiShield was five months at one site in Menge District in Benishangul-Gumuz and that of Fludora Fusion was 10 months in Abaya and Galana Districts. However, residual efficacy of Fludora Fusion on dung walls in Gelana District ranged from five to six months, depending on surface type and location.

1.3.4. Other Vector Control

Following the detection of *An. stephensi* in Ethiopia, the NMEP in collaboration with stakeholders, developed an October 2021 policy brief on monitoring and eliminating *An. stephensi*. Based on entomological data, LSM was selected as a potentially effective intervention for the control of *An. stephensi* in Ethiopia. Since August 2022, PMI has been supporting a pilot implementation of LSM in eight towns where *An. stephensi* was detected. Preliminary results from this pilot show a significant impact from LSM on entomological indicators. While awaiting final results, including epidemiological impact, PMI is planning the transition of LSM implementation to local governments with minimal support, to ensure broader coverage and sustainability. The NMEP also plans to implement LSM and has procured about 40,000 liters of Aquatain®, or polydimethylsiloxane, a silicon-based liquid larvicide, with Government of Ethiopia (GoE) funds for this purpose. PMI will work with the NMEP to ensure deployment of this larvicide in the most effective and safe way possible, considering concerns about its safety for aquatic life and its vulnerability to inefficacy with any disruptions to the aquatic surface membrane it forms.

2. Malaria in Pregnancy

2.1. PMI Goal and Strategic Approach

The draft NMSP recommends that all pregnant women living in malaria endemic areas should sleep under an ITN and have access to malaria diagnosis and treatment. Ethiopia's strategic plan does not recommend intermittent preventive treatment for pregnant women due to the relatively low malaria burden. The revised National Malaria Guidelines 2022 recommend providing weekly chloroquine (CQ) suppression to pregnant women with *P. vivax* infection until delivery and breastfeeding are completed. These guidelines also recommend treating pregnant women in any trimester with *P. falciparum* infection with artemether-lumefantrine.

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 line with national guidelines at antenatal care (ANC) clinics, as well as at adult outpatient departments and health posts where pregnant women may be seen. In addition, PMI works with the USAID Family Health Team and the FMoH Maternal and Child Health Directorate to increase ANC

attendance, which is not optimal in Ethiopia. A mini Demographic and Health Survey done in 2019 showed that 74 percent of women 15 to 49 years of age with a live birth in the 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.

2.2. Recent Progress (April 2022–April 2023)

- PMI procured and distributed 2.9 million nets in Afar, Benishangul-Gumuz, Gambella, and SNNP Regions to 5,212,610 people, of which 3.4 percent (177,229) were expected to have been given to pregnant women.
- As part of the above-mentioned net distribution campaign, PMI supported an SBC campaign that underlined the pregnancy-related benefits of sleeping under a net, including decreased maternal anemia and low birthweight, which reached 135,250 pregnant women and their families.
- PMI supported the provision of diagnosis and treatment services to almost 350 health facilities that offer ANC services, completed supervision visits in those facilities, and tracked malaria in pregnant women representing 1.5 percent of total malaria cases.

2.3. Plans and Justification for FY 2024 Funding

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

- PMI Ethiopia will continue to ensure that pregnant women are prioritized in ITN mass campaigns.
- PMI Ethiopia proposes to maintain the same level of funding targeting malaria case management for pregnant women with a focus on moderate to high malaria burden districts. This includes TA and program management support at the federal level to enable the provision of quality malaria in pregnancy case management.
- PMI Ethiopia will continue to support integrated (with maternal, newborn, child health, and nutrition programs) SBC activities to support women to overcome the barriers to ITN acquisition, use, and care, care-seeking for fever, and case management. More specifically, PMI will provide support to ensure health extension workers (HEWs) and other service providers are trained and provided with effective tools and skills identify barriers to ITN acquisition, use, and care and prompt care seeking for fever and to support women to overcome those barriers as part of a comprehensive ANC package. PMI will also support provider behavior change efforts, recognizing that quality of care and provider-client interactions influence pregnant women's decisions to return for future services and adopt and maintain recommended behaviors. 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 or other drug-based prevention in Ethiopia. However, PMI will support operational research to study the feasibility and effectiveness of malaria prevention and treatment approaches in migrant workers, which may include chemoprevention.

4. Case Management

4.1. PMI Goal and Strategic Approach

The draft NMSP 2024-2027 promotes a comprehensive case management strategy, including quality-assured parasitological testing of all suspected uncomplicated malaria cases, prompt and effective treatment with appropriate antimalarials for all confirmed uncomplicated cases, and emergent pre-referral and/or definitive management of severe febrile illness and severe malaria. PMI supports this approach through support to national level policy and programmatic activities, commodity procurement, and improvement of facility and community level health worker performance. PMI, in partnership with the Global Fund, also procures essential commodities for malaria diagnosis and treatment. Historically, PMI has funded procurement of chloroquine for *P. vivax* treatment, as well as injectable and rectal artesunate for severe malaria while Global Fund has procured malaria RDTs, ACTs to treat *P. falciparum*, and primaquine for both single low-dose to kill *P. falciparum* gametocytes and 14 days for radical cure of *P. vivax,* which is prescribed without glucose-6-phosphate dehydrogenase testing. Considering the high rates of histidine rich protein (*hrp2/hrp3)* gene deletions in Ethiopia, PMI has shifted to the procurement of non-HRP2 RDTs, and Global Fund recently made the decision to follow suit. PMI also finances mentoring and supportive supervision in 203 districts in 8 regions, while the remaining 718 malarious districts are supported through Global Fund.

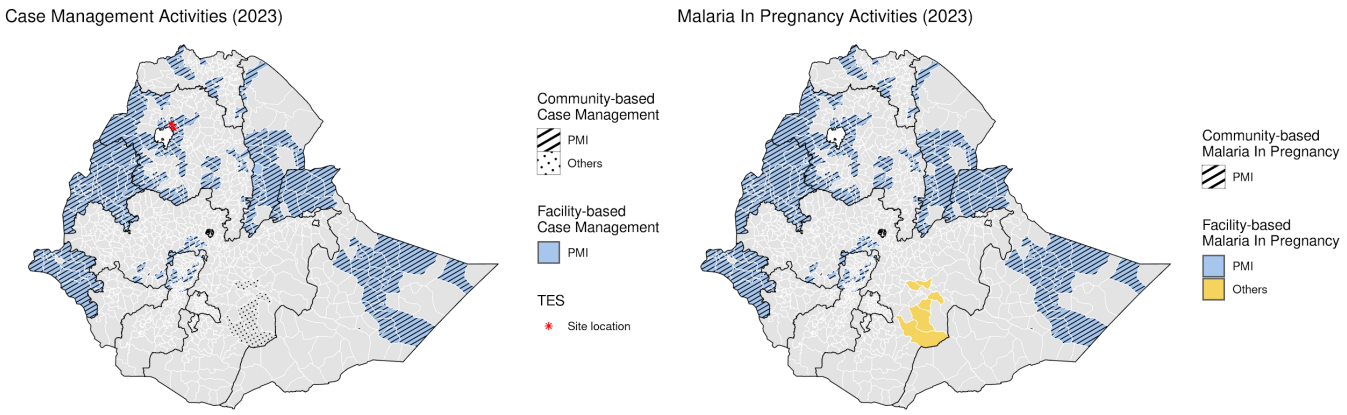
Through training, and supervision, PMI supports 1,563 HEWs in Ethiopia, to deliver community-based case management services in 1,400 health posts. These services include integrated community case management (iCCM), malaria community case management (mCCM) for all ages, and pre-referral rectal artesunate in 203 districts. The Ethiopian government pays HEW salaries. In 2021, 33-37 percent of confirmed malaria cases were managed at health post level. When compared to 2022, the number decreased to 27 percent nationally with wide regional variation (19 percent in Oromia, 25 percent in Amhara, 67 percent in Somali, and 43 percent in Afar). The reasons for this decrease in patients managed at health posts is not clearly known, but ongoing conflict and the expansion of the community based health insurance program are commonly cited reasons.

Ethiopia has a 15-year roadmap (2020–2035) to optimize the health extension program. According to this roadmap, health posts will be classified into three categories based mainly on accessibility. Health posts in villages (*kebeles*) that also have a health center or a primary hospital will be merged with the respective health center or hospital. Health posts in villages

that have access to a health center or a primary hospital within less than an hour of walking distance will continue providing the same service and will be known as basic health posts. Health posts in villages that are more than one hour walking distance from a health center or primary hospital will be upgraded to comprehensive health posts, which will provide basic curative services and use microscopy to diagnose malaria. In 2022, 17,534 health posts were assessed and 68 percent were classified as basic health posts, 11 percent as comprehensive, and 15 percent were merged with health centers or hospitals. The remaining 6 percent of health posts remained unclassified. Health posts in Tigray were not included in this categorization due to conflict and resulting inaccessibility.

The biggest challenge faced by the community health system is damage or looting during recent conflicts. In 2022, a total of 2,652 health posts out of the 17,457 in the country were damaged or looted. By region, 1728 of 3565 (48.5 percent) of health posts in Amhara 59 of 344 (17.2 percent) of health posts in Afar, 685 of 7126 (9.6 percent) of health posts in Oromia,172 of 424 (40.6 percent) of the health posts in Benishangul-Gumuz, and 8 of the 2,707 (.2 percent) of health posts in SNNP Regions were damaged or looted. Also, a report from the Ministry of Finance indicates 76 percent of health posts in Tigray have been damaged or looted. As a response, PMI is providing TA working with its implementing partners who have presence in Tigray, the WHO, and the NMEP to ensure availability of malaria commodities. PMI is also providing training and supervision for case management and surveillance, while the GoE and other development partners are working to restore damaged structures.

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



4.2. Recent Progress (April 2022–March 2023)

PMI contributed to the following achievements:

National Level Activities

- Helped revise the National Malaria Guidelines 2022, National Malaria Case Management Training Manual, and Integrated Malaria/Tuberculosis external quality assurance (EQA) Guidelines.
- Assisted the NMEP to establish a national malaria laboratory diagnosis technical working group.
- Assisted the NMEP to write a policy brief on histidine rich protein 2/3 deletions, which informed the decision for Ethiopia to shift to a non-HRP2 RDT.
- Provided technical and logistical support to the NMEP to respond to increased malaria cases in South West Ethiopia Peoples', Gambella, Amhara Regions, and Dire Dawa city administration.
- Provided technical and logistical support to the NMEP to respond to post-conflict malaria case management needs related to training and commodities in 171 conflict-affected health facilities in Amhara and Afar Regions.
- Strengthened quality assurance of malaria diagnostics in 16 private health facilities in Benishangul-Gumuz through training and supportive supervision.
- Helped coordinate relevant stakeholders to review the malaria section of the Integrated Refresher Training manual.
- Co-led monthly and ad hoc malaria case management technical working group meetings.
- Conducted malaria laboratory diagnosis training for 2,926 laboratory professionals in 203 PMI-supported districts.
- Provided in-service training to 3,708 health workers from 203 PMI-supported districts
- Provided training in laboratory equipment maintenance for 24 university lecturers from five biomedical engineering universities and supported the rollout of basic pre-service training in biomedical equipment maintenance training for 268 biomedical engineering students from Hawassa, Jimma, Gondar, and Addis Ababa universities.
- Initiated plans for an evaluation of supported cases management activities, which findings will inform future approaches.

Commodities

- Supported the procurement and distribution of 156,000 non-HRP2 malaria RDTs for the Amhara Region to pilot their implementation.
- Supported the procurement and distribution of 292 microscopes, lab supplies and equipment.
- Supported the procurement and distribution of 10 million tablets of chloroquine.
- Supported the procurement and distribution of 314,293 vials of injectable artesunate.

Facility Level:

- Out of the 428 PMI supported health facilities, 71-83 percent were supported with clinical supervision in each quarter.

- With PMI TA and Global Fund resources, the FMoH and EPHI scaled up malaria microscopy EQA. As a result, participation of health facilities in EQA increased from 58 percent (165 out of 283 facilities visited in a quarter) to 73 percent (260 out of 355 facilities visited in a quarter) within a year. The proportion of facilities participating in blind rechecking and scoring above 80 percent increased from 84 percent to 97 percent within a year.
- In supervised health facilities, the proportion of malaria cases treated according to the national guideline ranged from 79 percent (225 out of 285 facilities visited in a quarter) to 87 percent (265 out of 304 facilities visited in a quarter) in different quarters.
- Quarterly laboratory supervision was conducted for 62-83 percent of health facilities of the 428 PMI-supported facilities.
- The proportion of supervised health facilities that were found to have functional microscopes ranged from 77 percent (286 out of 370 facilities visited in a quarter) to 84 percent (255 out of 302 facilities visited in a quarter).
- Provided job aids, guidelines, and surveillance charts to 428 supported health centers and hospitals.

Community Level

- Provided job aids and surveillance charts to 1,400 supported health posts.
- Supported supervision of clinical case management in 1,400 health posts in FY 2022. The proportion of health posts that scored more than 80 percent for appropriate implementation of RDT, treatment, and data management guidelines improved from 43 percent (102/237) in quarter 1 of FY 2022 to 63 percent (97/154) in quarter 4 of FY 2022.

Please note that recent progress with monitoring antimalarial efficacy and the therapeutic efficacy studies (TES) approach is presented in the Plans and Justification for FY 2024 Funding section below.

4.3. Plans and Justification for FY 2024 Funding

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

National Level Case Management Activities

- PMI will continue to provide TA and program management support in malaria diagnosis and treatment for the FMoH, NMEP, RHBs, zonal health departments, *woreda* health offices, and targeted health facilities. In addition, PMI will continue to train laboratory personnel, clinical professionals, and program management staff to maintain high levels of knowledge in malaria case management guidelines and capacity.

- PMI will continue to provide financial support to national and subnational biomedical centers and biomedical engineering training programs to improve capacity in equipment maintenance and increase availability of functional equipment for malaria case management.

Commodities

PMI will continue to procure injectable artesunate, artesunate suppositories, and chloroquine to address the national need; and promote rational use, especially for injectable artesunate. PMI plans to procure 37,164 doses of rectal artesunate, and 300,000 vials of injectable artesunate and 10 million chloroquine tablets. The increase in malaria cases in the past three years has resulted in an increased need for RDTs and antimalarials drugs. To meet this increased need, the NMEP frontloaded Global Fund resources, which has resulted in large anticipated gaps in malaria commodities in subsequent years. In addition to putting increased efforts into reducing the current malaria burden, PMI plans to work with the NMEP and partners to address as much of this gap as possible in the Global Fund grant application that will be submitted in August 2023, to cover programmatic funding for 2024 to 2026. Also, to further reduce the gap of 11.9 million tests projected for 2025, PMI supports a strategic shift in the new NMSP that prioritizes the use of RDTs for symptomatic cases, as opposed to using RDTs for the detection of asymptomatic cases in malaria elimination settings as part of reactive case detection. For ACTs, PMI will reinforce the implementation of clinical guidelines to minimize treatment of unconfirmed cases to shrink the anticipated gap of 6.9 million doses. Similarly, PMI will work on promoting strict adherence to guidelines regarding the diagnosis and treatment of *P. vivax* malaria to further reduce the primaquine gap projected to reach 29.2 million in 2025. PMI anticipates successful burden reduction efforts to result in a reduction of the 892,400 estimated gap in chloroquine supplies. PMI will reprogram funds to procure additional chloroquine for FY 2024 and 2025 only if trends in the next year confirm a gap in order to avoid expiry and wastage of chloroquine at health facilities as experienced in recent years. Finally, PMI will support the implementation of new guidelines which limit treatment of severe malaria to hospitals to prevent non-rational use of injectable artesunate and decrease the current gap, which is estimated to be 113,292 vials.

Please refer to the ACT, RDT, injectable artesunate, and artesunate suppository Gap Tables in annex for more detail on planned quantities and distribution channels.

Facility Level

- PMI will continue to contribute financially and technically to national EQA activities and finance on-site evaluations for malaria microscopy as well as clinical mentoring in 338 targeted districts. PMI will provide support to improve clinical data quality focusing on data validity at the facility level.

- PMI will work directly with private clinics (including on-site clinics at farms and other workplaces) to improve malaria diagnosis and treatment among mobile and migrant populations.

Community Level

- PMI will support malaria community case management for all age groups and will conduct case management mentorship visits to approximately 5,400 of 12,815 health posts located in malaria-endemic areas. Global Fund support through the NMEP will cover the remaining health posts.
- Since Ethiopia is generally a low malaria burden country based on the WHO risk stratification, the Ethiopian national malaria guidelines recommend single, low-dose primaquine for the treatment of *P. falciparum* malaria and radical cure for *P. vivax* treatment. There is currently a projected gap in the primaquine need, but PMI is working with the Global Fund to address this need as they have traditionally procured primaquine.

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 AS-PY + single-dose of PQ Pv: CQ or AS-PY +14 days of PQ	In-country (AHRI) and 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	Gambella, Amhara, SNNP Regions	Pf: AL	In-country (AHRI) and CDC Atlanta

AHRI: Armauer Hansen Research Institute; AL: artemether-lumefantrine; AS-PY: artesunate-pyronaridine; CDC: Centers for Disease Control and Prevention; CQ: chloroquine; *Pf: Plasmodium falciparum*; *Pv: Plasmodium vivax*; PQ: primaquine; SNNP: South Nations', Nationalities, and Peoples'.

Other Planned Case Management Activities

- Since the 2021-2022 TES revealed concerning high prevalence of R622I Kelch mutations (more than 50% in the day of treatment failure samples), which has been associated with reduced artemisinin in-vitro susceptibility, PMI will be conducting a TES in 2023 for just *P. falciparum* with artemether-lumefantrine in up to four sites. Although

high efficacy (more than 95%) and no delayed parasite clearance were noted, Ethiopia has proactively included artesunate-pyronaridine as an alternative first-line treatment and dihydroartemisinin-piperaquine as the new second line treatment while they continue to deploy single low dose primaquine for *P. falciparum* throughout the country. With FY 2024 funding, PMI will conduct the next TES in 2025.

5. Health Supply Chain and Pharmaceutical Management

5.1. PMI Goal and Strategic Approach

PMI's main objective in supply chain and pharmaceutical management is to ensure continuous availability of quality products needed for malaria control and elimination at health facilities and community levels.

PMI's principal supply chain investments aim at improving malaria commodity availability at service delivery sites and includes: forecasting and supply planning TA to the FMoH; logistics management information systems capacity-building; data visibility improvement for assessing and monitoring stock status; increasing the Ethiopian Pharmaceutical Supply Services warehousing and distribution capabilities; procurement, distribution, and monitoring of ITNs; and procurement of antimalarials and diagnostic commodities. Overall, these focus areas align with the national supply chain strategy functional areas of forecasting, procurement, rational use of medicines, storage and distribution, and strategic data.

5.2. Recent Progress (April 2022–April 2023)

- For malaria treatment and diagnostic commodities, PMI supported EPSS to conduct monthly stock status risk analyses and plan mitigation interventions. Stock status information was shared regularly with the relevant stakeholders for informed decision making, and a multi-year malaria commodity stockout reduction plan was developed at the national level to guide investments and prioritize activities that continue to accelerate stockout reductions.
- PMI collected data between August and September 2022 for an end-use verification (EUV) assessment from 106 sampled health facilities in nine regions as well as the central EPSS hub and 14 sub-national warehouses. The data showed improvements in commodity availability compared to the previous EUV conducted in February 2021. PMI shared these findings with all relevant stakeholders and made recommendations on how to improve coordination between the FMoH and the different levels of the in-country supply chain system. To that effect, PMI supported platforms to strengthen coordination, including review meetings and performance improvement workshops aimed at improving reporting and reducing stockouts.
- In 2022, PMI supported site-level supportive supervision in about 2,000 selected health facilities on supply chain management for malaria diagnostic and treatment commodities to strengthen the stock management, rational dispensing, stock availability, and timely request of anti-malarial commodities and RDTs.

- Leveraging other United States government health programming resources, PMI supported the launch of a health commodity management information system called Dagu 2.1. This web-based logistics system provides real-time consumption data at the health facility level, automated alerts, and aims to strengthen last-mile delivery as well as ensure adequate stock on hand by providing automated alerts. The system is now implemented in 900 health facilities. A survey conducted in selected health facilities in Addis Ababa revealed that Dagu 2.1 deployment increased the availability of commodities by 20 percent.
- PMI provided technical support to the Ethiopian Food and Drug Administration on self-benchmarking for market control, regulatory inspection, and licensing for the establishment of regulatory functions according to WHO standards. The support ensured the completion of Ethiopian Food and Drug Administration's self-benchmarking exercise using the WHO's tool to achieve WHO's Maturity Level 3.
- PMI supported the Dire Dawa branch lab for International Organization for Standardization certification.

5.3. Plans and Justification with FY 2024 Funding

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

Despite the positive influence of USAID support in supply chain and pharmaceutical management in the past several years, there are still system and implementation level challenges. The current security situation makes it hard to reach multiple conflict-affected areas. Additionally, the recurrent issue of delayed procurement of Global Fund commodities leads to low stock status at the central EPSS hub, which contributes to resupply delays.

With FY 2024 funds, PMI plans to continue to support the NMEP's goal of ensuring continuous supply and availability of quality antimalarial products.

- PMI will continue to provide TA to FMoH and EPSS in quantification, supply planning, forecasting, drug management, requisition, drug exchange/transfer, tracking/disposal, and the development of supply chain of standard operating procedures and in-service training materials along with supporting EPSS's capacity to procure and distribute malaria products using a framework agreement.
- PMI will provide support to facilitate data triangulation and capturing actual consumption practices in health facilities, *woredas*, RHB, and EPSS hubs to address discrepancies between malaria cases (District Health Information Software 2) and medicines consumption data (Logistics Management Information System) as well as absence of actual consumption data.
- PMI will conduct two EUV assessments to review the availability of malaria commodities and understand how malaria is being diagnosed and treated at the facility and health post level.

- PMI will provide continued support to the Ethiopian Food and Drug Administration to regulate local manufacturers and provide TA to local manufactures on Good Manufacturing Practices, including addressing quality concerns of giemsa stain solution production.

6. Malaria Vaccine

In 2022, the FMoH formed a panel of malaria experts to analyze data and determine Ethiopia's eligibility for the malaria vaccine at the sub-national level. This analysis is aiming to stratify districts based on malaria incidence and mortality for children under five years old, as well as annual parasite index. The analysis is also looking at the country's capacity when it comes to the expanded immunization program and vaccine supply and logistics management. This work is ongoing and is expected to inform the country's decision of whether or not to apply to GAVI to support the procurement and targeted deployment of the malaria vaccine.

7. Social and Behavior Change

7.1. PMI Goal and Strategic Approach

Through the use of SBC interventions aligned with the Advocacy, Communication and Social Mobilization Guide for Malaria Elimination in Ethiopia, 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. PMI supports SBC activities that promote the uptake and maintenance of all key malaria interventions. To ensure the most strategic allocation of resources, the deployment of high quality, targeted SBC interventions for prioritized malaria behaviors will be supported, including ITN use and care and care-seeking for fever. PMI supports context-specific, evidence-based, community-based, and multimedia SBC activities designed to support individuals to overcome the barriers to the aforementioned prioritized behaviors. In addition, PMI supports national and sub-national capacity strengthening for malaria SBC and monitoring and evaluation of malaria SBC activities.

7.2. Recent Progress (April 2022–April 2023)

PMI achieved the following:

- Supported the design and implementation of SBC activities in 42 high burden districts in Benishangul-Gumuz, Gambella, and Amhara Regions and all the town kebeles of Dire Dawa where *An. stephensi* has been detected.
- Continued to support SBC activities focused on increasing correct and consistent use and care of ITNs among those with access to an ITN. According to the 2020 mini-Malaria Indicator Survey (MIS) 2020, the proportion of households with at least one ITN was 67 percent (ownership); the proportion of households with at least one ITN for every two people was 40 percent (access); and the proportion of the household population that slept under a net the previous night was 44 percent (use). Low use of ITNs (<50 percent) in low malaria burden districts poses a challenge. For example, in

2020, ITN use in high-burden regions like Gambella and Benishangul-Gumuz was 88 percent and 69 percent, respectively; whereas in low-burden regions like Oromia and Dire Dawa it was 40 percent and 15 percent, respectively.

- Continued supporting SBC activities to increase care-seeking for fever at facility based and community based service delivery points, leveraging the positive trend seen between 2015 and 2020. According to the 2015 MIS, advice or treatment was sought for 38 percent of children under five years of age, whereas according to the 2020 mini-MIS, advice or treatment was sought for 64 percent of children under five years of age. According to the 2020 mini-MIS, among this same group, 90 percent received a parasitological test for malaria.
- Initiated plans for the implementation of a malaria behavioral survey in order to better understand barriers to behaviors related to net use and prompt care seeking.
- Developed the National *An. stephensi* SBC Guide released in February 2023. The guide's development was informed by a community insights assessment in Dire Dawa, where implementation of activities recommended in the guide was supported by PMI.
- Organized road shows and market days, aligned with the ITN mass distribution in Gambella, Benishangul-Gumuz, and SNNP Regions that reached 135,250 individuals.
- Developed a demonstration video and radio spots on correct and consistent ITN use and care in six local languages (Amharic, Agnuak, Nuer, Mezenger, Arabic, and Gumuz).
- Completed a literature review to understand, learn from, and adapt existing malaria SBC activities.
- Implemented an integrated SBC baseline survey to better understand the factors that influence the practice of key malaria-related behaviors, including ITN use and care and prompt care-seeking for fever.
- Provided technical assistance to NMEP for the 2023 MPR with a focus on SBC and revitalization of the FMoH Health Promotion and Education Technical Working Group.

7.3. Plans and Justification with FY 2024 Funding

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

- PMI will support implementation of context-specific, evidence-based, and theory-informed malaria SBC interventions at individual, household and community levels, including community- and facility-level interpersonal communication activities, mass media, mid-media, and print media.
- PMI will conduct community-based surveillance activities to improve malaria case detection, care-seeking behavior, use of ITNs in low and very low malaria burden areas.
- PMI will coordinate between SBC and service delivery actors, including HEWs, to strengthen service communication through service providers during ANC visits and routine case management activities.
- PMI will support district and community-level SBC capacity strengthening to increase the capacity of actors to design and implement SBC activities.

- PMI will implement SBC activities associated with *An. stephensi* control, including ones that promote community acceptance of, and involvement in, LSM interventions (i.e., household larviciding, community larviciding, regularly finding and removing standing water, and covering water storage containers).

Priorities

PMI supports SBC activities that support individuals, household, and communities to overcome barriers to adopting and practicing all malaria interventions, based on behavioral outcome data from the 2020 mini-MIS; the following behaviors will be prioritized in FY 2024 (see Table 3).

Table 3. Priority Behaviors to Address

Behavior	Target Population	Geographic Focus	Programming to Address Behavior
Correct and consistent ITN use and care	Rural communities, urban dwellers, semi-urban settlers, and high-malaria risk regions	Benishangul- Gumuz, Gambella, Amhara, and other high-malaria burden regions	Conduct individual, household (door-to-door) and community-level interpersonal communication informed by data.
Prompt care-seeking for fever	Rural communities, urban dwellers, semi-urban settlers, migrant laborers in high-malaria risk regions	Benishangul- Gumuz, Gambella, Amhara, and other high-malaria burden regions	Conduct community- and household-level interpersonal communication informed by data. Improve health literacy of the community on the available malaria services through community health bazaar and health extension visits. Provide TA to media stations for production and airing of radio shows and spots to address barriers to prompt care-seeking informed by data.
Acceptance of and involvement in larval source management activities		Dire-Dawa	Work with the local authorities to improve knowledge and practices on community larval source management for individuals, households and communities, including removal of potential mosquitoes breeding sources and covering of water storage sites and containers, through multiple communication channels and community engagement platforms.

ITN: insecticide-treated mosquito nets; TA: technical assistance.

Additional Support Activities:

Other than routine monitoring of PMI-supported SBC activities, such as routine audience monitoring of outputs (e.g., reach and recall of malaria SBC activities) and intermediate outcomes (e.g., self-efficacy, attitudes, norms, etc.), PMI does not plan to support any

additional SBC data collection activities with FY 2024 funds. However, given the limited understanding of the factors that influence ITN use and care, prompt care-seeking for fever, and acceptance of and involvement in community participation in larval source management activities, in 2023, PMI supported an integrated SBC baseline survey to explore the factors that influence key malaria-related behaviors. Also, in 2024, PMI will support the implementation of the Malaria Behavior Survey to explore the behavioral, social, and environmental factors that influence the adoption and maintenance of malaria-related behaviors. Data from the integrated SBC baseline survey and Malaria Behavior Survey will be used to inform the design of PMI-supported SBC activities, including audience segmentation and selection of appropriate SBC channels.

8. Surveillance, Monitoring, and Evaluation

8.1. PMI Goal and Strategic Approach

In line with the current national health information system (HIS) strategy 2021-2025, which aims to improve evidence-based decision-making by ensuring availability, access, and use of quality data, PMI supported the roll-out and scale-up of the district health information system 2 (DHIS2) and the electronic community health information system (eCHIS). PMI prioritizes improving data quality by supporting routine data quality audits led by the GoE and data review meetings at districts, improving DHIS2 timeliness and completeness, and creating a data use “culture” to monitor malaria hot spots and respond immediately, especially in elimination districts. This includes improving data analysis and reporting through forms, wall charts, and quarterly review meetings, strengthening real time surveillance, and conducting foci investigations where appropriate.

PMI works with the FMoH and districts to address major challenges regarding data quality and access, discrepancies between different data sources, and inclusion of data from private facilities in Ethiopia. PMI’s support to the EFETP has also significantly improved malaria surveillance while leveraging usage of the PHEM. Numerous surveillance and external data evaluations have demonstrated the benefits of PHEM data in terms of completeness, timeliness, and quality. PHEM data, which is reported weekly, allows for timely response and is used in a malaria early warning system, Epidemic Prognosis Incorporating Disease and Environmental Monitoring for Integrated Assessment. This system incorporates climate data and provides alerts for potential future upsurges. In districts targeted for elimination, PMI piloted case based surveillance and implementation of the 1-3-7 model per national guidelines in two districts. This approach entails reporting a malaria case within a day of diagnosis, investigating this case within 3 days, and investigating the foci within a 70 meter radius of the case’s residence, as well as implementing a response within 7 days.

8.2. Recent Progress (April 2022–April 2023)In collaboration with the FMoH's data use partnership, which brings together the diverse partners working across the HIS, PMI supported the following activities in Ethiopia:

- Provided substantial support for SM&E strengthening activities, including onsite training of 4,675 health workers (HEWs, PHEM and HIS focal person) from health facilities and health posts on accurate recording and reporting of malaria indicators. PMI also provided job aids and register books, conducted supportive supervision and mentorship, and conducted quarterly review meetings in collaboration with RHBs.
- Support to PHEM focused on digitization to enhance reporting, enable reporting of indicators on a weekly basis, and strengthen capacity at district and health facility levels to generate quality data that can be analyzed and used for decision-making.
- Provided technical support to 73 *woreda* health offices covering 297 health facilities to conduct quarterly routine data quality audits and assess malaria and other indicators.
- Supported the implementation of eCHIS in 179 health posts in seven *woredas*, with plans to scale this system up with support from other partners.
- Conducted a baseline assessment in 57 PMI-supported districts targeted for malaria elimination. The assessment data will be used to develop tailored malaria surveillance and elimination activities.

8.3. Plans and Justification with FY 2024 Funding

The FY 2024 funding tables contain a full list of SM&E activities that PMI proposes to support.

With FY 2024 funding, PMI will:

- Strengthen surveillance in 57 districts targeted for elimination (see Figure 3) by training health workers from districts and health facilities, including private facilities, on quality data collection, reporting, and use for both DHIS2 and eCHIS. PMI will expand case and foci investigation following the 1-3-7 model from 2 to 6 districts, selecting these based on the findings of the baseline assessment mentioned above, with the aim of eventually scaling this up to all 57 districts. PMI will work with the *woredas (*regions) and the NMEP to identify best practices in surveillance and response in the context of increased burden, and scale them to shrink the malaria map.
- Continue to support DHIS2 and the expansion of eCHIS malaria modules in agrarian *woredas,* and finish developing a malaria module for pastoralist and urban eCHIS.
- Support cascade training for revised malaria indicators and strengthen routine data quality audits to improve malaria data quality at national, regional and *woreda* levels. Increase support to EPHI to improve completeness and timeliness of weekly malaria reported through PHEM, leveraging other U.S. government Global Health Security support.
- Continue to strengthen the capacity of teams at *woredas* and health facilities to analyze and use malaria data for decision-making through supervision and mentorship, both in

person and virtually, and support regular data triangulation of service, disease, and supply chain reports to address and limit discrepancies.

Figure 3: PMI Surveillance for Malaria Elimination (S4ME) *Woredas*, 2023

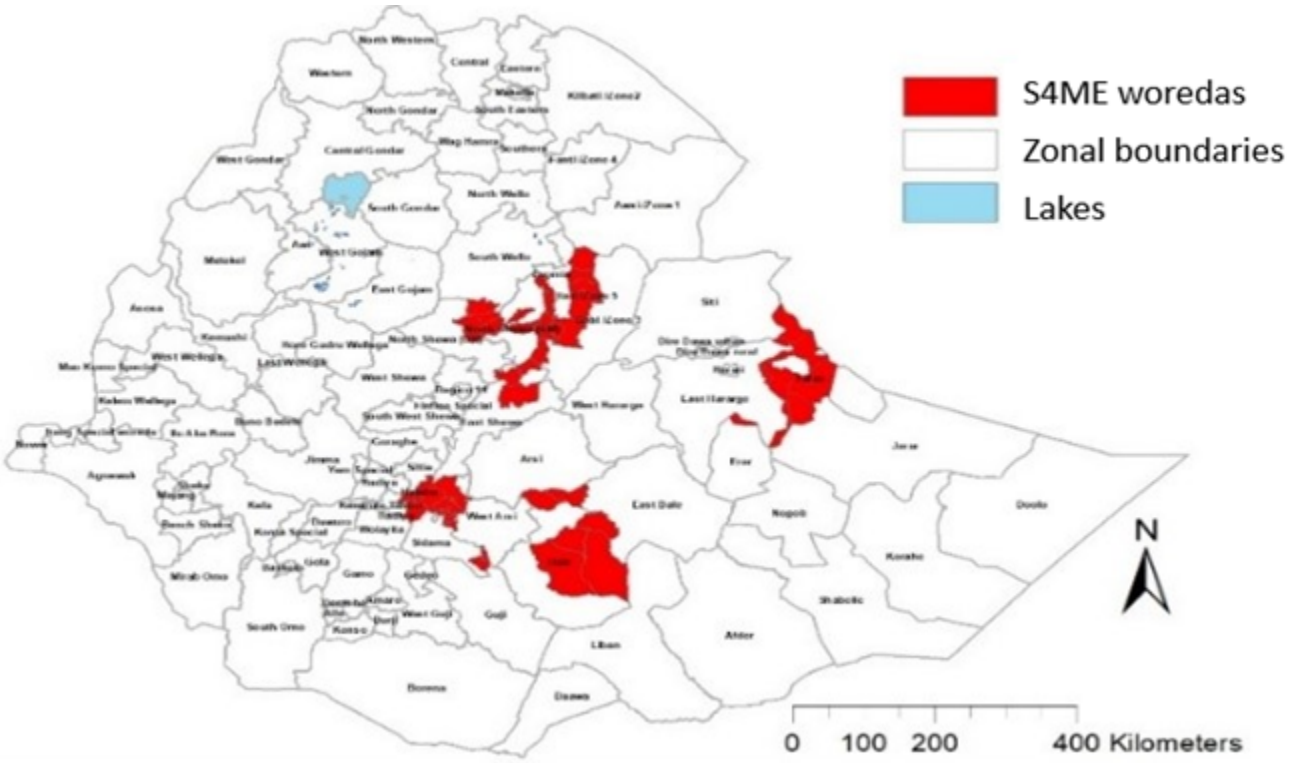


Table 4. Available Malaria Surveillance Sources

Source	Data Collection Activity	2020	2021	2022	2023	2024	2025
Household Surveys	Demographic Health Survey				P*#		
Household Surveys	Malaria Indicator Survey	X				P	
Household Surveys	Multiple Indicator Cluster Survey						
Household Surveys	Expanded Program on Immunization survey						
Health Facility Surveys	Service Provision Assessment				X*		
Health Facility Surveys	Service Availability Readiness Assessment survey						P*
Health Facility Surveys	Other Health Facility Survey						
Malaria Surveillance and Routine System Support	Therapeutic Efficacy Studies		X		P		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	X	X	X	X	P	P
Malaria Surveillance and Routine System Support	Support to Integrated Disease Surveillance and Response	X	X	X	X	P	P
Malaria Surveillance and Routine System Support	Electronic Logistics Management Information System (Dagu)	X	X	X	X	P	P
Malaria Surveillance and Routine System Support	Malaria Rapid Reporting System						
Other	End-use Verification Survey	X	X	X	X	P	P
Other	School-based Malaria Survey						
Other	Knowledge, Attitudes and Practices Survey, Malaria Behavior Survey					P	
Other	Malaria Impact Evaluation						
Other	Entomologic Monitoring Surveys	X	X	X	X	P	P

*Asterisk denotes non-PMI funded activities, X denotes completed activities and P denotes planned activities.
#The 2023 DHS will not include a malaria module.

9. Operational Research and Program Evaluation

9.1. PMI Goal and Strategic Approach

Priority areas for PMI Ethiopia's operations research (OR) are informed by the PMI strategy and the PMI OR priorities with input from the NMEP and the NMSP 2024–2027. The NMSP includes strengthening OR as a key implementation strategy and identifies 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 interventions for these populations; and to improve the effectiveness of antimalarial interventions, while anticipating program needs related to elimination activities. Also, PMI regularly sponsors various conferences involving universities, EPHI (the lead agency for public health research within FMoH), and partners to learn about ongoing in-country research and to harmonize PMI Ethiopia's OR priorities with FMoH research goals.

9.2. Recent Progress (April 2022–April 2023)

- The manuscript for the study to evaluate the safety of the primaquine radical cure for *P. vivax* without testing for glucose-6-phosphate dehydrogenase deficiency, which was completed in 2021, is drafted and undergoing review. The study detected no glucose-6-phosphate dehydrogenase deficient *P. vivax* patients and noted no serious adverse events in those prescribed primaquine radical cure.
- Data analysis for the cluster randomized controlled trial comparing targeted mass drug administration (tMDA) versus reactive case detection in Oromia was completed. The study, which covered two consecutive major malaria transmission seasons, showed that acceptance, coverage, and adherence for tMDA were high, while adverse events were low. Results regarding the impact of the interventions were inconclusive, as all three study arms (tMDA, reactive case detection, and control) showed significant declines in annual parasite index. This was thought to be mainly due to the low number of cases identified and investigated. The manuscript for this study is pending publication.
- Leveraging funding from the Bill and Melinda Gates Foundation (BMGF) and the Wellcome Trust, PMI, through TA and its routine vector surveillance activities, supported a prospective case control study to investigate the role of *An. stephensi* in malaria transmission following a dry season outbreak in Dire Dawa from April to July 2022. The study results showed spatial clustering of *P. falciparum* infections in the case contacts, but not the controls, with a strong association with the detection of *An. stephensi*; providing the first epidemiological evidence linking *An. stephensi* with an increase in urban malaria transmission in the Horn of Africa. The publication of this study manuscript is pending.
- Preliminary results after one year of monitoring the impact of PBO ITNs compared to IRS with standard ITNs showed a similar impact on epidemiological indicators. The IRS + standard ITN arms resulted in a 26.8 percent decrease in malaria cases from baseline to year 1 of the study compared to a 31.3 percent decrease in the PBO ITN arm. Descriptive analysis of entomological indicators revealed a 24 hour mortality of 65 percent and 34 percent for insectary and wild mosquitoes, respectively, 5 months after distribution in the PBO ITN arm compared to 34 percent for insectary mosquitoes in the IRS + standard ITN arm. This is compared to 100 percent and 97 percent for new PBO nets and 23 percent and 0 percent for new standard nets for insectary and wild mosquitoes, respectively. PMI plans to review the year 2 study data when available and will make a decision at that time on whether or not there is sufficient information regarding the performance of PBO nets to answer the study questions to end the study or to continue for a third year.

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

Recently Completed OR/PE Studies	Status of Dissemination	Start date	End date
RACD versus tMDA in malaria elimination districts	Manuscript pending publication	2020	2022
Ongoing or Planned OR/PE Studies	**Status**	**Start date**	**End date**
PBO versus IRS and standard nets efficacy study	Year one data analysis completed	June 2021	June 2023 or 2024

IRS: indoor residual spraying; OR/PE: operations research/program evaluation; PBO: piperonyl-butoxide; RACD: reactive case detection; tMDA: targeted mass drug administration

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
Norwegian Agency for Development Cooperation/Swedish International Development Cooperation Agency	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
NIH	Baylor University	Tracking the spread of a South Asian malaria vector in the Horn of Africa: A genetic approach	Sept. 2020–Aug. 2023
Wellcome Trust	Liverpool School of Tropical Medicine/AHRI	Controlling Emergent An. stephensi in Ethiopia and Sudan (CEASE) Project	Jan. 2021–Dec. 2024
BMGF	AHRI	ACHIDES: African Centre for hrp2/3 Deletion Surveillance	Feb. 2021–Jan. 2024
UNITAID	MMV	VivAction, Finding better tools for the diagnosis and treatment of *P. vivax* malaria	May 2021–Feb. 2025
BMGF/Wellcome Trust	AHRI	Implication of *An. stephensi* in an outbreak of Plasmodium falciparum parasites that carry markers of drug and diagnostic resistance in Dire Dawa City, Ethiopia.	Jan. 2022–July 2022
BMGF	Malaria Control and Elimination Partnership	High risk population interventions evaluation	Jan. 2022–Dec. 2023

	in Africa (MACEPA IV)/UCSF		
Sumitomo Chemical	Jimma University	Evaluation of the Efficacy and Residual Activity of Larvicide Formulations (SumiLarv™ 2MR, SumiLarv™ 0.5G & Abate® 1SG) for the Control of an Invasive Mosquito Species, *An. stephensi* Liston (Diptera: Culicidae) in Ethiopia	Jan. 2022–Dec. 2023
BMGF	University of Notre Dame/UCSF	Entomological Surveillance Planning Tool in Ethiopia	June 2022–Dec. 2023

AHRI: Armauer Hansen Research Institute; *An.: Anopheles;* NIH: National Institutes for Health; BMGF: Bill and Melinda Gates Foundation; MMV: Medicines for Malaria Venture; NIH: National Institutes for Health; UCSF: University of California San Francisco.

9.3. Plans and Justification with FY 2024 Funding

The FY 2024 funding tables contain a full list of OR/PE activities that PMI proposes to support.

- In order to address the issue of migrant workers moving between low transmission highlands and high transmission lowlands in pursuit of seasonal work and driving onward malaria transmission, PMI will work with the NMEP and MACEPA to study the feasibility and efficacy of different prevention and case management strategies for this population. PMI is working on finalizing the concept note for this study and will use funding allocated in the FY 2022 and FY 2023 MOPs along with additional, external resources to expand the types of interventions tested and improve the rigor of the evaluation.

10. Capacity Strengthening

10.1. PMI Goal and Strategic Approach

The draft NMSP envisions a health system strengthened with well-qualified and committed health workers to support malaria control and other health related efforts nationwide. In line with this vision, PMI Ethiopia supports capacity strengthening and malaria health improvements at regional, zonal, district, facility and community levels including data-driven decision making. Specifically, PMI supports both pre- and in-service training of health staff and addresses the shortage of malariologists and epidemiologists through the implementation of the EFETP. PMI also reinforces the capacity of partner GoE institutions, such as the NMEP,

EPHI, and Armauer Hansen Research Institute through TA, support of appropriate training, and material or financial support.

10.2. Recent Progress (April 2022–April 2023)

- To strengthen local leadership and move forward USAID's sustainability goals, PMI supported local institutions and organizations to build their technical and management capabilities. This included TA for ten universities and providing Armauer Hansen Research Institute with entomological equipment to ensure sustainability of entomological monitoring in Ethiopia.
- PMI Ethiopia strengthened the capacity of local organizations to conduct community-based malaria SBC to ensure increased ITN use and early treatment seeking from the community.
- To ensure increased use of malaria guidelines in clinical education and practice, PMI supported higher education institutions to align malaria course objectives with the current global recommendations and national guidelines. PMI supported the FMoH to convert the national malaria case management training manual into an online continuous professional development course. The online course is self-paced, and 578 health workers took the training over the past 12 months.
- PMI continued to support EFETP fellows to conduct numerous malaria research projects, outbreak investigations, and data analysis to inform decision-makers. Through their work focused on surveillance system evaluation and strengthening, EFETP fellows made significant contributions to the PHEM system. EFETP currently includes over 400 fellows from eight different universities, with PMI providing financial and mentorship support to 17 fellows participating in the two-year advanced program. In collaboration with the CDC National Center for Emerging and Zoonotic Infectious Diseases Border Health Team, five of these EFETP malaria track fellows are conducting research on the impact of population movements on the spread of malaria and *An. stephensi*.

10.3. Plans and Justification with FY 2024 Funding

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

With FY2024 funding, PMI will:

- Continue to support workforce development through pre-service education for six health care professional cadres: medical doctors, health officers, nurses, midwives, laboratory technicians, and pharmacy professionals.
- Continue to support at least four EFETP fellows per year in the advanced program. In addition to providing financial support, PMI will strive to strengthen coordination between the EFETP, the NMEP, and other strategic partners in order to broaden mentorship opportunities for fellows, gear project topics to address current malaria questions and needs, and ensure project findings are promptly and widely disseminated.

- Initiate support for the 3-month FETP Frontline program, which targets lower-level health-care workers and enrolls about 20 district surveillance officers per cohort. Through this new support, PMI aims to expand epidemiology and entomological capacity at the district level.
- Pending the return of Peace Corps Volunteers who left Ethiopia following the 2020 global evacuation due to COVID-19, PMI will support volunteers to conduct malaria SBC activities at the community level. Volunteers who have historically been engaged in ITN distribution and the promotion of ITN use are anticipated to return in early 2024.

11. Staffing and Administration

Six health professionals oversee PMI programming in Ethiopia. The single interagency team led by the USAID mission director, or their designee, consists of resident advisors representing USAID and 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	2023	2024	2025
Total country population	112,851,337	115,785,472	118,795,895
Total population at risk for malaria	77,867,423	79,891,976	81,969,167
PMI-targeted at-risk population	77,867,423	79,891,976	81,969,167
Population targeted for ITNs	43,447,765	56,155,954	57,616,009
Continuous distribution needs			
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
Mass Campaign Distribution Needs			
Mass distribution campaigns	18,562,876	8,146,014	9,244,078
Mass distribution ITN type	Single Pyrethroid	Dual AI	Dual AI
Estimated total need for campaigns	18,562,876	8,146,014	9,244,078
Total ITN Need: Continuous and Campaign	**18,562,876**	**8,146,014**	**9,244,078**
Partner Contributions			
ITNs carried over from previous year		1,523,862	0
ITNs from Government	0	678,078	0
Type of ITNs from Government	Single Pyrethroid	Dual AI and PBO	Dual AI and PBO
ITNs from Global Fund	17,096,133		
Type of ITNs from Global Fund	Single Pyrethroid	Dual AI and PBO	Dual AI and PBO
ITNs from other donors			
Type of ITNs from other donors			
ITNs planned with PMI funding	2,990,605	2,000,000	1,850,000
Type of ITNs with PMI funding	Single Pyrethroid	Dual AI	Dual AI
Total ITNs Contribution Per Calendar Year	**20,086,738**	**4,201,940**	**1,850,000**
Total ITN Surplus (Gap)	**1,523,862**	**(3,944,074)**	**(7,394,078)**

AI: active ingredient; ANC: antenatal care; ITN: insecticide-treated mosquito net; PBO: piperonyl-butoxide.

Table A-2. RDT Gap Analysis Table

Calendar Year	2023	2024	2025
Total country population	112,851,337	115,785,472	118,795,895
Population at risk for malaria	77,867,423	79,891,976	81,969,167
PMI-targeted at-risk population	77,867,423	79,891,976	81,969,167
RDT Needs			
Total # of projected suspected malaria cases	22,258,052	21,961,177	21,664,302
% of suspected malaria cases tested with an RDT	55%	55%	55%
RDT Needs (tests)	**12,241,929**	**12,078,647**	**11,915,366**
Needs estimated based on HMIS data	**12,241,929**	**12,078,647**	**11,915,366**
Partner Contributions (tests)			
RDTs from Government	0	0	0
RDTs from Global Fund	4,063,600	1,980,400	
RDTs from other donors			
RDTs planned with PMI funding	1,000,000		
Total RDT Contributions per Calendar Year	**5,063,600**	**1,980,400**	**0**
Stock Balance (tests)			
Beginning balance	9,826,225	2,647,896	0
- Product need	12,241,929	12,078,647	11,915,366
+ Total contributions (received/expected)	5,063,600	1,980,400	0
Ending Balance	**2,647,896**	**(7,450,351)**	**(11,915,366)**
Desired end of year stock (months of stock)	12	12	12
Desired end of year stock (quantities)	12,241,929	12,078,647	11,915,366
Total Surplus (Gap)	**(9,594,032)**	**(19,528,998)**	**(23,830,732)**

HMIS: health management information system; RDT: rapid diagnostic test..

Table A-3. ACT Gap Analysis Table

Calendar Year	2023	2024	2025
Total country population	112,851,337	115,785,472	118,795,895
Population at risk for malaria	77,867,423	79,891,976	81,969,167
PMI-targeted at-risk population	77,867,423	79,891,976	81,969,167
ACT Needs			
Total projected # of malaria cases	4,561,318	4,480,823	4,396,921
Total ACT Needs (treatments)	**6,932,880**	**6,932,880**	**6,932,880**
Needs estimated based on consumption data	**6,932,880**	**6,932,880**	**6,932,880**
Partner Contributions (treatments)			
ACTs from Government	0	0	0
ACTs from Global Fund	3,801,930	4,168,350	
ACTs from other donors			
ACTs planned with PMI funding	0	0	0
Total ACTs Contributions per Calendar Year	**3,801,930**	**4,168,350**	**0**
Stock Balance (treatments)			
Beginning balance	3,837,660	706,710	0
- Product need	6,932,880	6,932,880	6,932,880
+ Total contributions (received/expected)	3,801,930	4,168,350	0
Ending Balance	**706,710**	**(2,057,820)**	**(6,932,880)**
Desired end of year stock (months of stock)	12	12	12
Desired end of year stock (quantities)	6,932,880	6,932,880	6,932,880
Total Surplus (Gap)	**(6,226,170)**	**(8,990,700)**	**(13,865,760)**

ACT: artemisinin-based combination therapy.

Table A-4. Injectable Artesunate Gap Analysis Table

Calendar Year	2023	2024	2025
Injectable Artesunate Needs			
Projected # of severe cases	77,542	76,174	74,748
Projected # of severe cases among children	18,245	17,923	17,588
Average # of vials required for severe cases among children	6	6	6
Projected # of severe cases among adults	59,297	58,251	57,160
Average # of vials required for severe cases among adults	12	12	12
Total Injectable Artesunate Needs (vials)	**413,292**	**413,292**	**413,292**
Needs estimated based on consumption data	**413,292**	413,292	**413,292**
Partner Contributions (vials)			
Injectable artesunate from Government	0	0	0
Injectable artesunate from Global Fund	0	0	0
Injectable artesunate from other donors			
Injectable artesunate planned with PMI funding	314,293	298,350	300,000
Total Injectable Artesunate Contributions per Calendar Year	**314,293**	**298,350**	**300,000**
Stock Balance (vials)			
Beginning balance	125,015	26,016	0
- Product need	413,292	413,292	413,292
+ Total contributions (received/expected)	314,293	298,350	300,000
Ending Balance	**26,016**	**(88,926)**	**(113,292)**
Desired end of year stock (months of stock)	12	12	12
Desired end of year stock (quantities)	413,292	413,292	413,292
Total Surplus (Gap)	**(387,276)**	**(502,218)**	**(526,584)**

Table A-5. RAS Gap Analysis Table

Calendar Year	2023	2024	2025
Artesunate Suppository Needs			
# of severe cases expected to require pre-referral dose (or expected to require pre-referral dose based on number of providers for the service)	9,123	8,962	8,794
Total Artesunate Suppository Needs (suppositories)	**51,260**	**51,260**	**51,260**
Needs estimated based on # of providers offering pre-referral services	**51,260**	**51,260**	**51,260**
Partner Contributions (suppositories)			
Artesunate suppositories from Government	0	0	0
Artesunate suppositories from Global Fund	0	0	0
Artesunate suppositories from other donors			
Artesunate suppositories planned with PMI funding	0	65,356	37,164
Total Artesunate Suppositories Available	**0**	**65,356**	**37,164**
Stock Balance (suppositories)			
Beginning balance	2,160	0	14,096
- Product need	0	51,260	51,260
+ Total contributions (received/expected)	0	65,356	37,164
Ending Balance	**0**	**14,096**	**0**
Desired end of year stock (months of stock)	2	2	2
Desired end of year stock (quantities)	8,543	8,543	8,543
Total Surplus (Gap)	**(8,543)**	**5,553**	**(8,543)**

RAS: rectal artesunate suppositories.

Table A-6. Primaquine Gap Analysis Table

Calendar Year	2023	2024	2025
Total Country Population	112,851,337	115,785,472	118,795,895
Total population at risk for malaria	77,867,423	79,891,976	81,969,167
PMI-targeted at-risk population	77,867,423	79,891,976	81,969,167
Primaquine Needs			
Total projected # of malaria cases	4,561,318	4,480,823	4,396,921
Total projected # of *Pf* cases	3,603,441	3,539,850	3,473,568
Total projected # of *Pv* cases	912,264	896,165	879,384
Total projected # of mixed cases (*Pf* + *Pv*)	45,613	44,808	43,969
Total Primaquine Needs (tablets)	**29,265,600**	**29,265,600**	**29,265,600**
Needs estimated based on consumption data	**29,265,600**	**29,265,600**	**29,265,600**
Partner Contributions (tablets)			
Primaquine from Government	0	0	0
Primaquine from Global Fund	16,442,000	28,046,200	
Primaquine from other donors			
Primaquine planned with PMI funding			
Total Primaquine Contributions per Calendar Year	**16,442,000**	**28,046,200**	**0**
Stock Balance (tablets)			
Beginning balance	6,911,500	0	0
- Product need	29,265,600	29,265,600	29,265,600
+ Total contributions (received/expected)	16,442,000	28,046,200	0
Ending Balance	**(5,912,100)**	**(1,219,400)**	**(29,265,600)**
Desired end of year stock (months of stock)	12	12	12
Desired end of year stock (quantities)	29,265,600	29,265,600	29,265,600
Total Surplus (Gap)	**(35,177,700)**	**(30,485,000)**	**(58,531,200)**

Pf: Plasmodium falciparum; *Pv: Plasmodium vivax*.

Table A-7. Chloroquine Gap Analysis Table

Calendar Year	2023	2024	2025
Total country population	112,851,337	115,785,472	118,795,895
Population at risk for malaria	77,867,423	79,891,976	81,969,167
PMI-targeted at-risk population	77,867,423	79,891,976	81,969,167
Chloroquine Needs	**10,892,400**	**10,892,400**	**10,892,400**
Total projected number of malaria cases	4,561,318	4,480,823	4,396,921
Total projected number of *Pf* malaria cases	3,649,054	3,584,658	3,517,537
Total projected number of *Pv* malaria cases	912,264	896,165	879,384
Total Chloroquine Needs (tablets)	**10,892,400**	**10,892,400**	**10,892,400**
Needs estimated based on consumption data	**10,892,400**	**10,892,400**	**10,892,400**
Partner Contributions (tablets)			
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	7,300,000	4,000,000	10,000,000
Total Chloroquine Contributions per Calendar Year	**7,300,000**	**4,000,000**	**10,000,000**
Stock Balance (tablets)			
Beginning balance	1,885,000	0	0
- Product need	10,892,400	10,892,400	10,892,400
+ Total contributions (received/expected)	7,300,000	4,000,000	10,000,000
Ending balance	**(1,707,400)**	**(6,892,400)**	**(892,400)**
Desired end of year stock (months of stock)	12	12	12
Desired end of year stock (quantities)	10,892,400	10,892,400	10,892,400
Total Surplus (Gap)	**(12,599,800)**	**(17,784,800)**	**(11,784,800)**

Pf: Plasmodium falciparum; *Pv: Plasmodium vivax*.