U.S. PRESIDENT’S MALARIA INITIATIVE

Ethiopia

Malaria Operational Plan FY 2022
This FY 2022 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 2022 appropriation from U.S. Congress. Any updates will be reflected in revised postings.

This document was prepared in the early months of 2021 as the COVID-19 pandemic continued to evolve worldwide, including in PMI-focus countries. The effects of the pandemic on malaria control and elimination work in 2022 are difficult to predict. However, because U.S. Congressional appropriations for PMI are specific to work against malaria and any appropriations for work against the COVID-19 are specific for that purpose and planned through separate future U.S. Government planning processes, this FY 2022 MOP will not specifically address the malaria-COVID-19 interface and will reassess any complementary work through timely reprogramming in countries.
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ABBREVIATIONS

ACPR    Adequate clinical and parasitological response
ACT     Artemisinin-based combination therapy
AHRI    Armauer Hansen Research Institute
AI      Active ingredient
AL      Artemether-lumefantrine
ANC     Antenatal care
API     Annual parasite index
BMGF    Bill & Melinda Gates Foundation
C4H     Communication for Health
CDC     U.S. Centers for Disease Control and Prevention
CQ      Chloroquine
CY      Calendar year
DHA     Digital Health Activity
DHIS2   District Health Information Software 2
DHS     Demographic and Health Survey
DP      Dihydroartemisinin-piperaquine
eCHIS   Electronic Community Health Information System
EFDA    Ethiopian Food and Drug Administration
EFETP   Ethiopian Field Epidemiology Training Program
eHIS    Electronic Health Information System
EPHI    Ethiopian Public Health Institute
EPSA    Ethiopian Pharmaceuticals Supply Agency
EQA     External Quality Assessment
FMOH    Federal Ministry of Health
FTAT    Focal test and treat
FY      Fiscal year
Global Fund Global Fund to Fight AIDS, Tuberculosis, and Malaria
HEP     Health Extension Program
HEW     Health extension worker
HMIS    Health Management Information System
HP      Health post
iCCM    Integrated Community Case Management
IDP     Internally displaced person
IPTi    Intermittent preventive treatment in infants
IPTp    Intermittent preventive treatment for pregnant women
IRS     Indoor residual spraying
ITN     Insecticide-treated mosquito net
LLIN    Long-lasting insecticide-treated net
LMIS    Logistics Management Information System
MBS     Malaria Behavior Survey
MIP     Malaria in pregnancy
MIS     Malaria indicator survey
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>MOP</td>
<td>Malaria Operational Plan</td>
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<td>NMEP</td>
<td>National Malaria Elimination Program</td>
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<td>NMSP</td>
<td>National Malaria Strategic Plan</td>
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<td>OR</td>
<td>Operational research</td>
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<td>PBO</td>
<td>Piperonyl butoxide</td>
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<td>PE</td>
<td>Program evaluation</td>
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<td>PHEM</td>
<td>Public Health Emergency Management</td>
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<td>PMI</td>
<td>U.S. President’s Malaria Initiative</td>
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<td>PSC</td>
<td>Pyrethrum spray catch</td>
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<td>RDQA</td>
<td>Routine data quality audit</td>
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<tr>
<td>RDT</td>
<td>Rapid diagnostic test</td>
</tr>
<tr>
<td>RHB</td>
<td>Regional Health Bureau</td>
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<tr>
<td>SARA</td>
<td>Service Availability and Readiness Assessment</td>
</tr>
<tr>
<td>SBC</td>
<td>Social and behavior change</td>
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<tr>
<td>SDP</td>
<td>Service delivery point</td>
</tr>
<tr>
<td>SDPQ</td>
<td>Single-dose primaquine</td>
</tr>
<tr>
<td>SM&amp;E</td>
<td>Surveillance, monitoring, and evaluation</td>
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<tr>
<td>SMC</td>
<td>Seasonal malaria chemoprevention</td>
</tr>
<tr>
<td>SNNP</td>
<td>Southern Nations, Nationalities, and Peoples’</td>
</tr>
<tr>
<td>SP</td>
<td>Sulfadoxine-pyrimethamine</td>
</tr>
<tr>
<td>TA</td>
<td>Technical assistance</td>
</tr>
<tr>
<td>TES</td>
<td>Therapeutic efficacy study</td>
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<tr>
<td>tMDA</td>
<td>Targeted mass drug administration</td>
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<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
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<td>WHO</td>
<td>World Health Organization</td>
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**EXECUTIVE SUMMARY**

The U.S. President’s Malaria Initiative (PMI)—led by the U.S. Agency for International Development (USAID) and implemented together with the U.S. Centers for Disease Control and Prevention (CDC)—delivers cost-effective, lifesaving malaria interventions alongside catalytic technical and operational assistance to support Ethiopia to end malaria. PMI has been a proud partner of Ethiopia since 2008, helping to decrease child death rates by 52 percent from 123 per 1,000 live births in 2005 to 59 per 1,000 live births in 2019 (Mini-Demographic and Health Survey [DHS] 2019) through investments totaling almost $511.5 million.

The proposed PMI fiscal year (FY) 2022 budget for Ethiopia is $35 million. This Malaria Operational Plan (MOP) outlines planned PMI activities in Ethiopia using FY 2022 funds. Developed in consultation with the National Malaria Elimination Program (NMEP) and key malaria stakeholders, proposed activities reflect national and PMI strategies, draw on best-available data, and align with the country context and health system. Proposed PMI investments support and build on those made by the Government of Ethiopia as well as other donors and partners.

In Ethiopia, malaria is highly seasonal, and unstable with epidemic-prone transmission patterns in many parts of the country. Peak malaria transmission occurs between September and December, after the main rainy season from June to August. Some areas also experience a second minor malaria transmission period from April to June, following a short rainy season from February to March. According to the Malaria Indicator Surveys (MIS) in 2007 and 2015, there was a reduction in malaria prevalence from 0.9 percent in 2007 to 0.5 percent in 2015. Malaria morbidity has shown significant reduction as well. The number of confirmed malaria cases decreased by 31 percent between 2016 and 2020. Based on the Health Management Information System (HMIS) reports (2016–2020), malaria-related admissions have also significantly decreased over the same period. In particular, the decline in 2019 has been the greatest with only 15,307 admissions, down from over 30,000 admissions in 2018. Similarly, mortality due to malaria has decreased by 58 percent, from 510 in 2016 to 212 in 2020. In 2020, *Plasmodium vivax* accounted for 18 percent of malaria cases.

PMI will support investments in the following intervention areas with FY 2022 funds:

**Vector Control**

Progress and key results to-date:

- The National Malaria Strategic Plan (NMSP): 2021–2025 aims to cover 100 percent of the population at risk of malaria with one type of globally recommended vector control interventions by 2021.
- PMI cumulatively procured over 44 million insecticide-treated mosquito nets (ITNs) between 2008 and 2020 and has been supporting the Ethiopian Federal Ministry of Health (FMOH) to conduct indoor residual spraying (IRS) since 2008. Since 2014, PMI has also been supporting the national malaria program to conduct behavioral monitoring of malaria vectors and insecticide resistance surveillance, and supporting the coordination of insecticide resistance data for more timely reporting and analysis of data and implementation of appropriate interventions for local resistance profiles.
With FY 2020 funds, PMI procured and distributed 3,457,234 ITNs and also successfully completed the IRS campaign in 44 high malaria burden districts where 527,375 (95.6 percent) housing structures were sprayed and 1,511,778 residents protected.

Proposed investments with FY 2022 funding:

• With FY 2022 funds, PMI will procure ~3 million ITNs and continue to support safe and effective IRS implementation within 48 high-burden districts in the Amhara, Benishangul-Gumuz, and Gambela regions, in addition to continuing to provide limited IRS support to 70 graduated districts in the Oromia Region. In addition, PMI will continue to support NMEP to conduct entomological monitoring in selected sites. PMI is also planning to continue Anopheles stephensi surveillance and longitudinal monitoring and an evaluation of larvicides for An. stephensi control.

Case Management

Progress and key results to-date:

• The NMSP (2021–2025) aims to conduct confirmatory testing for 100 percent of suspected malaria cases and treat all confirmed cases according to the national guidelines by 2021.
• Since the launch of PMI, a total of 9,240,000 rapid diagnostic tests (RDTs) and 15,046,630 artemisinin-based combination therapy (ACT) treatment doses have been procured and distributed. In addition, in collaboration with regional and district health offices, PMI has supported and expanded health worker training, mentoring and supervision for quality malaria diagnosis using microscopy, and the management of malaria at district-level health centers and community-level health posts through integrated community case management (iCCM).

Proposed investments with FY 2022 funding:

• With FY 2022 funds, PMI will procure ~75,000 PfLDH/PvLDH-based RDTs, 44,179 doses of rectal artesunate, and 314,293 vials of injectable artesunate, and will continue to strengthen malaria diagnosis and treatment in the public health facilities. In addition, PMI is considering supporting the FMOH to strengthen malaria diagnosis and treatment in the private sector.

Malaria in Pregnancy (MIP) and Additional Drug-Based Preventative Strategies

Progress and key results to-date:

• The NMSP (2021–2025) does not recommend intermittent preventive treatment for pregnant women (IPTp), intermittent preventive treatment in infants (IPTi), or seasonal malaria chemoprevention (SMC). However in low and very low malaria transmission areas targeted for malaria elimination, the interventions include case investigation and targeted mass drug administration.

Proposed investments with FY 2022 funding:

• PMI will support the NMEP to implement the elimination strategy, which includes case investigation and targeted mass drug administration (tMDA).
**Supply Chain**

Progress and key results to-date:

- The NMSP (2021–2025) aims to improve the malaria supply chain and the quality of antimalarial commodities. PMI Ethiopia supports the NMEP to procure, store, and distribute antimalarial diagnostic and treatment commodities and ITNs to the last mile. In addition, PMI provides technical assistance (TA) to the Ethiopian Pharmaceuticals Supply Agency (EPSA) in supply planning and forecasting of malaria commodities.

Proposed investments with FY 2022 funding:

- With FY 2022 funds, PMI will continue supporting NMEP to have a continuous and sustainable availability of antimalarial commodities and continue to build capacity at EPSA. In addition, PMI will fill in the national commodity gap by procuring 2.99 million ITNs, 44,179 doses of rectal artesunate, and 314,293 vials of injectable artesunate.

**Surveillance, Monitoring, and Evaluation (SM&E)**

Progress and key results to-date:

- The NMSP (2021–2025) aims to improve malaria surveillance and response systems. PMI supports NMEP to strengthen the malaria SM&E system of Ethiopia as per the national strategic plan.
- In FY 2020, PMI conducted training of health workers from NMEP, Ethiopian Public Health Institute (EPHI), and Regional Health Bureau (RHB) on data quality, data analysis, real-time data transfer, and strengthening routine surveillance systems. PMI also supported EPHI to develop the malaria elimination assessment tool and supported EPHI to conduct a baseline assessment for malaria elimination.

Proposed investments with FY 2022 funding:

- With FY 2022 funds, PMI will continue supporting NMEP to strengthen the malaria SM&E system and expand the current SM&E support from 50 to 100 districts. In addition, PMI will support NMEP to build the capacity of the malaria program at the district, health facility, and community levels to collect, analyze, and utilize data to achieve the goal of malaria elimination.

**Program Evaluation & Operational Research (PE & OR)**

Progress and key results to-date:

- The NMSP (2021–2025) envisions the need for OR studies to guide and improve program decisions. PMI has supported OR in Ethiopia to address key program bottlenecks especially in building the evidence to improve *P. vivax* case management.
- Through FY 2014, PMI has supported OR projects including assessments of drug adherence, glucose-6-phosphate dehydrogenase deficiency prevalence, malaria serology studies exploring relationships between school-based children and community malaria prevalence, and the role of serology in MIS in low-transmission settings.
• With FY 2019 funds, PMI supported experimental hut trial OR to assess the entomological impact of piperonyl butoxide (PBO) ITNs and IRS and any antagonistic effects between PBO and organophosphate insecticide, pirimiphos-methyl, used in IRS. With FY 2020 funds, PMI is supporting OR to assess PBO/IRS co-deployment in the Amhara Region to determine whether PBO ITNs offer comparable impact to standard ITNs + IRS.

• PMI is currently conducting OR to assess the safety of primaquine radical cure without glucose-6-phosphate dehydrogenase testing for P. vivax case management and to evaluate the impact of reactive case detection compared to targeted mass drug administration in response to index cases in elimination areas.

Proposed investments with FY 2022 funding:

• Although no funds have been allocated, PMI is considering supporting NMEP to conduct the monitoring of possible pilot RDT (pf/pv LDH) implementation in areas with identified high HRP2/HRP3 deletion prevalence. In addition, Ethiopia has about 35 percent of malaria due to P. vivax and there is no radical cure intervention for pregnant women. PMI, therefore, would like to explore possible chloroquine suppression in pregnant women presenting with P. vivax.

Social Behavior Change (SBC)

Progress and key results to-date:

• The NMSP (2021–2025) aims to achieve adoption of appropriate behavior and practices toward antimalarial interventions by 85 percent of households living in malaria endemic areas by 2025. To achieve this objective, the NMEP will utilize health extension workers (HEWs), health development armies, and model family households to deliver SBC interventions.

• Since 2014, PMI has initiated and supported two local organizations’ community-based malaria SBC activities as part of the USAID/Ethiopia local capacity development program.

Proposed investments with FY 2022 funding:

• With FY 2022 funds, PMI will focus on adoption of recommended malaria behaviors at household and families levels through community/school engagement, interpersonal communication, and mobilizing leaders, champions, and influencers.

• Integrated SBC and vector control activities for An. stephensi control will be supported.

Health Systems Strengthening (HSS)

Progress and key results to-date:

• As outlined in the NMSP, substantial resources are needed to strengthen health systems and to provide capacity-building for malaria control and elimination in Ethiopia. PMI has historically strengthened the health systems in Ethiopia by creating competent health professionals, strengthening human resources for health management and regulation for improved distribution and performance of the health workforce, and improving malaria data collection, reporting, analysis, and utilization at all levels.

Proposed investments with FY 2022 funding:
• With FY 2022 funds, PMI will continue supporting the improvement of the health workforce for malaria elimination and is proposing to scale up a malaria module developed as part of the electronic community health information system (eCHIS). PMI will prioritize malaria endemic areas in the selection of districts for the implementation of eCHIS. In addition, PMI will continue to support the development and implementation of ITN tracking tools during ITN distribution campaigns and improve the supply chain information system.

PMI supported NMEP and other key malaria stakeholders to develop the NMSP for 2021–2025. The latest NMSP aims to reduce malaria morbidity and mortality by 50 percent from the 2020 baseline and achieve zero indigenous malaria in districts with annual parasite index less than 10 and prevent reintroduction of malaria in districts reporting zero indigenous malaria cases by 2025. The new NMSP prioritizes achieving malaria elimination by 2030 by expanding malaria elimination districts through strengthening malaria surveillance and response. PMI also contributed to a new stratification strategy based on current evidence, specifically the annual parasite index, to adapt and implement malaria prevention and control methods specific to the unique malaria epidemiology in each strata.
I. INTRODUCTION

The U.S. President’s Malaria Initiative (PMI)—led by the U.S. Agency for International Development (USAID) and implemented together with the U.S. Centers for Disease Control and Prevention (CDC)—delivers cost-effective, lifesaving malaria interventions alongside catalytic technical and operational assistance to support Ethiopia to end malaria. PMI has been a proud partner of Ethiopia since 2008, helping to decrease child death rates by 52 percent from 123 per 1,000 live births in 2005 to 59 per 1,000 live births in 2019 (Mini-DHS 2019) through investments totaling almost $511.5 million.

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### Ethiopia at a Glance

- **Geography:** Ethiopia is located in the Horn of Africa bordering six countries: Eritrea, Djibouti, Somalia, Kenya, South Sudan, and Sudan. The country has an area of 1.1 million square kilometers with altitude ranging from 4,620 meters above sea level at Ras Dashen Mountain to 148 meters below sea level at the Danakil (Dallol) Depression. More than half of the country lies above 1,500 meters.

- **Climate and Malaria Transmission Seasonality:** Ethiopia is characterized by diverse climates, which translates into diverse vegetation zones with average annual temperature of 23.1°C. Coldest temperatures: about 5°C (November to January) over the highlands of Central, North, and Southeast. Warmest temperatures: about 37°C (March to May/June) in Northeast (Afar) and South-East Lowlands. Ethiopian weather is also influenced by tropical Indian Ocean conditions and global weather patterns, including El Niño and La Niña. Peak malaria transmission occurs between September and December, after the main rainy season from June to August.


- **Population at Risk of Malaria:** 52 percent (National Malaria Elimination Strategic Plan: 2021–2025). The highest malaria burden regions are usually areas of stable and intense malaria transmission with altitudes below 1,000 meters located mainly in the western lowlands of the country comprising 53.5 million people primarily living in areas of Gambela, Benishangul-Gumuz, Western Oromia, Amhara, some parts of South Nations, Nationalities and Peoples, and Tigray regions.

- **Principal Malaria Parasites:** Based on 2015–2019 malaria parasite data obtained from 25 malaria sentinel sites, a quarter (25%, n = 410,409) of the total 1,620,885 suspected cases were malaria positive with *Plasmodium falciparum* accounting for about 65% and the rest were mainly due to *P. vivax*. However, the rate for *P. falciparum* (80.1%) was higher in the lowlands while *P. vivax* (33.2%) was relatively higher in the highlands (National Malaria Elimination Strategic Plan: 2021–2025).

- **Principal Malaria Vectors:** *Anopheles arabiensis*, a member of the *An. gambiae complex*, is the main malaria vector in Ethiopia with a wide geographical distribution. Other malaria vectors such as *An. funestus*, *An. Pharoensis*, and *An. nili* are considered as secondary malaria vectors with limited distribution. A recent
study confirmed that *An. stephensi* is widely distributed and established in eastern Ethiopia. Studies are ongoing to evaluate the distribution of *An. stephensi* in other parts of the country.¹

- **Malaria Case Incidence per 1000 Population:** 28 per 1,000 population at risk in 2020 (FMOH Annual Performance Report 2020–2019)

- **Under-Five Mortality Rate:** 59 per 1,000 live births (2019 Ethiopian mini DHS)

- **World Bank Income Classification and Gross Domestic Product (GDP):** Ethiopia is classified under the “low-income economies ($1,035 or less)” (https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups)

- **Government Health Budget:** 12% of the total government budget

- **Trafficking in Persons Designations, 2018–2020:** Ethiopia was under Tier 2 in 2018 to 2020. More recently expanding insecurity situations in Tigray are increasing internally displaced persons (IDPs) and concerns for human rights violations. (Trafficking in Persons Reports, 2018, 2019, and 2020, Department of State, USA)

- **Malaria Funding and Program Support Partners Include:**
  - U.S. President’s Malaria Initiative (PMI)
  - Global Fund to Fight AIDS, Tuberculosis, and Malaria (Global Fund)
  - World Health Organization (WHO)
  - United Nations Children’s Fund (UNICEF)
  - Bill & Melinda Gates Foundation (BMGF)
  - Ethiopian Public Health Institute (EPHI)
  - Armauer Hansen Research Institute (AHRI)
  - Ethiopian Pharmaceuticals Supply Agency (EPSA)
  - Jimma University, Arba Minch University, Addis Ababa University (School of Health Sciences, Aklilu Lemma Institute of Pathobiology and School of Public Health)

- **PMI Support of National Malaria Control Strategy:** As per the National Malaria Elimination Strategic Plan (NMSP): 2021–2025, PMI’s support in Ethiopia includes: vector control through indoor residual spraying (IRS) and long-lasting insecticide treated mosquito nets (ITNs), strengthening the quality of malaria diagnosis and treatment services, procurement of commodities to address national gaps, and community-based malaria social behavior change (SBC) activities. PMI supports the highly needed malaria surveillance, monitoring, and evaluation in malaria elimination efforts. In addition, PMI builds capacity of the malaria program at all levels to improve planning, implementation, coordination and monitoring of malaria elimination activities, the capacity for developing and implementing operational research (OR), supply chain management systems, and the electronic Health Information System (eHIS) to improve evidence-based decision-making. (See III. Overview of PMI’s support of Ethiopia’s Malaria Elimination Strategy for additional details.)

- **PMI Investments:** Ethiopia began implementation as a PMI-focus country in FY 2008. The proposed FY 2022 PMI budget for Ethiopia is $35 million. This brings the total PMI investment to nearly $511.5 million.

PMI organizes its investments around the activities below, in line with the Ethiopia national malaria elimination strategy (2021–2025).

Figure 1. PMI’s approach to end malaria

Building and strengthening the capacity of Ethiopia’s people and institutions—from the central level to communities—to effectively lead and implement evidence-based malaria control and elimination activities is paramount to PMI. The majority of PMI’s planned support for FY 2022, across the areas of vector control, human health, and critical support systems such as supply chain, contain elements of capacity-building and system strengthening. PMI/Ethiopia will continue to rely on and engage with local partners—such as Health, Development, and Antimalaria Association to expand its SBC activities, and the Armauer Hansen Research Institute (AHRI) and local universities for operational research and entomological surveillance activities—and is expanding its local partner base to reach recalcitrant high malaria burden districts and expand malaria elimination districts. Finally, PMI/Ethiopia will continue to rely on private sector partnerships such as Addis Continental

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2A number of actions are cross-cutting in nature. For example, social and behavioral change (SBC) is embedded in all vector control and human health work; program evaluation (PE) and operational research (OR) are relevant in all of the fieldwork; finance and management support and the introduction of new tools/interventions are critical for all programs; and elimination requires work across the full spectrum of transmission.
Institute of Public Health and workplace activities to reach high-risk populations in implementing PMI supported activities.

To accelerate sustainable development, PMI developed a programmatic inventory to assess the strengths and persistent challenges of Ethiopia’s program (see Annex B). The activities proposed in this MOP are tailored to draw on these strengths and address weaknesses; activities will be monitored to evaluate the effectiveness of capacity-building efforts. In addition, while PMI understands it will take time for Ethiopia to fully finance its development priorities, PMI will work with other partners (e.g., the Global Fund) to jointly track Ethiopia’s funding commitments across the malaria portfolio.

II. MALARIA SITUATION AND PROGRESS

In Ethiopia, malaria is highly seasonal, and unstable with epidemic-prone transmission patterns in many parts of the country. *Plasmodium falciparum* and *P. vivax* are the major malaria parasites. *Anopheles arabiensis* is the primary malaria vector in Ethiopia, with *An. funestus*, *An. pharoensis*, and *An. nili* as secondary vectors. *An. stephensi*, an invasive, urban vector with artificial container breeding sites, has been identified as well. Peak malaria transmission occurs between September and December, after the main rainy season from June to August. In addition, some areas experience a second minor malaria transmission period from April to June, following a short rainy season from February to March. Because peak malaria transmission often coincides with the planting and harvesting season, the majority of malaria burden is among older children and working adults in rural agricultural areas, thus there is a resultant heavy economic burden in Ethiopia. Although historically Ethiopia has been prone to periodic widespread malaria epidemics, they have been largely absent since 2004 after the scale-up of malaria control interventions.

Figure 2. Trends in malaria prevalence
*Children 6 to 59 months of age who tested positive for malaria by microscopy and RDT 2007–2015*

*Prevalence estimates for 2011 are for all ages.*
Figure 3. Trends in suspected* and confirmed malaria cases

*Suspected malaria cases are not collected in the HMIS but have been calculated by summing the number of tested patients plus clinically treated as presumed cases.

Figure 4. Malaria risk map of districts categorized by annual parasite index (API), Ethiopia, 2020
Table 1. Malaria stratification with estimated population distribution, NMEP, June 2020

<table>
<thead>
<tr>
<th>Malaria Strata</th>
<th>API* (case/1,000)</th>
<th>Population (2020)</th>
<th>% Population</th>
<th>No. of Woreda</th>
<th>% Woreda</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free</td>
<td>0</td>
<td>49,272,928</td>
<td>47.9</td>
<td>236</td>
<td>22.6</td>
</tr>
<tr>
<td>Very low</td>
<td>&gt;0 &amp; &lt;5</td>
<td>30,168,016</td>
<td>29.3</td>
<td>485</td>
<td>46.4</td>
</tr>
<tr>
<td>Low</td>
<td>&gt;=5 &amp; &lt;10</td>
<td>4,999,818</td>
<td>4.9</td>
<td>80</td>
<td>7.6</td>
</tr>
<tr>
<td>Moderate</td>
<td>&gt;=10 &amp; &lt;50</td>
<td>13,480,217</td>
<td>13.1</td>
<td>177</td>
<td>16.9</td>
</tr>
<tr>
<td>High</td>
<td>&gt;=50</td>
<td>4,929,814</td>
<td>4.8</td>
<td>68</td>
<td>6.5</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>102,850,793</td>
<td>100%</td>
<td>1046</td>
<td>100%</td>
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</table>

*API = Annual parasite index

Table 2. Key indicators from malaria indicator surveys (MIS) and mini-DHS 2007–2020

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<tr>
<td>% Households with at least one ITN</td>
<td>65</td>
<td>55</td>
<td>64</td>
<td>64.8</td>
<td>66.8</td>
</tr>
<tr>
<td>% Households with at least one ITN for every two people</td>
<td>37</td>
<td>24</td>
<td>32</td>
<td>39.3</td>
<td>40.3</td>
</tr>
<tr>
<td>% Population with access to an ITN</td>
<td>N/A</td>
<td>N/A</td>
<td>49</td>
<td>N/A</td>
<td>48</td>
</tr>
<tr>
<td>% Population that slept under an ITN the previous night</td>
<td>N/A</td>
<td>25</td>
<td>40</td>
<td>42.6</td>
<td>44.2</td>
</tr>
<tr>
<td>% Children under five years of age who slept under an ITN the previous night</td>
<td>41</td>
<td>38</td>
<td>45</td>
<td>51.4</td>
<td>52.3</td>
</tr>
<tr>
<td>% Pregnant women who slept under an ITN the previous night</td>
<td>43</td>
<td>35</td>
<td>44</td>
<td>59.1</td>
<td>62.0</td>
</tr>
<tr>
<td>% Children under five years of age with a fever in the last two weeks for whom advice or treatment was sought within 24 hours</td>
<td>16</td>
<td>51</td>
<td>38**</td>
<td>N/A</td>
<td>64.0</td>
</tr>
<tr>
<td>% Children under five years of age with a fever in the last two weeks who had a finger or heel stick</td>
<td>N/A</td>
<td>17</td>
<td>17</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>% Children receiving an ACT among children under five years of age with a fever in the last two weeks who received any antimalarial drug</td>
<td>N/A</td>
<td>29</td>
<td>89</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>-----------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
<td>------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>% Women who received two or more doses of IPTp during their last pregnancy in the last two years</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>% Women who received three or more doses of IPTp during their last pregnancy in the last two years</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Under-five mortality rate per 1,000 live births</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>67</td>
<td>59</td>
</tr>
<tr>
<td>% Children under five years of age with parasitemia by microscopy</td>
<td>0.6</td>
<td>1.3†</td>
<td>0.6</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>% Children under five years of age with parasitemia by RDT</td>
<td>1.7</td>
<td>4.5†</td>
<td>1.4</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>% Children under five years of age with severe anemia (Hb&lt;8gm/dl)</td>
<td>5.5</td>
<td>0.7</td>
<td>6.0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*The 2017 and 2020 mini surveys were post-ITN distribution cross-sectional, household surveys that were implemented using a standardized questionnaire.
**Seeking care not limited to within 24 hours.
†In all ages.

Table 3. Evolution of key malaria indicators reported through routine surveillance systems

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td># Suspect malaria cases¹</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>HMIS/DHIS2</td>
</tr>
<tr>
<td># Patients receiving diagnostic test for malaria²</td>
<td>6,378,352</td>
<td>6,246,949</td>
<td>6,115,025</td>
<td>5,655,309</td>
<td>6,873,798</td>
<td>FMOH Annual Performance Report 2020</td>
</tr>
<tr>
<td>Total # malaria cases³</td>
<td>2,320,135</td>
<td>1,755,748</td>
<td>1,206,891</td>
<td>993,999</td>
<td>1,509,182</td>
<td>FMOH Annual Performance Report 2020</td>
</tr>
<tr>
<td># Confirmed cases⁴</td>
<td>2,033,310</td>
<td>1,530,739</td>
<td>989,182</td>
<td>904,495</td>
<td>1,398,750</td>
<td>FMOH Annual Performance Report 2020</td>
</tr>
<tr>
<td># Presumed cases⁵</td>
<td>286,825</td>
<td>225,009</td>
<td>217,709</td>
<td>89,504</td>
<td>110,432</td>
<td>FMOH Annual Performance Report 2020</td>
</tr>
<tr>
<td>% Malaria cases confirmed⁶</td>
<td>88%</td>
<td>87%</td>
<td>82%</td>
<td>91%</td>
<td>93%</td>
<td>FMOH Annual Performance Report 2020</td>
</tr>
<tr>
<td>Indicator</td>
<td>2016</td>
<td>2017</td>
<td>2018</td>
<td>2019</td>
<td>2020</td>
<td>Source</td>
</tr>
<tr>
<td>-----------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>--------</td>
</tr>
<tr>
<td>Test positivity rate (TPR)(^1)</td>
<td>32%</td>
<td>25%</td>
<td>16%</td>
<td>16%</td>
<td>20%</td>
<td>FMOH Annual Perf Report 2020; DHIS2</td>
</tr>
<tr>
<td>Total # &lt;5 malaria cases(^8)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>% Cases in children&lt;5(^9)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Total # severe cases(^10)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>Total # malaria deaths(^11)</td>
<td>510</td>
<td>356</td>
<td>158</td>
<td>213</td>
<td>212</td>
<td>Annual Perf Report 2019–2020</td>
</tr>
<tr>
<td>% Data completeness(^13)</td>
<td>98%</td>
<td>97%</td>
<td>N/A</td>
<td>86%</td>
<td>92%</td>
<td>HMIS/DHIS2</td>
</tr>
</tbody>
</table>

1. Number of patients presenting with signs or symptoms possibly due to malaria (e.g., fever). 2. RDT or microscopy, all ages, outpatient and inpatient. 3. Total reported malaria cases; all ages, outpatient and inpatient, confirmed and unconfirmed cases. 4. Diagnostically confirmed; all ages, outpatient and inpatient. 5. Clinical/presumed/unconfirmed; all ages, outpatient and inpatient. 6. # confirmed cases divided by total # cases. 7. Confirmed cases divided by # patients receiving a diagnostic test for malaria (RDT or microscopy). 8. Outpatient and inpatient, confirmed and unconfirmed. 9. Total # <5 cases divided by total # of cases. 10. In Ethiopia, any case of malaria admission is defined as severe but this indicator is not included in their annual reports. 11. All ages, outpatient, inpatient, confirmed, and unconfirmed. 12. Total # of health facilities reporting data into the HMIS/DHIS2 system that year. 13. # monthly reports from health facilities divided by # health facility reports expected.

### III. OVERVIEW OF PMI’S SUPPORT OF ETHIOPIA’S MALARIA STRATEGY

The national malaria strategic plan (NMSP) goals and objectives for 2021–2025 include the following:

**Goals**

- By 2025, reduce malaria morbidity and mortality by 50 percent from 2020 baseline.
- By 2025, achieve zero indigenous malaria in districts with annual parasite index less than 10 and prevent reintroduction of malaria in districts reporting zero indigenous malaria cases.

**Strategic Objectives**

- By 2025, achieve adoption of appropriate behavior and practices toward antimalarial interventions by 85 percent households living in malaria endemic areas.
- By 2021 and beyond, conduct confirmatory testing for 100 percent of suspected malaria cases and treat all confirmed cases according to the national guidelines.
- By 2021 and beyond, cover 100 percent of the population at risk of malaria with one type of globally recommended vector control interventions.
- By 2021 and beyond, conduct cases or foci investigation, classification, and response in districts currently having annual parasite index (API) less than 10 and prevent reintroduction of malaria into areas reporting zero indigenous malaria cases.
- By 2021 and beyond, generate 100 percent evidence that facilitates appropriate decision-making.
• By 2021 and beyond, build capacity of all levels of the health offices to coordinate and implement malaria elimination interventions.

The Ethiopia national malaria elimination strategic plan proposes to eliminate malaria in districts with an annual parasite index less than 10 by 2025 and the total elimination of malaria from Ethiopia by 2030. Ethiopia has declared malaria elimination efforts in 236 selected districts, encompassing six different regions, starting in 2017. The criteria for enrolling districts for malaria elimination included selecting districts with low or very low malaria transmission (API less than 10), availability of district level surveillance data, high coverage of vector control interventions, adequate access to treatment, limited cross-border population movement, and logistical feasibility. To achieve elimination targets, the Ethiopia FMOH will focus on engagement and governance at different levels by strengthening partnerships from the national to community level. A strong political commitment from the RHBs will be critical in all aspects of malaria prevention and control.

Additional areas of focus in selected malaria elimination districts include maximizing health facility capabilities for active case detection and 100 percent case laboratory confirmation, community involvement and ownership, private sector roles and partnerships, investigating elimination tools such as mass drug administration approaches, and improving surveillance systems for case detection and reporting. The Ethiopia FMOH has developed a malaria elimination technical document to guide the implementation of malaria elimination activities.

Global Fund resources are used to procure the majority of ITNs, ACTs, and RDTs; procure insecticides for IRS; and support gaps in case management strengthening. PMI supports gaps in malaria commodities; provides coordination and TA for supply chain management and surveillance, monitoring, and evaluation; supports TA and operational support for IRS in Western Ethiopia with high rates of malaria burden; and supports malaria case management strengthening in selected facilities throughout Ethiopia (Figure 5).

Figure 5. Map of target areas for PMI interventions
IV. PARTNER FUNDING LANDSCAPE

PMI emphasizes the importance of partner alignment for malaria control, recognizing that different partners bring complementary expertise and resources. In recent years, PMI, the Global Fund, and the Bill & Melinda Gates Foundation (BMGF) have harmonized financial, supply chain, and programmatic data. In particular, PMI and the Global Fund agreed to a harmonized financial taxonomy to aid comparison of our investments to better identify potential overlap or gaps.

Due to the U.S. Government fiscal year budget cycle and approximate timing of annual appropriations, PMI MOP resources fund activities that largely occur during the following fiscal year. For example, this FY 2022 MOP is anticipated to largely fund implementation of activities starting in 2023. Global Fund resources are based on the calendar year (CY) and planned for a three-year grant cycle. Most partner country governments and other partners also budget based on the calendar year.

The tables below summarize contributions by key external partners and partner country governments in CY 2020–2022 (Tables 4a-c and Tables 5a-c), providing insight into total country investments. Because new grants funded through the Global Fund 2021–2023 grant cycle are just beginning, or will begin later in 2021, Global Fund country investments may still evolve in some countries. The partner country government invests substantial funding into the national-to-local infrastructure and service delivery that benefits malaria programs and many others. However, it is not always possible to attribute funding for malaria specifically from the partner country government without a standardized method. There may be similar challenges for attributing other partner funds.

Table 4a. Annual budget by Level 1 category for CY 2020

<table>
<thead>
<tr>
<th>Funder</th>
<th>Vector Control</th>
<th>Case Management</th>
<th>Drug-Based Prevention</th>
<th>Supply Chain</th>
<th>Monitoring, Evaluation &amp; Research</th>
<th>Cross-cutting and HSS</th>
<th>Total Per Funder</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMI</td>
<td>$22.5M</td>
<td>$6.4M</td>
<td>$0.3M</td>
<td>$1.3M</td>
<td>$1.9M</td>
<td>$3.6M</td>
<td>$36.0M</td>
</tr>
<tr>
<td>Global Fund</td>
<td>$10.8M</td>
<td>$15.2M</td>
<td></td>
<td></td>
<td>$0.7M</td>
<td>$1.0M</td>
<td>$27.7M</td>
</tr>
<tr>
<td>Gov⁴</td>
<td>$25.8M</td>
<td>$0.3M</td>
<td></td>
<td></td>
<td></td>
<td>$7.8</td>
<td>$33.9M</td>
</tr>
<tr>
<td>Other⁵</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$0.0M</td>
</tr>
<tr>
<td>Total Per Category</td>
<td>$59.1M</td>
<td>$21.9M</td>
<td>$0.3M</td>
<td>$1.3M</td>
<td>$2.6M</td>
<td>$12.4M</td>
<td>$97.6M</td>
</tr>
</tbody>
</table>
### Table 4b. Annual budget by Level 1 category for CY 2021

<table>
<thead>
<tr>
<th>Funder</th>
<th>Vector Control</th>
<th>Case Management</th>
<th>Drug-Based Prevention¹</th>
<th>Supply Chain²</th>
<th>Monitoring, Evaluation &amp; Research</th>
<th>Cross-cutting and HSS³</th>
<th>Total Per Funder</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMI</td>
<td>$19.9M</td>
<td>$5.6M</td>
<td>$0.3M</td>
<td>$3.5M</td>
<td>$2.9M</td>
<td>$3.8M</td>
<td>$36.0M</td>
</tr>
<tr>
<td>Global Fund</td>
<td>$24.2M</td>
<td>$5.2M</td>
<td></td>
<td></td>
<td>$1.3M</td>
<td>$21.2M</td>
<td>$51.9M</td>
</tr>
<tr>
<td>Gov⁴</td>
<td>$1.6M</td>
<td>$1.2M</td>
<td></td>
<td></td>
<td>$22.4M</td>
<td>$2.9M</td>
<td>$28.1M</td>
</tr>
<tr>
<td>Other⁵</td>
<td>$5.7M</td>
<td>$3.6M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$9.3M</td>
</tr>
<tr>
<td><strong>Total Per Category</strong></td>
<td><strong>$51.4M</strong></td>
<td><strong>$15.6M</strong></td>
<td><strong>$0.3M</strong></td>
<td><strong>$3.5M</strong></td>
<td><strong>$26.6M</strong></td>
<td><strong>$27.9M</strong></td>
<td><strong>$125.3M</strong></td>
</tr>
</tbody>
</table>

### Figure 7c. Annual budget by Level 1 category for CY 2022

<table>
<thead>
<tr>
<th>Funder</th>
<th>Vector Control</th>
<th>Case Management</th>
<th>Drug-Based Prevention¹</th>
<th>Supply Chain²</th>
<th>Monitoring, Evaluation &amp; Research</th>
<th>Cross-cutting and HSS³</th>
<th>Total Per Funder</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMI</td>
<td>$20.8M</td>
<td>$6.5M</td>
<td>$0.3M</td>
<td>$1.6M</td>
<td>$2.6M</td>
<td>$3.2M</td>
<td>$35.0M</td>
</tr>
<tr>
<td>Global Fund</td>
<td>$12.3M</td>
<td>$8.0M</td>
<td></td>
<td></td>
<td>$1.1M</td>
<td>$21.7M</td>
<td>$43.1M</td>
</tr>
<tr>
<td>Gov⁴</td>
<td>$1.6M</td>
<td>$1.2M</td>
<td></td>
<td></td>
<td>$22.5M</td>
<td>$1.5M</td>
<td>$26.8M</td>
</tr>
<tr>
<td>Other⁵</td>
<td>$9.9M</td>
<td>$0.6M</td>
<td></td>
<td></td>
<td>$4.9M</td>
<td></td>
<td>$15.4M</td>
</tr>
<tr>
<td><strong>Total Per Category</strong></td>
<td><strong>$44.6M</strong></td>
<td><strong>$16.3M</strong></td>
<td><strong>$0.3M</strong></td>
<td><strong>$6.5M</strong></td>
<td><strong>$26.2M</strong></td>
<td><strong>$26.4M</strong></td>
<td><strong>$120.3M</strong></td>
</tr>
</tbody>
</table>

¹ Drug-based prevention, including SMC and MIP, where applicable. ² Covers management of in-country warehousing and distribution of malaria commodities, except for ITNs, which are separately captured under Vector Control. ³ HSS = health systems strengthening. ⁴ Domestic resources (Funding landscape, NMEP, July 9, 2020) ⁵ Other (Funding landscape, NMEP, July 9, 2020)
Figure 8a. Annual budget, breakdown by commodity, Calendar Year 2020

<table>
<thead>
<tr>
<th>Funder</th>
<th>ITNs Continuous Distribution</th>
<th>ITNs Mass Distribution</th>
<th>IRS(^1) Insecticide</th>
<th>ACTs</th>
<th>RDTs</th>
<th>Severe Malaria</th>
<th>SMC-Related</th>
<th>IPTp-Related</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMI(^2)</td>
<td>$0.0M</td>
<td>$8.6M</td>
<td>$10.0M</td>
<td></td>
<td></td>
<td>$0.8M</td>
<td></td>
<td></td>
<td>$19.4M</td>
</tr>
<tr>
<td>Global Fund(^3)</td>
<td>$5.0M</td>
<td>$4.3M</td>
<td>$4.7M</td>
<td>$2.9M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$16.9M</td>
</tr>
<tr>
<td>Gov(^4)</td>
<td>$25.8M</td>
<td>$0.3M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$26.1M</td>
</tr>
<tr>
<td>Other(^5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$0.0M</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$0.0M</td>
<td>$13.6M</td>
<td>$40.1M</td>
<td>$5.0M</td>
<td>$2.9M</td>
<td>$0.8M</td>
<td>$0.0M</td>
<td>$0.0M</td>
<td>$62.4M</td>
</tr>
</tbody>
</table>

Figure 8b. Annual budget, breakdown by commodity, CY 2021

<table>
<thead>
<tr>
<th>Funder</th>
<th>ITNs Continuous Distribution</th>
<th>ITNs Mass Distribution</th>
<th>IRS(^1) Insecticide</th>
<th>ACTs</th>
<th>RDTs</th>
<th>Severe Malaria</th>
<th>SMC-Related</th>
<th>IPTp-Related</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMI(^2)</td>
<td>$7.6M</td>
<td>$5.6M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$13.2M</td>
</tr>
<tr>
<td>Global Fund(^3)</td>
<td>$10.6M</td>
<td>$3.7M</td>
<td>$1.9M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$16.2M</td>
</tr>
<tr>
<td>Gov(^4)</td>
<td>$1.6M</td>
<td>$0.3M</td>
<td>$0.9M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$2.8M</td>
</tr>
<tr>
<td>Other(^5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$0.0M</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$0.0M</td>
<td>$18.2M</td>
<td>$10.9M</td>
<td>$2.2M</td>
<td>$.9M</td>
<td>$0.0M</td>
<td>$0.0M</td>
<td>$0.0M</td>
<td>$32.2M</td>
</tr>
</tbody>
</table>
## Figure 8c. Annual budget, breakdown by commodity, CY 2022

<table>
<thead>
<tr>
<th>Funder</th>
<th>ITNs Continuous Distribution</th>
<th>ITNs Mass Distribution</th>
<th>IRS Insecticide</th>
<th>ACTs</th>
<th>RDTs</th>
<th>Severe Malaria</th>
<th>SMC-Related</th>
<th>IPTp-Related</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMI</td>
<td>$7.9M</td>
<td>$5.4M</td>
<td></td>
<td>$0.6M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$13.9M</td>
</tr>
<tr>
<td>Global Fund</td>
<td></td>
<td>$4.1M</td>
<td>$26.3M</td>
<td>$2.6M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$33.0M</td>
</tr>
<tr>
<td>Gov</td>
<td>$1.6M</td>
<td>$0.3M</td>
<td>$0.9M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$2.8M</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$0.0M</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$0.0M</td>
<td>$7.9M</td>
<td>$11.1M</td>
<td>$26.6M</td>
<td>$3.5M</td>
<td>$0.6M</td>
<td>$0.0M</td>
<td>$0.0M</td>
<td>$49.7M</td>
</tr>
</tbody>
</table>

Note: Categories reflect the harmonized financial taxonomy (Levels 1-3) developed by BMGF, Global Fund, and PMI in 2019, as part of a broader data harmonization initiative but may continue to evolve. 1. IRS insecticide: for PMI, commodity costs may be inextricable from IRS implementation costs in historical data – field identified as ND where this is the case. 2. PMI commodity costs are fully loaded, including costs for the ex-works price of the commodity, quality control, freight, insurance, and customs. 3. Global Fund commodity costs in the table above only include ex-works commodity value; additional costs, including quality control, freight, insurance, and customs totaled for the CY 2022–2024 period are unknown. 4. Domestic resources (Funding landscape, NMEP, July 9, 2020). 5. Other (Funding landscape, NMEP, July 9, 2020).

## V. ACTIVITIES TO BE SUPPORTED WITH FY 2022 FUNDING

The FY 2022 budget tables contain a full list of activities that PMI proposes to support in Ethiopia with FY 2022 funding. Please visit [www.pmi.gov/resource-library/mops](http://www.pmi.gov/resource-library/mops) for these FY 2022 budget tables. Key data used for decision-making for this MOP planned investments is provided in Annex A of this document.
ANNEX A: INTERVENTION-SPECIFIC DATA

This section outlines key data that helped inform decision-making around FY 2022 MOP funding allocations to PMI-supported activities.
I. VECTOR CONTROL

NMEP Objective

According to NMEP NMSP (2021–2025), the two major insecticide-based malaria prevention services implemented in Ethiopia are targeted Indoor Residual Spraying (IRS) and distribution of insecticide-treated mosquito nets (ITNs). The major strategic vector control objective of NMEP is to cover 100 percent of the population at risk of malaria with one type of globally recommended vector control intervention by 2021. A strategic plan for An. stephensi is currently under review by the FMOH but it aims to implement appropriate larval control methods to tackle invasive vectors.

NMEP Approach

In Ethiopia, the main malaria vector control measures help reduce human-vector contact and minimize the survival of adult mosquitoes. NMEP plans to achieve and maintain universal ITN coverage in high, moderate, and low malaria risk areas while 51 percent of the population is targeted for ITNs in very low malaria risk areas according to the new NMSP (2021–2025). Ethiopia utilizes stand-alone, rolling mass campaigns as the only distribution method of ITNs. Campaigns are conducted at the community/kebele level through active participation and coordination of Health Extension Workers (HEWs) at health posts (HPs) every three years targeting one ITN per two people. In the high malaria risk districts, which account for 9 percent of the population at risk of malaria in the country, the NMEP co-deploys both IRS and ITNs as a rapid transmission reduction approach.

PMI Objective in Support of NMEP

PMI supports the main vector control activities including distribution of ITNs and IRS according to the national vector control guidelines. PMI is planning to support a field evaluation of long lasting larvicides that the national program is using for larval source management as a vector control tool for An. stephensi in Ethiopia to generate data for the strategic control of the species (please refer to the Operational Research section for more details).

PMI-Supported Recent Progress (progress with FY 2019 funding)

- PMI successfully completed an IRS campaign in 44 high malaria burden districts in Gambela (14), Benishangul-Gumuz (20), and Oromia (10) regions. Through this IRS campaign 527,375 (95.6 percent) housing structures were sprayed protecting 1,511,778 residents including 226,996 children under five years of age and 43,747 pregnant women.
- Trained 2,350 individuals to deliver safe and effective IRS.
- Conducted entomological monitoring including vector bionomics monitoring in seven sentinel sites and insecticide resistance monitoring of An. arabiensis in 21 sites and An. stephensi in five sites plus synergist assays in an additional 11 sites.
- Monitored insecticide decay rate through cone bioassays in three districts sprayed with Actellic®.
- Supported an entomological training workshop, including An. stephensi identification and surveillance methods, for 47 individuals from academic institutions, NMEP, and district health offices.
• Procured and completed the distribution via rolling mass campaigns of 3.4 million ITNs. An additional 2,831,150 ITNs were procured and are currently being distributed, and 179,000 PBO ITNs were procured for the purpose of piloting PBO use to generate local evidence for NMEP decision-making for future wide-scale use.

PMI-Supported Planned Activities in CY 2021 (with currently available funds)

• Conduct insecticide resistance monitoring of *An. arabiensis* in 16 sites.
• Conduct IRS quality assurance and decay rate cone bioassay monitoring in six districts.
• Conduct vector bionomics monitoring monthly in nine sites.
• Pilot community-based mosquito collections working with female mosquito collectors in two districts in Oromia Region.
• Conduct insecticide resistance monitoring of *An. stephensi* in five existing sites and new sites based on the FY 2021 surveillance findings from the main transportation route transects.
• Pilot community based surveillance for *An. stephensi* in Awash town, Awash Fantale district, Afar Region.
• Conduct *An. stephensi* monitoring in eight towns previously negative for *An. stephensi* and their respective satellite rural sites during the dry season.
• Procure 2.9 million ITNs and distribute via mass campaigns.
• Support ITN mass campaigns including distribution, storage/warehousing, and TA.
• Conduct IRS in 48 districts in Gambela (14), Benishangul-Gumuz (21), Oromia (7), and Amhara (6) in the months of May, June, and July 2021.
• Conduct community mobilization activities in conjunction with IRS and ITN distribution campaigns.

I.1. ENTOMOLOGICAL MONITORING

Key Goal

Determine the geographic distribution, bionomics, and insecticide resistance profiles of the main malaria vectors in the country to inform vector control decision-making.

Entomological monitoring in Ethiopia remains a priority to ensure that vector control interventions are guided by evidence. Ethiopia updated its national insecticide resistance monitoring and management strategy to minimize insecticide selection pressure, and is currently implementing this plan. The detection of *An. stephensi* in 2016 (Carter et al., 2018) in Ethiopia and subsequent expansion from urban to rural areas necessitated more robust entomological monitoring.

Key Question 1

Where is entomological monitoring taking place, what types of activities are occurring, and what is the source of funding?

NMEP and EPHI have selected 25 sites across the country for entomological monitoring and epidemiological surveillance (Figure A-1). These sites represent different eco-epidemiology zones and intervention areas of the country. PMI made substantial efforts to align its entomological and insecticide resistance monitoring support with these sentinel sites. As a result, most (20/25) of the PMI supported entomological monitoring sites are either
aligned with or near to the NMEP sentinel sites. PMI plans to maintain its funding allocation for entomological monitoring to continue to strengthen entomological monitoring (e.g., behavioral monitoring, insecticide resistance surveillance, etc., including work on *An. stephensi*) and support the coordination of insecticide resistance surveillance for more timely reporting and data analysis.

Following the detection of *An. stephensi* in Ethiopia in 2016, PMI carried out different activities to understand its habitat, spread, biting, and resting behavior and susceptibility/resistance to different insecticides. However, the relative role of *An. stephensi* in malaria transmission under local conditions is yet to be determined. The most appropriate *An. stephensi* control and elimination approaches need to be studied. PMI/Ethiopia has been supporting cross-sectional *An. stephensi* surveys in selected sites since 2018. In 2021, PMI plans to support NMEP to conduct surveys that target areas situated on the main transportation routes that start from Djibouti and extend to Amhara and Tigray, the route from the border of Sudan to Gondar town in Amhara, the route in Amhara that is accessible to Afar and areas in Somali Region previously not investigated, and a town in Oromia that borders Kenya in the south. In FY 2022, PMI proposes to support NMEP to control *An. stephensi* in the already invaded areas by supporting NMEP to implement proven vector control measures and support the evaluation of potential new methods. In addition, PMI plans to support NMEP to stop *An. stephensi* from invading any new geographical areas through the combined surveillance and control response. NMEP is developing a strategic plan to support interventions directed against *An. stephensi* with the aim of eliminating this species from the invaded areas in Ethiopia.

Supporting Data

**Figure A-1. Map of entomological sentinel sites and insectaries in 2020**
### Table A-1. Entomological monitoring activities, 2018 to present

<table>
<thead>
<tr>
<th>Site</th>
<th>District</th>
<th>Activities</th>
<th>Supported by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melka Sedi</td>
<td>Amibara (Standard long-lasting insecticide-treated net [LLIN])</td>
<td>Insecticide susceptibility</td>
<td>PMI</td>
</tr>
<tr>
<td>Harbu 01 Addis Mender</td>
<td>Kallu (NMEP IRS-Propoxur and standard LLIN)</td>
<td>CDC light trap, PSC*, Prokopack, Insecticide susceptibility</td>
<td>PMI</td>
</tr>
<tr>
<td>Jiga Yelemdar</td>
<td>Jabitehnan (NMEP IRS-Propoxur and standard LLIN)</td>
<td>CDC light trap, PSC, Prokopack, Insecticide susceptibility</td>
<td>PMI</td>
</tr>
<tr>
<td>Kokit</td>
<td>Metema (PMI IRS-Actellic 300CS)</td>
<td>CDC light trap, PSC, Prokopack, wall bioassay, Insecticide susceptibility</td>
<td>PMI</td>
</tr>
<tr>
<td>Felege Selam/Pawi</td>
<td>Pawi (PMI IRS-Fludora® Fusion)</td>
<td>CDC light trap, wall bioassay, Insecticide susceptibility</td>
<td>PMI</td>
</tr>
<tr>
<td>Keshmando 2</td>
<td>Bambasi (PMI IRS-SumiShield®)</td>
<td>CDC light trap, PSC, Prokopack, Insecticide susceptibility</td>
<td>PMI</td>
</tr>
<tr>
<td>Hidase Project</td>
<td>Guba (PMI IRS-SumiShield)</td>
<td>CDC light trap, PSC, Prokopack</td>
<td>PMI</td>
</tr>
<tr>
<td>Belemgua</td>
<td>Menge (PMI IRS-SumiShield)</td>
<td>Wall bioassay</td>
<td>PMI</td>
</tr>
<tr>
<td>Melka Jebdu</td>
<td>Dire Dawa® (NMEP IRS-Propoxur and standard LLIN)</td>
<td>Insecticide susceptibility</td>
<td>PMI</td>
</tr>
<tr>
<td>Kureugegn-1</td>
<td>Lare (PMI IRS-Actellic 300CS)</td>
<td>CDC light trap, PSC, Prokopack, wall bioassay</td>
<td>PMI</td>
</tr>
<tr>
<td>Abobo</td>
<td>Abobo (PMI IRS-Actellic 300CS)</td>
<td>Insecticide susceptibility</td>
<td>PMI</td>
</tr>
<tr>
<td>Samaro</td>
<td>Abaya (PMI IRS-Fludora Fusion)</td>
<td>CDC light trap, PSC, Prokopack, wall bioassay</td>
<td>PMI</td>
</tr>
<tr>
<td>Tore Badiya</td>
<td>Gelana (PMI IRS-Fludora Fusion)</td>
<td>CDC light trap, wall bioassay</td>
<td>PMI</td>
</tr>
<tr>
<td>Metehara health post</td>
<td>Fentale (NMEP IRS-Propoxur and standard LLIN)</td>
<td>Insecticide susceptibility</td>
<td>PMI</td>
</tr>
<tr>
<td>Zeway/Batu Health post</td>
<td>Batu (NMEP IRS-Propoxur and standard LLIN)</td>
<td>Insecticide susceptibility</td>
<td>PMI</td>
</tr>
<tr>
<td>Asendabo</td>
<td>Omonada (NMEP IRS-Propoxur and standard LLIN)</td>
<td>Insecticide susceptibility</td>
<td>PMI</td>
</tr>
<tr>
<td>Wondogenet</td>
<td>Wondo (NMEP IRS-Propoxur and standard LLIN)</td>
<td>Insecticide susceptibility</td>
<td>PMI</td>
</tr>
<tr>
<td>Site</td>
<td>District</td>
<td>Activities</td>
<td>Supported by</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------------------------------------</td>
<td>-----------------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Tullu Ghana</td>
<td>Abe Dongoro (PMI IRS-SumiShield 50 WG)</td>
<td>CDC light trap, wall bioassay</td>
<td>PMI</td>
</tr>
<tr>
<td>Benile</td>
<td>Benatsemay (Standard LLIN)</td>
<td>CDC light trap, PSC, Prokopack, Insecticide susceptibility</td>
<td>PMI</td>
</tr>
<tr>
<td>Mehal Korga</td>
<td>Misrak Badawacho (NMEP IRS-Propoxur and standard LLIN)</td>
<td>Insecticide susceptibility</td>
<td>PMI</td>
</tr>
<tr>
<td>Kuraz-I project</td>
<td>Selamago (NMEP IRS-Propoxur and standard LLIN)</td>
<td>CDC light trap, PSC, Prokopack</td>
<td>PMI</td>
</tr>
<tr>
<td>Erer</td>
<td>Erer (NMEP IRS-Propoxur and standard LLIN)</td>
<td>Insecticide susceptibility</td>
<td>PMI</td>
</tr>
<tr>
<td>Seleklaka</td>
<td>Medabay Zana (NMEP IRS-Propoxur and standard LLIN)</td>
<td>Insecticide susceptibility</td>
<td>PMI</td>
</tr>
<tr>
<td>Harbu</td>
<td>Harbu</td>
<td>CDC light trap, PSC, Prokopack, wall bioassay, Insecticide susceptibility</td>
<td>PMI</td>
</tr>
<tr>
<td>Alamata</td>
<td>Alamata</td>
<td>CDC light trap, PSC, Prokopack, wall bioassay, Insecticide susceptibility</td>
<td>EPHI</td>
</tr>
<tr>
<td>Jawi</td>
<td>Jawi</td>
<td>CDC light trap, PSC, Prokopack, wall bioassay, Insecticide susceptibility</td>
<td>EPHI</td>
</tr>
<tr>
<td>Shewa Robit</td>
<td>Shewa Robit</td>
<td>CDC light trap, PSC, Prokopack, wall bioassay, Insecticide susceptibility</td>
<td>EPHI</td>
</tr>
<tr>
<td>Dembia</td>
<td>Dembia</td>
<td>CDC light trap, PSC, Prokopack, wall bioassay, Insecticide susceptibility</td>
<td>EPHI</td>
</tr>
<tr>
<td>Dubti</td>
<td>Dubti</td>
<td>CDC light trap, PSC, Prokopack, wall bioassay, Insecticide susceptibility</td>
<td>EPHI</td>
</tr>
<tr>
<td>M/Abaya-Bir bir</td>
<td>M/Abaya-Bir bir</td>
<td>CDC light trap, PSC, Prokopack, wall bioassay, Insecticide susceptibility</td>
<td>EPHI</td>
</tr>
<tr>
<td>Dilla</td>
<td>Dilla</td>
<td>CDC light trap, PSC, Prokopack, wall bioassay, Insecticide susceptibility</td>
<td>EPHI</td>
</tr>
</tbody>
</table>

* PSC: pyrethrum spray catch
Table A-2. Distribution and bionomics of malaria vectors, 2019–2020

<table>
<thead>
<tr>
<th>Site/District</th>
<th>Vector</th>
<th>Season (month)</th>
<th>Preferred Biting Location (Indoor/Outdoor)</th>
<th>Peak Biting Time</th>
<th>Preferred Resting Location*</th>
<th>Preferred Host</th>
<th>Annual Entomological Inoculation Rate (EIR)**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abaya</td>
<td>An. gambiae s.l.</td>
<td>May–March</td>
<td>0.29/0.71</td>
<td>midnight–6:00 a.m.</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
</tr>
<tr>
<td>Bambasi</td>
<td>An. gambiae s.l.</td>
<td>May–March</td>
<td>0.34/0.66</td>
<td>midnight–6:00 a.m.</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
</tr>
<tr>
<td>Lare</td>
<td>An. gambiae s.l.</td>
<td>May–March</td>
<td>0.42/0.59</td>
<td>6:00 p.m.–midnight</td>
<td>N/A</td>
<td>N/A</td>
<td>0.13</td>
</tr>
<tr>
<td>Jabitehnan</td>
<td>An. gambiae s.l.</td>
<td>May–March</td>
<td>0.56/0.44</td>
<td>midnight–6:00 a.m.</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
</tr>
<tr>
<td>Harbu</td>
<td>An. gambiae s.l.</td>
<td>May–March</td>
<td>0.35/0.65</td>
<td>6:00 p.m.–midnight</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
</tr>
<tr>
<td>Benatsemay</td>
<td>An. gambiae s.l.</td>
<td>May–March</td>
<td>0.46/0.54</td>
<td>6:00 p.m.–midnight</td>
<td>N/A</td>
<td>Bovine (33%)</td>
<td>0</td>
</tr>
<tr>
<td>Metema</td>
<td>An. gambiae s.l.</td>
<td>May–March</td>
<td>0.45/0.55</td>
<td>midnight–6:00 a.m.</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
</tr>
</tbody>
</table>

* Marked as N/A if simultaneous indoor and outdoor collections are not conducted.
** EIR: Number of infectious bites per person per year.

According to PMI VectorLink’s preliminary report, An. stephensi abundance was surveyed in four towns (Awash, Dire Dawa, Kebridehar, and Metehara) from May to August 2020 and a total of 114 An. stephensi were sampled (Table A-3). The majority (65 percent) of An. stephensi collections were from Prokopack/backpack aspiration from animal shelters (goat/sheep/cattle). The second largest collection (19.3 percent) was from cattle baited tent trap followed by PSC (12.3 percent). In addition, An. arabiensis was collected from Awash (N = 15), Dire Dawa (N = 2) and Metehara (N = 223). A total of 17 An. pharoensis were also captured from Metehara. This survey shows the coexistence of An. arabiensis and An. stephensi in Awash and An. stephensi dominance in Dire Dawa and Kebridehar.
Table A-3. Abundance of *An. stephensi* relative to primary vectors in longitudinal monitoring sites

<table>
<thead>
<tr>
<th>Species</th>
<th>Awash</th>
<th>Dire Dawa</th>
<th>Kebridehar</th>
<th>Metehara</th>
<th>Total</th>
<th>% Anopheles</th>
</tr>
</thead>
<tbody>
<tr>
<td>An. stephensi</td>
<td>26</td>
<td>40</td>
<td>42</td>
<td>6</td>
<td>114</td>
<td>30.7</td>
</tr>
<tr>
<td>An. arabiensis</td>
<td>15</td>
<td>2</td>
<td>0</td>
<td>223</td>
<td>240</td>
<td>64.7</td>
</tr>
<tr>
<td>An. pharoensis</td>
<td>15</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>4.6</td>
</tr>
</tbody>
</table>

*An. stephensi* was first detected in Ethiopia in Kebridehar in 2016. Larval and adult collections of *An. stephensi* conducted from 2018 to 2020 revealed widespread distribution in the eastern part of the country of this species. In addition to major urban and peri-urban areas, the species has now also been detected in rural areas along major motorways or transportation routes (Table A-4).

Table A-4. Sites in Ethiopia where *An. stephensi* had been found in 2020

<table>
<thead>
<tr>
<th>Nearest town</th>
<th>Number of visited kebeles</th>
<th>Number of kebeles positive for <em>An. stephensi</em></th>
<th>Number of potential breeding sites inspected</th>
<th>Number of sites positive for <em>An. stephensi</em> (%)</th>
<th>Number of sites positive for Aedes (%)</th>
<th>Number of <em>An. stephensi</em> sites that also contained Aedes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awash</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1 (33)</td>
<td>1 (33)</td>
<td>1 (100)</td>
</tr>
<tr>
<td>Bati</td>
<td>7</td>
<td>3</td>
<td>165</td>
<td>6 (4)</td>
<td>42 (25)</td>
<td>4 (67)</td>
</tr>
<tr>
<td>Degehabur</td>
<td>6</td>
<td>2</td>
<td>32</td>
<td>7 (22)</td>
<td>7 (22)</td>
<td>2 (29)</td>
</tr>
<tr>
<td>Dire Dawa</td>
<td>7</td>
<td>2</td>
<td>17</td>
<td>2 (12)</td>
<td>8 (47)</td>
<td>2 (100)</td>
</tr>
<tr>
<td>Gewane</td>
<td>4</td>
<td>3</td>
<td>127</td>
<td>10 (8)</td>
<td>24 (19)</td>
<td>7 (70)</td>
</tr>
<tr>
<td>Godey</td>
<td>6</td>
<td>1</td>
<td>24</td>
<td>1 (4)</td>
<td>6 (25)</td>
<td>0</td>
</tr>
<tr>
<td>Kebridehar</td>
<td>8</td>
<td>6</td>
<td>40</td>
<td>13 (33)</td>
<td>6 (15)</td>
<td>0</td>
</tr>
<tr>
<td>Meki</td>
<td>5</td>
<td>0</td>
<td>17</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Metehara</td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>1 (8)</td>
<td>2 (17)</td>
<td>0</td>
</tr>
<tr>
<td>Semera</td>
<td>5</td>
<td>2</td>
<td>136</td>
<td>3 (2)</td>
<td>22 (16)</td>
<td>2 (67)</td>
</tr>
<tr>
<td>Zeway</td>
<td>3</td>
<td>0</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>55</td>
<td>21</td>
<td>589</td>
<td>44 (7)</td>
<td>118 (20)</td>
<td>18 (40)</td>
</tr>
</tbody>
</table>
Presence of *An. stephensi* was investigated in 44 kebeles surrounding Awash, Bati Degehabour, Dire Dawa, Gewane, Meki, Metehara, Semera, and Zeway towns in 628 potential breeding habitats. It was found that 40 (6.4 percent) of breeding habitats were positive for *An. stephensi*. Most *An. stephensi* were collected from man-made habitats (e.g., concrete water containers, wells, cisterns, and overhead and ground-level water tanks) though natural breeding habitats (e.g., tire tracks) were also found to be positive.

**Figure A-2. An. stephensi survey sites for 2021**

In 2021, *An. stephensi* surveys will target areas situated on main transportation routes and along the borders of Djibouti, Kenya, Sudan, and Somalia (Figure A-2). The areas are divided in four transects: Transect I lies between Addis Ababa and Wereta town. Wereta is a dry port that is connected to Djibouti and serves the region. Transect II extends through the western part of Amhara, between Gondar and Degolo town (capital town of Quara District). Transect III covers parts of Afar, Amhara, and Tigray regions. Transect IV lies between Jigjiga (capital of Somali) and Doolow at the border of Somalia. These surveys will target the towns that lie along these routes and the surrounding rural areas in 20 km radius. Adult *An. stephensi* will be collected from resting sites such as residential houses, kitchens, latrines and animal shelters using Prokopack aspirators. Natural and artificial breeding habitats will be searched, and larvae and pupae will be sampled from positive habitats and raised to adults for species identification. The findings of these surveys and evidence generated in the country and neighboring countries will help to consolidate strategic directions toward *An. stephensi* control and halt its spread or eliminate it. In line with this, NMEP is developing a strategic plan, which is under review, directed against *An. stephensi*, with the aim of controlling its spread and finally eliminating it from the invaded areas in Ethiopia. In 2022, PMI proposes to support NMEP to control *An. stephensi* in the already invaded areas by supporting NMEP to implement proven vector control measures and support the evaluation of potential new methods to control *An. stephensi* and halt its spread into new geographical areas.
Key Question 2

What is the current insecticide resistance profile of the primary malaria vectors including *An. stephensi*?

**Supporting Data**

*An. arabiensis*

Insecticide resistance monitoring, which included susceptibility tests with discriminating doses, resistance intensity tests, and PBO synergist test, were done on populations of *An. arabiensis* in 21 sites. In addition, populations of *An. stephensi* from Dire Dawa city, Kebridehar in Somali, and Gewane, Semera, and Awash in Afar were investigated for their susceptibility to insecticides.

The World Health Organization (WHO) tube test was used to measure the susceptibility/resistance status of *An. arabiensis* population to 0.1 percent bendiocarb, 0.1 percent propoxur, 0.25 percent pirimiphos-methyl, 0.5 percent alpha-cypermethrin, 0.5 percent deltamethrin, and 0.75 percent permethrin in all 21 sites. Susceptibility/resistance of *An. stephensi* was measured in five sites. The WHO method was also used to test 2 percent clothianidin-impregnated papers from Sumitomo Chemicals. Clothianidin tests were conducted in Abobo, Amibara, Omonada, Bambasi, Halaba, Dubti, and Zeway-Dugda. The CDC bottle bioassay method was used to test chlorfenapyr at a dose of 100 micrograms/bottle. *An. arabiensis* from Abaya, Abobo, Bahirdar, Dubti, Fentale, Halaba, Omonada, and Zeway-Dugda were tested against chlorfenapyr. The level of resistance intensity to the pyrethroid insecticides (alpha-cypermethrin, deltamethrin, and permethrin) at the concentrations of 1X, 5X, and 10X was assessed on the populations of *An. arabiensis* from Abaya, Abobo, Amibara, Omonada, Zeway-Dugda, Halaba, and Pawi. Similar tests were carried out on *An. stephensi* from Awash. PBO synergist tests were carried out on *An. arabiensis* where the mosquitoes were pre-exposed to PBO and then to alpha-cypermethrin, deltamethrin, and permethrin in Abaya, Abobo, Amibara, Bambasi, Omonada, Dangur, Humera, Jawi, Medabay Zana, Pawi, and Zeway-Dugda to assess whether PBO restores susceptibility to the three insecticides. PBO synergist assays were also conducted on *An. stephensi* from Dire Dawa against the three pyrethroids and from Awash against deltamethrin.

Accordingly, in the WHO tube tests, *An. arabiensis* was susceptible to pirimiphos-methyl, propoxur, and bendiocarb with 98 percent to 100 percent mortality in all 21 sentinel sites after 24 hours of holding period (Figures A-3a and A-3b) except for bendiocarb in Bahirdar, where mortality was 97 percent (categorized as possible resistance). *An. arabiensis* was found resistant to the pyrethroid insecticides alpha-cypermethrin, deltamethrin, and permethrin where the susceptibility tests were conducted. Clothianidin killed 100 percent of wild *An. arabiensis* by day four post-exposure in Abobo, Amibara, Omonada, Bambasi, and Halaba and on day five in Dubti while 98 percent mortality was observed in wild *An. arabiensis* from Zeway-Dugda on day seven. All insectary *An. arabiensis* tested in parallel to the wild *An. arabiensis* died on days three and four (Figure A-4).

Chlorfenapyr demonstrated 100 percent mortality of wild *An. arabiensis* from Zeway-Dugda within 24 hours and within 48 hours from Omonada and Fentale. *An. arabiensis* from Abobo and Halaba died within 72 hours while those from Abaya and Dubti had 89 percent and 97 percent mortality after 72 hours, which puts them in
resistance and possible resistance classifications, respectively. In the parallel tests, 100 percent mortality of the insectary colony of *An. arabiensis* was observed within 24 hours of exposure (Figure A-5).

**Figure A-3. Percentage mortality of *An. arabiensis* to permethrin, deltamethrin, alpha-cypermethrin, pirimiphos-methyl, propoxur and bendiocarb in WHO tube tests**

a) Oromia, Afar, Amhara, Gambela, and Somali regions

b) Benishangul-Gumuz; Southern Nations, Nationalities, and Peoples’ (SNNP); and Tigray regions
Figure A-4. Percentage mortality of insectary and wild An. arabiensis following exposure to clothianidin 2 percent.

High-intensity resistance of An. arabiensis populations from Amibara, Omonada, and Zeway-Dugda to alpha-cypermethrin, deltamethrin, and permethrin was observed (Figure A-6).

Figure A-5. Percentage mortality of insectary and wild An. arabiensis following exposure to chlorfenapyr (100UG/bottle).
Figure A-6. Percentage mortality of *An. arabiensis* in WHO tube resistance intensity assays after exposure to permethrin, deltamethrin, and alpha-cypermethrin at ×1, ×5, and ×10 times the diagnostic concentration (2019)

Pre-exposure to PBO restored susceptibility (98–100 percent mortality) of *An. arabiensis* to pyrethroids in many, but not all of the 11 sites, implicating the presence of a monooxygenase-based resistance mechanism (Figures A-7 a, b, and c). Specifically, susceptibility to alpha-cypermethrin was restored in seven sites, deltamethrin susceptibility was restored in eight sites, and permethrin susceptibility was restored in five sites.

Figure A-7. Percentage mortality of *An. arabiensis* pre-exposed to PBO synergist and exposed to insecticide alone (2019)

a) Alpha-cypermethrin
b) Deltamethrin

![Graph showing % mortality of An. arabiensis for different locations with Deltamethrin only and Deltamethrin + PBO.]

c) Permethrin

![Graph showing % mortality of An. arabiensis for different locations with Permethrin only and Permethrin + PBO.]

**An. stephensi**

Susceptibility status to propoxur and pirimiphos-methyl was tested in the *An. stephensi* population from Semera, Gewane, Awash, Dire Dawa, and Kebridehar. It was found that the *An. stephensi* population from Semera were susceptible to propoxur and pirimiphos-methyl. *An. stephensi* populations from Dire Dawa and Kebridehar were resistant to pirimiphos-methyl. *An. stephensi* populations from the five test sites were highly resistant to bendiocarb, alpha-cypermethrin, deltamethrin, and permethrin (Figure A-8).
To determine the susceptibility of An. stephensi larvae to the organophosphate larvicide temephos, bioassays were conducted in November 2020. Larvae from five sites (Awash Sebat Kilo, Dire Dawa, Kebridehar, Meki, and Semera) were used for the assays. Results showed that all of the populations tested were found to have 100 percent mortality at less than the threshold for susceptibility (0.25mg/L). Larvae from Dire Dawa, Awash Sebat Kilo, and Kebridehar had 100 percent mortality at 0.125mg/L, Meki had 100 percent mortality at 0.03125mg/L, and Semera had 100 percent mortality at 0.0625mg/L. These data suggest that Ethiopian An. stephensi is susceptible to temephos.

**Figure A-8. Percentage mortality of An. stephensi to permethrin, deltamethrin, alpha-cypermethrin, pirimiphos-methyl, propoxur, and bendiocarb using WHO tube tests (2019)**

In synergists assays, pre-exposure to PBO restored susceptibility to alpha-cypermethrin and permethrin in Dire Dawa and to deltamethrin in Awash (Figure A-9).

**Figure A-9. An. stephensi mortality in pre-exposure PBO and insecticide alone assays (2019)**
Conclusions for Entomologic Monitoring Investments

The results above indicate that pyrethroid resistance is widespread as it has been in previous years in the population of *An. arabiensis* coupled with high resistance intensity. *An. stephensi* is also highly resistant to deltamethrin, permethrin, and bendiocarb where the tests were carried out. Pre-exposure to PBO fully restored susceptibility in different sentinel sites while partial susceptibility restoration was also observed. *An. arabiensis* remains the predominant species and the main vector of malaria transmission in Ethiopia. *An. arabiensis* together with the secondary malaria vectors, *An. pharoensis* and *An. funestus* groups, tend to be early feeders indoors and outdoors and prefer to rest outdoors, which may limit the impact that IRS and ITNs would have in reducing malaria transmission in Ethiopia. Supplementary outdoor vector control interventions are likely required to further advance malaria control and achieve long-term malaria elimination. *An. arabiensis* is susceptible to pirimiphos-methyl, propoxur, clothianidin, chlorfenapyr, and bendiocarb, and this might provide opportunities for pre-emptive rotation of insecticides used in IRS to mitigate resistance and preserve the tools at hand. PMI will maintain the FY 2021 level of insecticide resistance and entomological monitoring support and will adjust activities as follows: reduce the number of sites for insecticide resistance monitoring by focusing on PMI-supported sites, conduct insecticide resistance monitoring only on the insecticides currently being used and potentially alternative insecticides, conduct insecticide resistance monitoring every other year as per WHO guidance, reduce the duration of behavioral monitoring to exclude months without mosquito populations, and transition to community-based entomological monitoring (with supervision). PMI will continue to work closely with the FMOH, RHBs, AHRI, EPHI, and local universities. On the basis of current findings, consideration of the next-generation insecticides for IRS as insecticide resistance monitoring and management approach is critical in addition to the consideration of either PBO or dual active ingredient (AI) insecticide ITNs. The spread and insecticide resistance of *An. stephensi* is concerning particularly with respect to malaria elimination efforts in the country. Coordinated efforts of NMEP, stakeholders, the scientific community, and all concerned is needed to halt the spread or eliminate *An. stephensi* from the region.

Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.

**1.2. INSECTICIDE-TREATED NETS (ITNs)**

**Key Goal**
Achieve high ITN coverage and use targets with effective nets, based on insecticide resistance data, in PMI-supported areas; and maintain high coverage and use with consistent ITN distribution (via campaigns and/or continuous channels).

**Key Question 1**
How has net ownership evolved since the start of PMI in the country?

According to the 2015 MIS, 64 percent of all households owned at least one ITN in malarious areas (areas <2,000m above sea level). Since 2015, Ethiopia has held four subnational campaigns, distributing more than 35 million nets. These subsequent campaigns have focused on increasing resources to ensure distribution to the end user, utilizing a tool to track ITN distribution, and deploying a comprehensive package of SBC activities. Ethiopia did not implement a standard MIS after 2015. However, NMEP conducted a customized survey to assess ITN ownership and use in 2020. The report shows a slight increase from 2015 in the percentage of households...
owning at least one net and eight percent increase in the population coverage with one net per two people (Figure A-10).

Supporting Data

According to an NMEP report regarding survey on ownership and use of long-lasting insecticidal nets and malaria treatment seeking behavior in Ethiopia (September 2020), 67 percent of households own at least one ITN, and on average households own 1.8 ITNs, an increase from 64 percent and 1.3 net per household in 2015 MIS (Figure A-10). It was found that 62 percent of the households have received ITNs in the past three years. Ownership of at least one ITN was higher in rural areas (70 percent) than urban areas (55.4 percent) and in the high malaria burden regions, Gambela was the highest (86 percent) followed by Somali (83 percent) in ITNs ownership.

Figure A-10. Trends in ITN ownership

Percentage of households that own ITNs

*KEY QUESTION 2a
What proportion of the population has access to an ITN? Of those who have access, what proportion of the population reports using an ITN?

Supporting Data

According to the 2015 MIS, ITN access and use was 49 and 48 percent, respectively (Figures A-11 and A-12). In the 2020 NMEP ITN ownership and use survey report, population access to ITNs and use was not distinctly stated. However, it was assumed from some sections of the report that access was 40 percent and use was 44 percent (Figure A-11). The reasons behind the observed decrease in ITN access and use are unclear but could be due to differences in how the two surveys were conducted and challenges of perfectly aligning distribution to targeted areas. The planned Malaria Behavior Survey (MBS) in 2022 will provide additional data that will inform activities aimed to improve ITN access and use. PMI supported ITN distributions by region for FY 2018 and FY 2019 are shown in Figure A-13.
**Figure A-11. Trends in ITN access and use from household survey data**

![Graph showing trends in ITN access and use from MIS 2015 and Mini Survey 2020.](image)

* NMEP report: A survey on ownership and use of ITNs and malaria treatment seeking behavior in Ethiopia, September 2020.

**Figure A-12. Trends in ITN access and use**

![Map showing ITN use/access ratio in Ethiopia.](image)
Key Question 2b

What percent of pregnant women and children under five years of age report sleeping under an ITN?

According to the NMEP survey report, there is some improvement in ITN use among children under five years of age and pregnant women in 2020 (Figure A-14). Accordingly, 62 percent of pregnant women and 52 percent of children under five years of age were found sleeping under ITNs in contrast to 35 percent and 38 percent, respectively, in 2015 (MIS).
Supporting Data

**Figure A-14. Trends in ITN use among children and pregnant women**

*Children under five years of age and pregnant women 15 to 49 years of age who slept under an ITN the night before the survey*

![Graph showing trends in ITN use among children and pregnant women.](image)

*NMEP report: A survey on ownership and use of ITNs and malaria treatment seeking behavior in Ethiopia, September 2020.*

**Key Question 3**

If ITN access is high but use is low, what significant structural and/or behavioral challenges affect the adoption and maintenance of ITN use and care behaviors?

The national ITN use:access ratio in Ethiopia is generally good. However, ownership and access are generally low throughout the country. According to the 2015 MIS, the national use to access ratio is 0.81, which is a little above the target. This means 8 out of 10 people with access to an ITN use the ITN. The ITN use:access ratio is highly variable by region, ranging from 0.58 to 1.15. Five of the 10 regions have use:access ratios below the target of 0.80. Tigray (0.68) and Diredawa (0.58) have the lowest use:access ratios. A PMI-supported study by Jimma University showed an overall use to access ratio of 0.70, which demonstrates a behavior-driven failure of 0.30 in PMI-targeted districts. This study identified several behavioral factors associated with low net use including shape of nets, sleeping arrangements, low risk perception, lack of awareness and negligence, preserving nets for future use, and the perception of low ITN efficacy. Additionally, the low risk perception of malaria during the dry season or low-transmission season are also major drivers of suboptimal net use.

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Because behavior related to use of ITNs is good (80 percent) among those who have access, improving access to ITNs is essential. In addition, PMI will implement behavior change campaigns to improve net use among those who have access, particularly during the dry season.

Supporting Data

- Low risk perception of malaria during dry season or low-transmission elimination areas is an internal factor that affects the adoption and maintenance of ITN use and care behaviors. The Communication for Health (C4H) midline report key informant interviews and qualitative studies indicated that people were less likely to use nets during the low-transmission season (C4H Midline, 2019).
- Limited net care at the household level contributed to high net attrition. According to the net durability study, the average life of an ITN is approximately two years and almost 72 percent of net attrition is attributed to wear and tear. Sustained adoption of household behavioral practices for better use and care of ITNs will improve net durability.
- An existing high outcome expectancy, or the belief that the net will protect them from malaria, is one of the facilitating behaviors for ITN use. The midline results from C4H activity have shown that 94.3 percent people believe use of ITNs can prevent malaria (C4H Midline, 2019).
- Additionally, children of school age have the lowest ITN use when households have insufficient ITNs but these differences level out in households that have enough ITNs.
- In the poorest populations, ITN ownership, access, and use is 51 percent, 35 percent, 26 percent, respectively, which are below the national averages.
- ITN access, use, and the use:access ratio are slightly lower for those living in rural areas than in urban areas.

Please refer to Section 3.4 for information on how SBC interventions will be directed to address the challenges identified above.

Key Question 4

What type of nets are being distributed via which channels?

Supporting Data

Since 2008, PMI has procured and distributed standard pyrethroid-treated nets through mass campaigns. PBO ITNs were procured recently for an evaluation with or without IRS in selected districts. Dual AI nets were not procured or planned for use in Ethiopia currently.

Table A-5. Insecticide-treated net (ITN) distribution

<table>
<thead>
<tr>
<th>Level Region</th>
<th>Mass Campaign June-Sept, 2020</th>
<th>ANC</th>
<th>EPI</th>
<th>School</th>
<th>Community</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gambela</td>
<td>251,975</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Benishangul-Gumuz</td>
<td>637,750</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>SNNPR</td>
<td>1,504,930</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Afar</td>
<td>549,547</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Key Question 5

What is the estimated need for ITNs during calendar years 2021–2023? How many, and what types, of ITNs will be procured, and by what partners? Through what channels will ITNs be distributed? Are there any projected ITN gaps?

In Ethiopia, standard regular ITNs are procured with funding from Global Fund and PMI. Global Fund’s procurement is handled through the Ethiopian Pharmaceuticals Supply Agency (EPSA), which contributes the majority of the ITNs needs while PMI supports procurement of the remaining gap. Distribution is done through a rolling campaign to replace nets every three years. The gap analysis table outlines the estimated need for CY 2021–2023 with the projected ITN gap.

Supporting Data

Table A-6. ITN Gap Analysis Table

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total country population</td>
<td>102,998,000</td>
<td>105,166,000</td>
<td>107,332,500</td>
</tr>
<tr>
<td>Total population at risk for malaria</td>
<td>53,661,958</td>
<td>54,791,486</td>
<td>55,920,233</td>
</tr>
<tr>
<td>PMI-targeted at-risk population</td>
<td>53,661,958</td>
<td>54,791,486</td>
<td>55,920,233</td>
</tr>
<tr>
<td>Population targeted for ITNs</td>
<td>53,661,958</td>
<td>54,791,486</td>
<td>55,920,233</td>
</tr>
</tbody>
</table>

**Continuous Distribution Needs**

<table>
<thead>
<tr>
<th>Channel</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel 1: ANC</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Channel 2: EPI</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Channel 3: School</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Channel 4:</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Additional ITNs required to avoid ITN stockouts</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Estimated Total Need for Continuous Channels</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Mass Campaign Distribution Needs**

<table>
<thead>
<tr>
<th>Mass distribution campaigns</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needs for potentially uncovered population in the mass campaign</td>
<td>-</td>
<td>343,342</td>
<td>840,987</td>
</tr>
<tr>
<td>Estimated Total Need for Campaigns</td>
<td>12,434,117</td>
<td>16,223,357</td>
<td>3,962,662</td>
</tr>
</tbody>
</table>

**Total ITN Need: Continuous and Campaign**

<table>
<thead>
<tr>
<th>Total ITN Need: Continuous and Campaign</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>12,434,117</td>
<td>16,223,357</td>
<td>3,962,662</td>
<td></td>
</tr>
</tbody>
</table>

**Partner Contributions**

<table>
<thead>
<tr>
<th>ITNs carried over from previous year</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,000,050</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ITNs from Government</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ITNs from Global Fund</td>
<td>4,280,506</td>
<td>12,482,370</td>
<td>333,333</td>
</tr>
<tr>
<td>ITNs from other donors</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ITNs planned with PMI funding</td>
<td>2,810,219</td>
<td>2,965,684</td>
<td>2,990,605</td>
</tr>
</tbody>
</table>

**Total ITNs Contribution Per Calendar Year**

<table>
<thead>
<tr>
<th>Total ITNs Contribution Per Calendar Year</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>12,090,775</td>
<td>15,448,054</td>
<td>3,323,938</td>
<td></td>
</tr>
</tbody>
</table>

**Total ITN Surplus (Gap)**

<table>
<thead>
<tr>
<th>Total ITN Surplus (Gap)</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>-343,342</td>
<td>-775,303</td>
<td>-638,724</td>
<td></td>
</tr>
</tbody>
</table>
Key Question 6
What is the current status of durability monitoring?

PMI conducted a 36-month net durability study from May 2015 to June 2018 (Table A-7). Results indicated that the average life of an ITN was less than two years, which falls far short of the predicted three-year lifespan of a net, where almost 72 percent of net attrition was attributed to net physical integrity (i.e., wear and tear). Given the major budget implications and ITN need gap, consensus has not yet been reached among in-country experts on switching to a two-year net replacement strategy. Improving ITN use and care instead is being considered as a possible SBC strategy to address the problem.

Supporting Data

Table A-7. Results of durability monitoring*

<table>
<thead>
<tr>
<th>Site</th>
<th>Survey and Time Since Distribution (months)</th>
<th>Attrition to Wear and Tear (%)</th>
<th>Nets in Serviceable Condition (%)</th>
<th>Optimal Insecticidal Effectiveness in Bioassay (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tigray, Amhara, Oromia, and SNNPR</td>
<td>12</td>
<td>22</td>
<td>48.6</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>39.1</td>
<td>39.6</td>
<td>95.3</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>71.8</td>
<td>15.6</td>
<td>19.0</td>
</tr>
</tbody>
</table>

* Source: Monitoring of attrition, physical integrity, and insecticidal activity of long-lasting insecticidal net in Ethiopia: A longitudinal multi-site study, 2019. This report is not available online yet.

Conclusions for ITN Investments

- PMI Ethiopia would like to at least maintain the funding level for ITNs with highest consideration of narrowing the ITNs need gap in the country. To the extent feasible, PMI will continue working with Global Fund and NMEP to improve targeting and quantification of ITN needs.
- PMI is working with district health offices and HEWs to ensure ITN delivery to the households. Except for the security concerns in some areas, PMI found this household delivery approach to be more effective particularly when accompanied by tailored SBC intervention, based on weekly ITN distribution updates and the annual program result report.
- Based on the evidence provided in the previous section, PMI will focus its malaria SBC interventions to increase ITN use and care through improving household practices for consistent use of ITNs throughout the year and educating individuals and families on net care behaviors to increase net durability. The existing belief (high outcomes-expectancy) that ITNs will protect from malaria will be used as an entry point for reducing the existing behavioral failure (20 percent to 30 percent) among those who have ITNs access.
- PMI and Global Fund are the two sources of funding covering the country’s ITN needs. Timely release of Global Fund resources for ITN procurement is critical for timely replacement of nets. Currently, there are gaps in filling the ITNs needed nationwide and PMI is unable to fill the gap completely without disrupting other malaria prevention and control activities.
• Considering the level and spread of malaria vector resistance to pyrethroids, there is a general understanding that Ethiopia needs to consider PBO or dual AI nets. The current funding envelope does not allow for meeting the ITN gap let alone a transition to PBO or dual AI nets. PMI is planning to conduct a PBO net evaluation comparing IRS to PBO nets alone in a non-inferiority study in high malaria burden districts in view of generating evidence to facilitate decision-making. If comparable results can be demonstrated for PBO use vs. IRS + standard nets, shifting of IRS resources to procure PBO nets will be considered.

Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.

1.3. INDOOR RESIDUAL SPRAYING (IRS)

Key Goal

Ensure high spray quality and coverage, with an appropriate and effective insecticide, in targeted endemic PMI-supported areas, in alignment with the national insecticide resistance management strategy.

Key Question I

What areas are targeted for IRS and why?

Supporting Data

According to the new NMSP (2021–2025), all areas stratified as a high malaria burden are targeted for IRS, which cover about 5 million or 4.8 percent of the total population or 9.2 percent of the population at risk of malaria. In this strategic plan, there is a shift from the previous NMSP 2017–2020, which targeted 51 percent of the population residing in moderate malaria risk areas bordering high malaria burden districts for IRS. While this seems like a massive reduction in the NMEP supported IRS program, in reality, the IRS program has almost remained the same. This is because, in the previous NMSP, IRS was not implemented in all targeted areas as per plan due to limited resources and insecticide choice. In the new NMSP, all IRS resources will be channeled to high malaria burden areas. The malaria risk stratification map (Figure 4) clearly shows that most western parts of the country have the highest burden. Accordingly, PMI supports IRS operations in 48 districts in high malaria burden areas (all 14 in Gambela, all 21 in Benishangul-Gumuz, seven in Oromia, and six in Amhara) (Figure A-15).
NMEP conducts IRS in many districts using its own resources and with support from the Global Fund and Millennium Development Goals pool funds. However, details regarding government-operated IRS are not readily available by district.

Key Question 2
In PMI-supported areas, what spray coverage rates have been achieved in the past three years and what are the plans for 2021?

High spray coverage has been achieved in PMI-supported IRS districts since the beginning of IRS operations support in the country. PMI strives to keep high coverage with global standard best practices in IRS including the use of satellite imagery for accurate detection of targeted structures. In 2021, PMI will be expanding its support into six new districts in the Amhara Region, where the burden of malaria is high (Table A-8).
Table A-8. IRS coverage

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Districts Sprayed (#)</th>
<th>Districts</th>
<th>Structures Sprayed (#)</th>
<th>Coverage Rate (%)</th>
<th>Population Protected (#)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>44</td>
<td>Benishangul-Gumuz (20 districts), Gambela (14 districts), Oromia (10 districts)</td>
<td>472,569</td>
<td>97</td>
<td>1,264,189</td>
</tr>
<tr>
<td>2019</td>
<td>44</td>
<td>Benishangul-Gumuz (20 districts), Gambela (14 districts), Oromia (10 districts)</td>
<td>487,746</td>
<td>95.5</td>
<td>1,334,868</td>
</tr>
<tr>
<td>2020</td>
<td>44</td>
<td>Benishangul-Gumuz (20 districts), Gambela (14 districts), Oromia (10 districts)</td>
<td>527,375</td>
<td>95.6</td>
<td>1,511,728</td>
</tr>
<tr>
<td>2021*</td>
<td>48</td>
<td>Benishangul-Gumuz (21 districts), Gambela (14 districts), Oromia (7 districts) and Amhara (6 districts)</td>
<td>792,891</td>
<td>TBD</td>
<td>1,965,581 (Est.)</td>
</tr>
</tbody>
</table>

*Denotes targets for current year

Key Question 3
What is the residual efficacy of the insecticides used for IRS in PMI-supported areas?

Supporting Data
The residual efficacy of Actellic, the current IRS insecticide, was assessed through WHO cone wall bioassays in PMI supported IRS districts on different wall types. Mortality in *An. arabiensis* dropped below the cutoff value of 80 percent in two months after spraying on mud walls and in three months of spraying for both mud and painted mud surfaces in Abaya. Mortality of *An. arabiensis* dropped below 80 percent four months after spraying on all wall types in Lare and Bambasi (Figures A-16a and A-16b). Tests were not conducted one month after spraying in Abaya due to security concerns. Most notably in Abaya district, Actellic failed to provide protection throughout the transmission period, September–November, when sprayed in June or July. Clothiandin residually efficacy was monitored in the pilot district Menge, Benishangul-Gumuz. Preliminary report shows SumiShield efficacy for six months and Fludora Fusion for five months. In discussion with NMEP, PMI expanded the use of SumiShield and Fludora Fusion to more PMI supported districts in 2021. Residual efficacy of clothianidin will be conducted and finding from these areas will guide NMEP decision in future insecticide selection for IRS.
Figure A-16. Insectary An. arabiensis mortality in cone bioassays on Actellic 300 SC sprayed surfaces

a) Wall type:

![Graph showing An. arabiensis mortality over time for different wall types and years.]

b) Site/district:

<table>
<thead>
<tr>
<th>Site/District</th>
<th>Year</th>
<th>Insecticide</th>
<th>Residual Efficacy (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abaya</td>
<td>2019</td>
<td>Actellic300CS</td>
<td>2 (less than 2 months on mud wall, 3 months on painted wall)</td>
</tr>
<tr>
<td>Lare</td>
<td>2019</td>
<td>Actellic300CS</td>
<td>4 (mud wall)</td>
</tr>
<tr>
<td>Bambasi</td>
<td>2019</td>
<td>Actellic300CS</td>
<td>4 (mud and painted walls)</td>
</tr>
<tr>
<td>Menge*</td>
<td>2020</td>
<td>Fludora Fusion</td>
<td>5 (mud and painted wall)</td>
</tr>
<tr>
<td>Menge*</td>
<td>2020</td>
<td>SumiShield 50WG</td>
<td>6 (mud and painted wall)</td>
</tr>
</tbody>
</table>

*The decay rate of Fludora Fusion and SumiShield was monitored in Menge district, where both insecticides were sprayed for piloting.

The residual insecticide efficacy result (Figure A-16a and b) shows that performance of Actellic300CS varies by site and wall types while the new generation insecticides remain efficacious for a longer period both on mud and painted mud walls.

Key Question 4
What is the insecticide rotation plan in PMI-supported areas?

Supporting Data
PMI conducted residual efficacy tests on Fludora Fusion and SumiShield, the WHO prequalified next generation insecticides, which were sprayed for pilot testing. Residual efficacy of five and six months was recorded for Fludora Fusion and SumiShield, respectively. On the basis of this locally generated evidence, PMI Ethiopia will use these next-generation IRS insecticides for rotation as per the national insecticide resistance monitoring and management strategy. This was on the basis of NMEP intention that PMI expand the piloting to more districts. In the coming years, PMI in discussion with the NMEP will implement a rotation of IRS insecticides for both the
organophosphate and the next generation IRS insecticides as depicted in the below table in PMI IRS supported districts (Table A-9).

**Table A-9. Insecticide rotation plan**

<table>
<thead>
<tr>
<th>Target Spray Area</th>
<th>2020</th>
<th>2021</th>
<th>2022*</th>
<th>2023*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gambela (14 districts)</td>
<td>Organophosphate</td>
<td>Organophosphate</td>
<td>SumiShield</td>
<td>SumiShield</td>
</tr>
<tr>
<td>Benishangul-Gumuz (18 districts)</td>
<td>Organophosphate</td>
<td>SumiShield</td>
<td>SumiShield</td>
<td>SumiShield</td>
</tr>
<tr>
<td>Benishangul-Gumuz - Dangur</td>
<td>Organophosphate</td>
<td>Organophosphate</td>
<td>SumiShield</td>
<td>SumiShield</td>
</tr>
<tr>
<td>Benishangul-Gumuz - Dibate</td>
<td>Organophosphate</td>
<td>Organophosphate</td>
<td>SumiShield</td>
<td>SumiShield</td>
</tr>
<tr>
<td>Benishangul-Gumuz - Pawi</td>
<td>Organophosphate</td>
<td>Fludora Fusion</td>
<td>Fludora Fusion</td>
<td>Fludora Fusion</td>
</tr>
<tr>
<td>Oromia - Horo Guduru (4 districts)</td>
<td>Organophosphate</td>
<td>SumiShield</td>
<td>SumiShield</td>
<td>SumiShield</td>
</tr>
<tr>
<td>Oromia - West Guji (3 districts)</td>
<td>Organophosphate</td>
<td>Fludora Fusion</td>
<td>Fludora Fusion</td>
<td>Fludora Fusion</td>
</tr>
<tr>
<td>Amhara (6 districts)</td>
<td>Carbamate</td>
<td>Organophosphate</td>
<td>Organophosphate</td>
<td>Organophosphate</td>
</tr>
</tbody>
</table>

*Planned.

Conclusions for IRS Investments

IRS is one of the mainstays of vector control in Ethiopia in high malaria burden districts according to the NMSP (2021–2025). PMI will continue supporting IRS in districts in the western part of the country with the highest malaria burden. In 2021, PMI graduated three low malaria burden districts from Oromia from PMI IRS support and expanded to six high malaria burden districts in Amhara Region. PMI will continue providing minimal support to graduated districts for them to sustain the gains. In collaboration with NMEP and partners, PMI will intervene as needed if malaria upsurges are detected in the recently graduated districts. PMI will continue evaluating the IRS supported districts’ malaria status to determine whether to graduate PMI support for IRS in more districts of Oromia based on best available entomological and epidemiological data in 2022. Pirimiphos-methyl residual efficacy results show average efficacy of three months. If pirimiphos-methyl is used for IRS, spray time closer to the main transmission period needs to be considered despite challenges with road access due to heavy rain. Whenever possible community based IRS and prepositioning could be considered. Entomological monitoring including behavioral, insecticide resistance and insecticide decay rate is becoming more important as clear evidence is needed to determine an IRS insecticide choice due to the challenges posed by spread of *An. stephensi*. PMI plans to maintain funding allocation for IRS and entomological monitoring.

Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.
2. HUMAN HEALTH

2.1. CASE MANAGEMENT

NMEP Objective
The Ethiopia Malaria Elimination Strategic Plan (2021–2025) states that early diagnosis and prompt treatment of malaria cases will be implemented nationwide for all segments of the population including regular residents, refugees, internally displaced persons (IDP), and mobile and migrant population, at both the community and health facility level. Treatment of malaria cases will be based on parasitological diagnosis. Rapid Diagnostic Tests (RDTs) are used at community levels (health posts [HPs]) and microscopy is used in health centers and hospitals. In other words, universal access to confirmatory testing and treatment of malaria cases will be ensured and case management implemented as per the national guidelines.

NMEP Approach
According to the Ethiopia Malaria Elimination Strategic Plan (2021–2025), microscopy is the primary means of malaria diagnosis at health centers and hospitals and RDTs are recommended to diagnose malaria at HPs. A malaria suspect case is defined in the National Malaria Guidelines (2018) as a person of any age group living in malaria endemic area with fever or history of fever in the past 48 hours or a person from non-malaria endemic area having fever or history of fever in the past 48 hours and has history of travel to malaria endemic areas in the past 30 days.

The FMOH states that artemether-lumefantrine (AL) with single low-dose primaquine should be used to treat *P. falciparum* infections, whereas chloroquine combined with radical cure primaquine (0.25mg/kg daily x 14 days) should be used to treat *P. vivax* cases without prior G6PD testing. Oral quinine remains the treatment of choice for uncomplicated *P. falciparum* for pregnant women during the first trimester of pregnancy, and as second-line for treatment failures. Rectal artesunate should be available at rural HPs for pre-referral treatment for children under six years of age, and parenteral artesunate or intramuscular artemether (alternate) should be available at health centers and hospitals for the treatment of severe malaria.

There are three levels of private health facilities. Primary and medium clinics are at the primary level; specialty clinics, specialty centers, and general hospitals are at the secondary level; and specialized hospitals are at the tertiary level. All private health facilities except primary clinics should have a microscope and should be able to test for malaria. According to the MIS (2015), 24.1 percent of mothers took their children under five years of age with fever to a private health facility. The Ethiopia Malaria Elimination Strategic Plan 2021–2025 identified limited engagement of private health facilities in malaria program implementation and put in place a plan to increase engagement of the private sector, which is outlined in the Malaria Public–Private Mix guideline, 2020. This strategy has a target of reaching all private health facilities with a public–private mix approach by 2025 from the baseline of 5.5 percent in 2018. The NMEP guidance for malaria diagnosis and treatment in the private sector is similar to that for the public sector. Malaria diagnosis should be confirmed with RDT for those clinics without microscopy services. Microscopy, if available, is the recommended method to diagnose malaria in private clinics. In general, drug availability and use are the same in the public and private sectors, except for the wider availability of artemether injection in the private sector to treat severe malaria.
Ethiopia has been implementing the health extension program (HEP) in communities that focuses on health promotion, disease prevention, and limited curative service of 16 packages since 2003. Changes in demography, disease epidemiology, socioeconomic factors, community demand, and global and national priorities have led to the revision of the HEP and development of a Road Map for Optimizing the Health Extension Program, 2020–2035. The goal of the Road Map is to accelerate the realization of universal health coverage through which all Ethiopians will have access to health services. HEP is the primary mechanism to achieve universal health coverage. There are three packages of HEP depending on catchment areas:

- The comprehensive HEP package includes maternal healthcare, integrated management of newborn and childhood illnesses, prevention and treatment of common adulthood illnesses, and follow-up of chronic illnesses. This is for communities that have limited access to health centers or hospitals that are more than one hour distance. Comprehensive service HPs will be staffed by two level IV HEWs, one midwife and one health officer.
- Basic HEP provides the existing package by improving quality and strengthening referral linkages. This is for communities that have access to a health center or hospital within a reasonable distance (one hour walk). These HPs will be staffed by two level IV HEWs and one nurse.
- For communities that already have a health center or a hospital within the kebele (village), HEP will be provided by the health centers or hospitals. There will be two HEWs providing health extension services. All staffing patterns will evolve and HEWs will be upgraded or replaced by higher-level health workers.

There are 39,878 HEWs in 17,587 HPs, which achieved a target of having one HP for 3,000–5,000 people. HEWs are trained in Technical and Vocational Education and Training institutes for 10 months and are provided with a comprehensive integrated refresher training by the Government of Ethiopia. They receive frequent supervision from the district health office and nearby health centers. The HEWs focus on preventive services; however, they also provide curative healthcare services for malaria for all ages, and pneumonia and diarrhea in children under five years of age using the iCCM approach of evidence-based diagnostic and treatment algorithms. For malaria, HEWs have been trained to confirm and report malaria diagnoses among clinically evaluated acutely ill patients using malaria multi-species RDTs. Severe malaria cases are referred to the next appropriate health facility, with initial pre-referral management using rectal artesunate. The HEWs are encouraged to consider other diagnostic possibilities for patients who test negative by malaria RDT, and to avoid empiric treatment with antimalarials.

The Road Map outlines different retention and motivation mechanisms for HEWs that include upgrading of all HEWs to level IV by 2025, which provides a clear career path for HEWs that was lacking in the past and introduction of monetary and nonmonetary benefit packages.

In addition to this, the HEP Road Map underlined redesign of community engagement mechanisms because the current community engagement platform of women-based Health Development Army is not adequately functioning. Results from the 2019 national HEP assessment have shown that there are gaps in the existing SBC approaches and programming and 41 percent of community members were not aware of the services available to them at the nearby HP. Revision of the community engagement strategy includes different approaches like introduction of a new community mobilization cadres called Village Health Leaders to bridge HEWs with households, optimization of health development army strategy, appending men engagement strategy, harnessing indigenous social structures, and implementing innovative approaches to engage the youth and implement motivation schemes.
The NMEP and RHB malaria teams conduct regular malaria-specific supportive supervision biannually to the lower levels including health facilities and community beneficiaries. The Woreda health office conducts integrated supportive supervision quarterly using an integrated checklist. Additionally, health centers provide supervision and mentoring support for their catchment HPs in an integrated manner.

**PMI Objective in Support of NMEP**

PMI builds the capacity of NMEP, EPHI, EPSA, regional laboratories, RHBs, and districts to manage the malaria case management program effectively. PMI supports the NMEP in updating malaria case management guidelines according to WHO and local context, training materials, and job aids. PMI is supporting training of HEWs, midwives, clinicians, pharmacists, and laboratory professionals on the current malaria case management guidelines. It also supports supervision and mentoring of health workers to improve the quality of malaria diagnosis and treatment. PMI in partnership with the Global Fund is also procuring essential commodities and drugs for malaria diagnosis and treatment.

PMI also builds capacity of woreda health offices to manage malaria case management in their catchment health facilities. A woreda will be graduated or transferred from PMI to RHB for routine support based on a standard transition scorecard that has eight criteria for clinical services, nine for lab, and four for reporting, monitoring, and supervision criteria. The facilities should demonstrate 90 percent of the criteria are met before graduating from PMI to RHB support.

PMI is supporting case management activities in all regions except Harari and Dire Dawa, which have low malaria burden.

**PMI-Supported Recent Progress (with FY 2019 and earlier funding)**

PMI procured 200,000 vials of injectable artesunate, 7,414,490 chloroquine tablets, and 90,000 artesunate suppositories. PMI assisted in the development of a pocket guide on malaria case management and national malaria training manual for malaria program managers. PMI also supported the development of clinical and program mentoring guidelines.

PMI supported malaria case management training for 2,362 clinical health workers, of which 1,754 were HEWs. PMI also supported malaria laboratory diagnosis training for 2,133 health professionals (of which 1,754 were health extension workers) including several rounds of onsite supportive supervision and mentorship. Laboratory strengthening activities for malaria microscopy include quality improvement, purchasing laboratory equipment and additional supplies, supportive supervision for treatment processes, and activities to improve private sector case management.

PMI supported external quality assessments (EQAs) for malaria microscopy in 225 out of 1650 targeted health facilities and performance assessments for RDTs in 504 out of 3,300 targeted HPs.

PMI expanded its supportive supervision integrated with maternal and child health projects to 5 hospitals, 103 health centers, and 496 HPs in developing regions.

Of the 410 targeted health facilities in high-burden areas, PMI conducted quarterly clinical mentoring at 320 health facilities, quarterly malaria microscopy mentoring at 361 health facilities, and quarterly monitoring and evaluation and data quality mentoring (which is integrated with case management support) at 353 health facilities.
The FMOH and EPHI is scaling up malaria microscopy EQA using Global Fund resources with PMI providing TA.

PMI provided biomedical support for five of 15 targeted subnational biomedical centers and two of four biomedical engineering teaching universities. Twenty-five biomedical engineers were trained on equipment maintenance of five types of equipment (microscopes, centrifuge, fridge, biosafety cabinet, and incubator).

In September 2020, PMI planned to conduct a therapeutic efficacy study (TES) of artemether-lumefantrine or pyronaridine-артесunate plus single-dose primaquine (SDPQ) for *P. falciparum* and chloroquine or pyronaridine-артесunate plus primaquine (14 days) for *P. vivax*. Due to ethical clearance delays, implementation of the study was postponed to September 2021.

Recent studies have confirmed high rates of HRP2/3-deletions in Eritrea and Sudan, thus PMI Ethiopia incorporated the testing of HRP2/3 deletions in TES samples collected in September 2017. TES based analysis showed presence of HRP2/3 double deletions in three out of 20 samples (15 percent). In addition, a collaborative effort between WHO and EPHI conducted a larger survey of several health facilities to investigate the occurrence of HRP2/3 deletions in districts in the Gambela, Tigray, and Amhara regions bordering Sudan and Eritrea. Preliminary results have shown 13 percent (350/2,704) discordant in malaria suspected self-presented patients screened by Carestart PfHRP2/PvLDH and SD-Bioline HRP2/PfLDH RDTs. The district specific results range from 5 percent to 30 percent. The final report of a national survey of HRP2/3 gene deletions is expected to be disseminated in May 2021.

Bottlenecks or challenges that have slowed and prevented implementation of case management strengthening activities include the relatively large number of health facilities in Ethiopia along with low government capacity; these have posed challenges to scaling up comprehensive EQA because it requires skilled human resources and logistics to reach all facilities.

There are also gaps in the timely supply of quality reagents (e.g., Giemsa) and laboratory supplies as well as lack of maintenance of microscopes and laboratory equipment. Other challenges include maintaining the quality of services in graduated health facilities and low adherence of health workers to standard protocols (e.g., testing all febrile patients, providing radical cure primaquine, inadequate recording and reporting of treated malaria cases, overdiagnosis of severe malaria, and over-utilization of artesunate injection).

Furthermore, there are challenges in responding timely to diagnostic issues in relation to HRP2/3 deletions.

**PMI-Supported Planned Activities in CY 2021 (with currently available funds)**

- PMI will continue to provide program management support in malaria diagnosis and treatment to the FMOH, NMEP, RHBs, zonal health departments, woreda health offices, and targeted health facilities. In addition, training will be provided to laboratory and clinical professionals and program management staff.
- PMI will also continue to support EQAs, onsite evaluations for malaria microscopy, and clinical mentoring in 1,760 health facilities. PMI will provide support to improve data quality focusing on data validity at the facility level.
- PMI will provide onsite case management and RDT mentorship to 3,796 HPs out of a total of 12,815 located in malaria-endemic areas.
• PMI will continue to provide support to national and 15 subnational biomedical centers and four biomedical engineering teaching universities to improve the availability of functional equipment for malaria case management.
• In addition, PMI will support a TES to monitor the first-line and alternate drugs in September 2021.

Key Goal
Improve access to and use of timely, quality, and well-documented malaria testing and treatment by providing facility- and community-based health workers with training, supervision, and malaria commodities to provide quality, effective care.

Key Question 1a
What is the status of care-seeking and/or access to care for children under five years of age with fever?

Care-seeking for fever for children under five years of age has improved from 38 percent in 2015 to 64 percent in 2020 according to a survey⁴ conducted by NMEP on ownership and use of LLINs and malaria care-seeking behavior in Ethiopia (Figure A-17).

Though access to primary healthcare is more than 90 percent in 2019 according to the Health Sector Transformation Plan, vulnerable populations such as migrant workers, IDPs due to disaster and conflict, and refugees have limited access to malaria services.

⁴ NMEP report: A survey on ownership and use of ITNs and malaria treatment seeking behavior in Ethiopia, September 2020.
Figure A-17. Trends in care-seeking for fever

Among children under five years of age with fever in the two weeks before the survey, percentage for whom advice or treatment was sought

Key Question 1b

What significant structural and/or behavioral challenges affect prompt care-seeking?

Detailed understanding of behavioral determinants for care-seeking is needed. This includes but is not limited to knowledge, attitude, self-efficacy, response efficacy, perceived risk, perceived severity, norms, patient-client interactions, and service communication. PMI is planning to obtain this information through the anticipated Malaria Behavior Survey (MBS) in 2022. A better understanding of the social factors, including cultural and gender norms, are essential to contextualize and adapt SBC interventions specific to the needs of different regions.

Supporting Data

- The C4H 2019 midline report showed close to 12 percent of children under five years of age in malarious areas had a fever in the two weeks before the survey. Out of these children, only 44 percent sought timely treatment within 24 hours of fever incidence, with 70 percent eventually seeking treatment.
- The 2015 MIS reported these same districts showed 16 percent of children under five years of age had fever during the two weeks preceding the survey and treatment was sought for only 38 percent of children with fever. There are geographical variations related to care-seeking behavior. Results from the 2015 MIS showed that among children under five years of age with fever, treatment was sought in 75.5 percent, 31.2 percent, and 45 percent of cases in Harari, Tigray, and Benishangul-Gumuz, respectively.
- In addition, the USAID health project gender analysis reports that poor service quality has caused men and women comparably to not seek care, or bypass services at the nearest health facility. Furthermore,
men and women who live in rural areas, who are less educated, and who are less wealthy have lower health service utilization rates.

Please refer to Section 3.4 for information on how SBC interventions will be directed to address the challenges identified above.

Key Question 2a
What proportion of patients are being tested and appropriately treated for malaria?

Malaria testing remains low in the MIS 2011 and 2015 surveys at 17 percent. The routine HMIS does not capture malaria suspected cases to allow monitoring of malaria testing rates although PMI is advocating along with the NMEP to include suspected cases in HMIS in 2021. However, treatment of children with fever with ACT has improved between the two MIS (29 percent in the 2011 MIS and 89 percent in the 2015 MIS, see Figure A-18).

Supporting Data

Figure A-18. Trends in diagnosis and treatment of children with fever
Among children under five years of age with fever in the two weeks before the survey and with fever in the two weeks before the survey who received any antimalarial

As shown in Table 3, in 2020, some 6,873,798 received diagnostic testing for malaria and 1,398,750 were confirmed to have malaria with a test positivity rate of 20 percent.

PMI supported malaria service integration with maternal, child health services in 37 woredas. Within these 37 woredas, 57.6 percent (1,254/2,176) of children under five years of age who had fever were tested for malaria and 76 percent (915/1,200) of malaria cases in all age groups were treated according to the national guidelines in FY 2020. In contrast, during the fourth quarter of FY 2020, only 49 percent (120/246) of mentored health
facilities scored >95 percent on a metric measuring treatment according to national guidelines in other PMI supported regions.

Key Question 2b
What significant structural and behavioral challenges affect testing and treatment practices among providers?

- The HMIS currently does not capture the number of malaria suspected patients or the number of patients with fever although PMI is working to add it. Therefore, it is not known what proportion of malaria suspected patients are tested, which makes it difficult to provide feedback to health workers. This is one factor for low malaria testing in Ethiopia.
- Providers’ low adherence to the national guidelines in providing malaria testing and treatment services as per the standard guideline is identified as a key barrier for recommended service provider behavior.
- The factors for low adherence to the national diagnosis and treatment protocols will be investigated with a baseline assessment in 2022.

Supporting Data

- A clinical audit\(^5\) of private providers conducted in 2016–2017 in northwest Ethiopia revealed that all malaria suspected patients were investigated either with microscopy (80.6 percent) or RDT (19.4 percent) for parasitological confirmation while only one-fifth of malaria patients had received “ideal” malaria treatment services, often compromised by the addition of artemether injection to oral treatment and/or the lack of single low-dose primaquine for \(P. falciparum\) cases.
- This study recommends a qualitative exploratory study to understand the reasons for the suboptimal adherence to national malaria diagnosis and treatment guidelines.
- Likewise, the 2020 qualitative study by Breakthrough Action in Gambela and Benishangul-Gumuz regions showed low adherence to national malaria diagnosis and treatment guidelines across all service facilities. Several factors were identified for the low adherence including trainings that were not properly given to all healthcare providers, inadequate coaching and mentorship after the training, focus on the volume of work rather than quality, and low provider motivation.
- According to a 2018 Service Availability and Readiness Assessment (SARA), on average only 36.5 percent of facilities followed FMOH malaria diagnosis and treatment guidelines.

Please refer to Section 3.4 for information on how SBC interventions will be directed to address the challenges identified above.

Key Question 3
What is the current and planned support for case management at health facilities and in the communities by CHWs?

PMI supports efforts to strengthen the quality of malaria laboratory diagnosis and treatment at community and health facility levels focusing on high malaria burden areas in the Gambela, Benishangul-Gumuz, Amhara, Tigray,

Oromia, SNNP, and Afar regions (Figure A-19). PMI also supports integrated malaria diagnosis and treatment with maternal and child health activities in the Afar and Somali regions (Figure A-19). The malaria diagnosis and treatment support is for public health facilities, private health facilities, and populations that have limited access to healthcare like IDPs, refugees, and mobile and migrant populations. Global Fund also provides malaria case management support for Ethiopia that is national in scope.

Supporting Data

**Figure A-19. Map of PMI-supported districts for malaria case management activities**

Key Question 4

What is the estimated need for RDTs during calendar years 2021–2023? Are there any projected RDT gaps based on anticipated partner contributions compared to estimated needs?

The estimated need for RDTs during CY 2021–2023 is 5,358,757, 5,869,710, and 5,668,018, respectively. There is a small gap of 76,410 RDTs in calendar year 2022 to meet the need for the year and 12 months of minimum stock at the end of the year. Given the identified >5 percent prevalence of HRP2/HRP3 double deletions in specific districts, PMI would like to start the process of switching to Pf/PvLDH-based RDTs for a phased implementation to mitigate false negative RDTs.
### Table A-10. RDT Gap Analysis Table

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total country population</td>
<td>102,998,000</td>
<td>105,166,000</td>
<td>107,332,500</td>
</tr>
<tr>
<td>Population at risk for malaria</td>
<td>53,661,958</td>
<td>54,791,486</td>
<td>55,920,233</td>
</tr>
<tr>
<td>PMI-targeted at-risk population</td>
<td>53,661,958</td>
<td>54,791,486</td>
<td>55,920,233</td>
</tr>
<tr>
<td><strong>RDT Needs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number of projected fever cases</td>
<td>9,279,233</td>
<td>10,164,000</td>
<td>9,814,750</td>
</tr>
<tr>
<td>Percent of fever cases tested with an RDT</td>
<td>55%</td>
<td>55%</td>
<td>55%</td>
</tr>
<tr>
<td><strong>RDT Needs (tests)</strong></td>
<td>5,358,757</td>
<td>5,869,710</td>
<td>5,668,018</td>
</tr>
<tr>
<td><em>Needs Estimated based on HMIS Data</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Partner Contributions (tests)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RDTs from Government</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>RDTs from Global Fund</td>
<td>5,358,757</td>
<td>5,869,710</td>
<td>5,668,018</td>
</tr>
<tr>
<td>RDTs from other donors</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>RDTs planned with PMI funding</td>
<td>0</td>
<td>75,000</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total RDT Contributions per Calendar Year</strong></td>
<td>5,358,757</td>
<td>5,944,710</td>
<td>5,668,018</td>
</tr>
<tr>
<td><strong>Stock Balance (tests)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beginning Balance</td>
<td>5,793,300</td>
<td>5,793,300</td>
<td>5,868,300</td>
</tr>
<tr>
<td>- Total Contributions (received/expected)</td>
<td>5,358,757</td>
<td>5,869,710</td>
<td>5,668,018</td>
</tr>
<tr>
<td>Ending Balance</td>
<td>5,793,300</td>
<td>5,868,300</td>
<td>5,868,300</td>
</tr>
<tr>
<td>Desired End of Year Stock (months of stock)</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Desired End of Year Stock (quantities)</td>
<td>5,358,757</td>
<td>5,869,710</td>
<td>5,668,018</td>
</tr>
<tr>
<td><strong>Total Surplus (Gap)</strong></td>
<td>434,543</td>
<td>(1,410)</td>
<td>200,282</td>
</tr>
</tbody>
</table>

A survey of HRP2/3 deletions in Ethiopia supported by WHO showed 9.6 percent (95 percent CI 8.4-10.9) estimated pfhrp2-deleted parasite prevalence among symptomatic falciparum cases overall, meeting WHO criteria for RDT policy change (Figure A-20).
Figure A-20. Map of HRP2/3 deletions in Ethiopia


Key Question 5
What is the estimated need for ACTs during calendar years 2021–2023? Are there any projected ACT gaps?

The estimated need for ACTs during CY 2021–2023 is 3,466,105, 3,087,713, and 2,709,320 treatment courses, respectively. There is no gap in the ACTs and all needs and the 12-month desired stock at the end of the year are met.
Table A-11. ACT Gap Analysis Table

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total country population</td>
<td>102,998,000</td>
<td>105,166,000</td>
<td>107,332,500</td>
</tr>
<tr>
<td>Population at risk for malaria</td>
<td>53,661,958</td>
<td>54,791,486</td>
<td>55,920,233</td>
</tr>
<tr>
<td>PMI-targeted at-risk population</td>
<td>53,661,958</td>
<td>54,791,486</td>
<td>55,920,233</td>
</tr>
<tr>
<td><strong>ACT Needs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total projected number of malaria cases</td>
<td>2,830,385</td>
<td>2,480,172</td>
<td>2,136,488</td>
</tr>
<tr>
<td><em>Total ACT Needs (treatments)</em></td>
<td><strong>3,466,105</strong></td>
<td><strong>3,087,713</strong></td>
<td><strong>2,709,320</strong></td>
</tr>
<tr>
<td><strong>Needs Estimated based on Consumption Data</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partner Contributions (treatments)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACTs from Government</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ACTs from Global Fund</td>
<td>3,466,105</td>
<td>3,087,713</td>
<td>2,709,320</td>
</tr>
<tr>
<td>ACTs from other donors [specify donor]</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ACTs planned with PMI funding</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em>Total ACTs Contributions per Calendar Year</em></td>
<td><strong>3,466,105</strong></td>
<td><strong>3,087,713</strong></td>
<td><strong>2,709,320</strong></td>
</tr>
<tr>
<td><strong>Stock Balance (treatments)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beginning Balance</td>
<td>4,324,090</td>
<td>4,324,090</td>
<td>4,324,090</td>
</tr>
<tr>
<td>- Product Need</td>
<td>3,466,105</td>
<td>3,087,713</td>
<td>2,709,320</td>
</tr>
<tr>
<td>+ Total Contributions (received/expected)</td>
<td>3,466,105</td>
<td>3,087,713</td>
<td>2,709,320</td>
</tr>
<tr>
<td>Ending Balance</td>
<td>4,324,090</td>
<td>4,324,090</td>
<td>4,324,090</td>
</tr>
<tr>
<td>Desired End of Year Stock (months of stock)</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Desired End of Year Stock (quantities)</td>
<td>3,466,105</td>
<td>3,087,713</td>
<td>2,709,320</td>
</tr>
<tr>
<td><strong>Total Surplus (Gap)</strong></td>
<td><strong>857,985</strong></td>
<td><strong>1,236,377</strong></td>
<td><strong>1,614,770</strong></td>
</tr>
</tbody>
</table>

Key Question 6

What is the estimated need for definitive treatment and pre-referral treatment for severe malaria during calendar years 2021–2023? Are there any anticipated gaps?

The estimated need for injectable artesunate during CY 2021–2023 is 430,656, 383,284, and 337,290 vials, respectively, while the estimated need for rectal artesunate during the same period is 51,260 100 mg suppositories for each year. All 12,815 (75 percent) of the HP in malarious areas will be providing pre-referral treatment for malaria. There is no anticipated gap in the injectable or rectal artesunate when planning for only six months desired end-of-year stock and not the recommended 12 months. There is no plan to procure intramuscular artesunate or intramuscular artemether for pre-referral treatment.
Supporting Data

**Key Question 7**

What is the estimated need for any other standard antimalarial drug used in the country (e.g., primaquine for *P. vivax*) during calendar years 2021–2023? Are there any anticipated gaps?

The estimated need for chloroquine during CY 2021–2023 is 7,895,000, 7,026,500, and 6,183,300 of 250 mg tablets, respectively. Ethiopia received 50,000,000 tablets of chloroquine donation from Medicines for Malaria Venture, so there is no gap for chloroquine tablets. The estimated need for primaquine during CY 2021–2023 is 17,406,000, 16,999,700, and 16,441,700 7.5 mg tablets, respectively. There is no anticipated gap of primaquine tablets in the three-year period because the Global Fund will procure all primaquine needs from 2021 to 2023.

Supporting Data

Table A-12. Primaquine Gap Analysis Table

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total country population</td>
<td>102,998,000</td>
<td>105,166,000</td>
<td>107,332,500</td>
</tr>
<tr>
<td>Population at risk for malaria</td>
<td>53,661,958</td>
<td>54,791,486</td>
<td>55,920,233</td>
</tr>
<tr>
<td>PMI-targeted at-risk population</td>
<td>53,661,958</td>
<td>54,791,486</td>
<td>55,920,233</td>
</tr>
<tr>
<td><strong>Chloroquine Needs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total projected number of malaria cases</td>
<td>2,830,385</td>
<td>2,480,172</td>
<td>2,136,488</td>
</tr>
<tr>
<td>Total projected number of <em>P. f.</em> malaria cases</td>
<td>2,066,181</td>
<td>1,810,526</td>
<td>1,559,637</td>
</tr>
<tr>
<td>Total projected number of <em>P.v</em> malaria cases</td>
<td>764,204</td>
<td>669,647</td>
<td>576,852</td>
</tr>
<tr>
<td><strong>Total Chloroquine Needs (tablets)</strong></td>
<td>7,895,000</td>
<td>7,026,500</td>
<td>6,183,300</td>
</tr>
</tbody>
</table>

*Needs Estimated based on Consumption Data*

**Partner Contributions (tablets)**

<table>
<thead>
<tr>
<th></th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloroquine tablets from Government</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chloroquine tablets from Global Fund</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chloroquine tablets from other donors [specify donor] MMV</td>
<td>50,000,000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chloroquine tablets planned with PMI funding</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total Chloroquine Contributions per Calendar Year</strong></td>
<td>50,000,000</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Stock Balance (tablets)**

<table>
<thead>
<tr>
<th></th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginning Balance</td>
<td>159,000</td>
<td>42,264,000</td>
<td>35,237,500</td>
</tr>
<tr>
<td>- Product Need</td>
<td>7,895,000</td>
<td>7,026,500</td>
<td>6,183,300</td>
</tr>
<tr>
<td>+ Total Contributions (received/expected)</td>
<td>50,000,000</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ending Balance</td>
<td>42,264,000</td>
<td>35,237,500</td>
<td>29,054,200</td>
</tr>
<tr>
<td>Desired End of Year Stock (months of stock)</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Desired End of Year Stock (quantities)</td>
<td>7,895,000</td>
<td>7,026,500</td>
<td>6,183,300</td>
</tr>
<tr>
<td><strong>Total Surplus (Gap)</strong></td>
<td>34,369,000</td>
<td>28,211,000</td>
<td>22,870,900</td>
</tr>
</tbody>
</table>
Key Question 8
Are first-line ACTs effective and monitored regularly?

According to 2017 TES, artemether-lumefantrine (AL) and dihydroartemisinin-piperaquine (DP) remain efficacious in Ethiopia for the treatment of *P. falciparum* infection and DP, AL, and chloroquine (CQ) remain efficacious for the treatment of *P. vivax* infection. Preliminary results from TES 2019 confirm the adequate clinical and parasitological responses of CQ plus 14 days of primaquine (3.5mg/kg) is 100 percent for treatment *P. vivax* and 98.7 percent for AL plus SDPQ for treatment of *P. falciparum* at Day 28. Day 42 failure rate for CQ plus 14 days primaquine is 10.9 percent and 3.9 percent for AL plus SDPQ (Table A-13).

Supporting Data

### Table A-13. Recently completed and ongoing antimalarial therapeutic efficacy studies

<table>
<thead>
<tr>
<th>Year</th>
<th>Sites</th>
<th>PMI Funded Y/N</th>
<th>Species/Treatment Arms</th>
<th>PCR-Corrected ACPR&gt;90%</th>
<th>Location Molecular Resistance Work Completed or Planned</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017*</td>
<td>Pawe, Arba Minch</td>
<td>Y</td>
<td>Pf/ AL, Pf/ DP, Pv/ CQ, Pv/ DP</td>
<td>Yes, Yes, Yes, Yes</td>
<td>CDC Atlanta (PARMA)</td>
</tr>
<tr>
<td>2019*</td>
<td>Arba Minch, Abergale, Tigay and Bambasi</td>
<td>N (Global Fund)</td>
<td>Pf/ AL+SDPQ, Pv/ CQ+14PQ</td>
<td>Yes</td>
<td>Armauer Hansen Research Institute (AHRI) Lab</td>
</tr>
<tr>
<td>2020*</td>
<td>Metehara, Shewarobit, Arba Minch and Hamusit</td>
<td>N (FMOH/WHO/EPHI)</td>
<td>Pf/ AL+SDPQ, Pf/ DP+SDPQ, Pv/ CQ+14PQ</td>
<td>N/A</td>
<td>Ethiopian Public Health Institute (EPHI) Lab, may request CDC support</td>
</tr>
<tr>
<td>2021 (Planned)</td>
<td>Amhara and Arba Minch</td>
<td>Y</td>
<td>Pf/ AL+SDPQ, Pf/ PY+SDPQ, Pv/ CQ+14PQ</td>
<td>N/A</td>
<td>Armauer Hansen Research Institute (AHRI) and CDC Atlanta (PARMA) Lab</td>
</tr>
</tbody>
</table>

ACPR: adequate clinical and parasitological response; AL: artemether-lumefantrine; DP: dihydroartemisinin-piperaquine; PARMA: PMI-supported Antimalarial Resistance Monitoring in Africa; N/A: not available; SDPQ: single-dose primaquine; PY: Pyramax (artesunate/pyronaridine); Pf: *Plasmodium falciparum*; Pv: *Plasmodium vivax*.

*Reports not yet available for formal review of the methods.

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Key Question 9

Are there other areas (e.g., lab strengthening, private sector support, etc.) that should be considered for PMI support?

The MIS in 2007 and 2015 found that about 24.1 to 36.4 percent of people initially receive care for febrile illnesses through the private sector, respectively. The NMSP states that partnership with the private sector will be promoted through public private partnership framework and regulations.

PMI was working directly with private clinics (including on-site farm/workplace clinics) to improve malaria diagnosis and treatment for migrant workers. As part of the FMOH migrant worker advisory group, PMI is helping to develop consistent health treatment policies, explore HEW outreach, and create commodity distribution guidelines that will improve migrant worker access to public health facilities and antimalarial drugs.

With FY 2022 funding, PMI will support private facilities in towns with very high malaria transmission potentially serving migrant workers and refugees. Although the number of supported private health facilities will be limited, the number of suspected cases tested and reported from these facilities are expected to be high as high-volume facilities in high-burden areas were selectively targeted for this activity.

Supporting Data

From July 2019 to September 2020, PMI supported the provision of malaria case management in 163 of 7,307 private for-profit health facilities and 29 temporary clinics. A total of 77,614 suspected cases were tested, of which 15,629 (20 percent) were positive for malaria and 1,774 (11 percent) were children under five years of age.

Conclusions for Case Management Investments

PMI proposes to expand malaria diagnosis and treatment services to reach IDPs. According to the Ethiopia National Displacement Report 7 produced by the International Organization for Migration, in the past few years there have been reports of internal displacement mainly due to conflict and other factors like flooding. In 2018, Ethiopia recorded the third highest number of new displacements worldwide, with 3,191,000 IDPs identified. Around 202,202 IDPs were displaced in October 2019 due to several flood incidences in Afar, Oromia, SNNP, and Somali Regions. According to the government, 1.8 million IDPs have returned to their place of origin as of June 2019. This nationwide, government-led return operation has been ongoing since April 2019. As of March 9, 2021, the International Organization for Migration counted 131,000 displaced persons in 39 accessible locations in Tigray due to the conflict in Northern Ethiopia. These data only capture those in accessible locations. IDPs have limited access to malaria preventive and treatment services, and may be at increased risk for malaria. In 2019, PMI supported an outreach service for IDPs of the Guji-Gedeo conflict in 10 IDP sites and found a malaria prevalence of 10.3 percent (94/913), which is 10 percentage points above the SNNP regional state prevalence. It was also observed that there was a shortage of ITNs.

There will not be a major change from FY 2020 and 2021 approved activities, but PMI will be targeting its interventions to prepare the healthcare workforce to address populations at risk for malaria, including IDPs and refugees.

Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.
2.2. DRUG-BASED PREVENTION

NMEP Objective
The Ethiopia Malaria Elimination Strategic Plan (2021–2025) doesn’t recommend IPTp, IPTi, or SMC. The low and very low malaria transmission areas are targeted for malaria elimination and the interventions include case investigation and targeted mass drug administration.

NMEP Approach
The Ethiopia Malaria Elimination Strategic Plan (2021–2025) includes support for malaria elimination interventions in 565 low and very low malaria transmission woredas. The interventions include strengthening surveillance, case investigation, and reactive case detection following reported index cases, and targeted population parasite clearance approaches such as targeted mass drug administration and foci investigation and management.

PMI Objective in Support of NMEP
N/A

PMI-Supported Recent Progress (past ~12 months)
N/A

PMI-Supported Planned Activities (next ~12 months with currently available funds)
N/A

2.2.1. MALARIA IN PREGNANCY (MIP)

Key Goal
Support the national strategy for MIP, which includes mass ITN distribution and effective case management of malaria per WHO and national guidelines.

Key Question 1a
What proportion of pregnant women are accessing antenatal care (ANC) early and frequently (as recommended by national and/or WHO strategies) during their pregnancy?

Supporting Data
ANC attendance is not optimal in Ethiopia (Figure A-21), however, in PMI-supported facilities, 85 percent (308/361) of health facilities manage malaria in ANC. The situation is not known in non-PMI-supported health facilities and pregnant women with malaria are managed either in the adult outpatient department or ANC. Strengthening case management in both adult outpatient departments and ANC will ensure effective malaria case management in pregnancy.
Key Question 1b
Are there important health systems and/or behavioral barriers to ANC attendance at health facilities?

Supporting Data
The Communication for Health (C4H) sociocultural qualitative study showed that low risk perception, fear and lack of power, uncertainty about pregnancy status, not wanting to disclose pregnancy status, sociocultural influence, family members’ influence, and inadequate information about first ANC visit were behavioral barriers to ANC attendance at health facilities. In addition, the study indicated that four ANC checkups is not the social norm due to the belief that an ANC checkup is required only when a pregnant woman experiences physical distress. The study also found that suboptimal quality of care, unfriendly healthcare providers, inaccessibility of health facilities on the weekends, distance and transportation challenges, and poor health facility infrastructure were identified as barriers to uptake of ANC services. Similarly, the C4H quantitative survey indicated that gender norms are another barrier for ANC attendance. ANC attendance has increased with PMI and Maternal Child Health support (28 percent to 62 percent for one ANC visit); however, first ANC visits are late (only 20 percent in first trimester) and few pregnant women make the recommended +4 ANC visits (32 percent +4 ANC). ANC attendance is challenged by lack of access, societal norms, and lack of gender empowerment. The majority of women reported that they decided to go to the health facility for the first ANC checkup without telling their husbands. The survey indicated that making an early ANC visit influenced multiple other health behaviors including use of ITNs by pregnant women. PMI will continue to work with Maternal Child Health and other partners to encourage early and frequent ANC attendance through community SBC, improving healthcare worker performance, and expanding access.

Key Question 2
What proportion of pregnant women are receiving the recommended doses of IPTp?
IPTp is not a recommended strategy in Ethiopia.

Supporting Data
N/A

Key Question 3a
What is the gap between ANC attendance and IPTp uptake (i.e., missed opportunities for giving IPTp at ANC)?
N/A

Supporting Data
N/A

Key Question 3b
What significant health system and/or behavioral challenges affect provider delivery of MIP services (e.g., IPTp and ITN distribution at ANC)?
N/A

Supporting Data
N/A

Key Question 4
Does the national ANC program or health information system collect data and track the proportion of pregnant women with fever, those tested for malaria, those found to have malaria infection, and those who are treated?

The national health information system does not collect data on the proportion of pregnant women with fever, those tested for malaria, those found to have malaria infection, and those who are treated.

Supporting Data
A quarterly performance report from a PMI implementing partner during July–September 2020 from private facilities of all regions in Ethiopia except Addis Ababa, Harari, and Somali showed 0.5 percent of malaria cases (80/15,629) were in pregnant women.

The health information system does not capture malaria in pregnancy data. There is a need to capture pregnancy status in all components of malaria data (cases, species, admission, and death) and incorporate these data into routine HMIS and Public Health Emergency Management (PHEM) data collection to better understand malaria in pregnancy in Ethiopia. The FMOH is currently revising the HMIS indicators and the NMEP has requested inclusion of malaria in pregnancy in the revised HMIS.

Key Question 5
What is the estimated need for sulfadoxine-pyrimethamine (SP) during 2021–2023? Are there any anticipated SP gaps? Are there gaps in other IPTp commodities?
Conclusions for MIP Investments

PMI proposes to maintain the same level of funding targeting malaria case management for pregnant women in 150 moderate to high malaria burden districts. There is also ongoing TA and program management support from the federal to district level so that the system is able to provide malaria diagnosis and treatment services to pregnant women.

PMI will also consider strategies to improve *P. vivax* case management in pregnant and breastfeeding women who cannot take primaquine.

Please see FY 2022 MOP budget tables for a detailed list of proposed activities with FY 2022 funding.

2.2.2. SEASONAL MALARIA CHEMOPREVENTION (SMC)

SMC is not a recommended intervention for Ethiopia.

2.2.3. ADDITIONAL DRUG-BASED PREVENTIVE STRATEGIES

One of the objectives of the Ethiopia Malaria Elimination Strategic Plan (2021–2025) is to conduct malaria elimination interventions in 565 low and very low malaria transmission *woredas*. The interventions include strengthening surveillance, case investigation following reported index cases, targeted population parasite clearance like targeted mass drug administration and foci investigation and management. PMI plans to support this initiative by building the capacity of 50 elimination targeted *woredas* starting in FY 2022.

Country Goal

The objective of the national malaria program is to conduct case or foci investigation, classification and response in *woredas* currently with annual parasite index of less than 10 and prevent reintroduction of malaria into areas reporting zero indigenous malaria cases by 2021 and beyond.

A national malaria elimination program was launched in 2017, initially in 50 *woredas*, later increased to 239 and during the current strategic plan increased to 565 targeted *woredas*. The NMEP has developed a case and foci investigation classification and response protocol and provided training to RHBs. Case and foci investigation have started partially in the selected *woredas*. Community sensitization was conducted in regions and *woredas* selected for malaria elimination.

PMI Goal

PMI will continue to support the national strategy for pre-elimination or elimination addressing relevant geographic areas in accordance with WHO recommendations. PMI is planning to build the capacity of the malaria program mainly at the *woreda* level in 50 elimination targeted *woredas* including health facilities and community platforms to identify malaria cases, utilize real-time data from digital systems to investigate and classify malaria
cases, and implement targeted malaria elimination interventions. Additionally, PMI will provide support to build program management capacity at zonal, regional, and national malaria programs.

PMI-Supported Recent Progress (progress with FY 2019 funding)

PMI supported surveillance activities in 25 malaria elimination targeted woredas in FY 2020. PMI supported NMEP to develop a case and foci investigation protocol, provided training on malaria elimination to woredas and regions, and conducted zone- and woreda-level review meetings to review data quality and malaria elimination activities. In addition, PMI supported case and foci investigation in Chiro woreda as a learning district in the Oromia Region, and focal test and treat (FTAT), which aims to test all residents within a 70 meter radius of the index case. In Chiro woreda from February 2020, a total of 14 malaria cases were confirmed out of which 11 were classified as local and eligible for additional investigation and response activities. The remaining three cases were imported from outside the woreda. Of the 11 eligible cases, eight (73 percent) were investigated and three were not because staff were unable to travel to kebeles far from the woreda due to transportation challenges. A total of 12 households were found to be eligible for FTAT and all 63 residents received malaria testing. Four positive cases, all classified as locally acquired, were identified and treated according to the national guidelines. No new index case was identified in the woreda from April to the end of September 2020.

Some implementation challenges observed were shortages of RDTs or ACTs at the HP level, even though they may be available at the woreda level. Some HEWs were not able to conduct case investigation due to transportation challenges.

PMI-Supported Planned Activities in CY 2021 (with currently available funds)

Building on the FTAT experiences in the Chiro learning woreda, PMI has expanded FTAT activities to 76 supported elimination woredas.

Key Question 1

What specific drug-based preventive or proactive strategies are directed toward pre-elimination and/or elimination in the near-term? Which of these merit PMI support for FY 2022 funding with consideration of existing or planned national or other partner funding?

PMI is supporting operational research comparing reactive case detection with targeted mass drug administration. The result will guide the selection of appropriate intervention by the NMEP. The NMEP is conducting mainly FTAT at this point although the national strategy recommends targeted mass drug administration in woredas targeted for elimination.

Supporting Data

PMI proposes strengthening malaria elimination support to NMEP with more program management support to national, regional, zonal and woreda malaria programs and increasing the number of woredas to be supported from 25 to 50. PMI hopes to develop a model of scalable malaria elimination interventions for Ethiopia that can be implemented with non-PMI resources like the Global Fund.

Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.
Conclusions for Other Preventive Drug-Use Investments

PMI will continue to support the NMEP national strategy for elimination by building capacity in 50 elimination targeted woredas to identify malaria cases, utilize real time data from digital systems to investigate malaria cases, and implement targeted malaria elimination interventions including FTAT.

Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.

3. CROSS-CUTTING AND OTHER HEALTH SYSTEMS

3.1. SUPPLY CHAIN

NMEP Objective

NMEP aims to ensure availability of antimalarial commodities as needed to ensure health facilities in malarious areas will not face stockouts of antimalarial commodities. Hence, improving the overall management of the malaria supply chain by supporting the forecasting, procurement, and distribution of antimalarial commodities are key objectives in the supply chain.

NMEP Approach

To increase Ethiopia’s capacity in terms of supply chain infrastructure, EPSA has 18 hubs in different regions of the country to ensure accessibility and equitable distribution of health commodities. Additionally, the NMEP aims to have a continuous and sustainable availability of antimalarial commodities through the following activities:

- Provide timely forecasting based on evidence for all malaria commodities.
- Improve procurement of malaria commodities in terms of timeline, process, and quality.
- Monitor stock status and respond timely and effectively to stockouts of malaria commodities at all levels of the FMOH supply chain.
- Work with malaria stakeholders to expeditiously clear malaria commodities entering the country and provide sustainable and uninterrupted distribution to all service delivery points (SDPs).
- Ensure the quality of antimalarial products at all health facilities.
- Promote the rational use of malaria products.

PMI Objective in Support of NMEP

PMI provides support to the NMEP and malaria supply chain in the following areas:

- Procurement, warehousing, and distribution of ITNs to the last mile.
- Procurement of antimalarial pharmaceuticals, diagnostic and laboratory commodities.
- Post-market surveillance of malaria commodities to ensure quality.
- Logistics management information system (LMIS) monitoring and capacity-building.
- Data visibility for the assessment and monitoring of stock levels.
- TA on supply planning and forecasting of malaria commodities.
- Warehousing and distribution process improvements.
• Institutional capacity-building and human resource development.

PMI-Supported Recent Progress (progress with FY 2019 funding)

• PMI supported the provision of site-level support at 727 selected HFs on health supply chain and pharmacy service activities for malaria diagnostic and treatment commodities, including stock management, rational dispensing, LMIS, stock availability, requests of antimalarial commodities, and RDTs. The supervision helped to identify the strengths and weaknesses of management practices and the availability of antimalarial commodities.

• PMI supported five EPSA branches (Hawassa, Arbaminch, Jimma, Negelle, and Gonder) in assessing the malaria stock status as per the malaria epidemic alert communicated from RHB and analyzed the average monthly consumption to support this preparedness activity. Based on the analysis, EPSA branches were instructed to initiate a request to central EPSA and monitor their stock status.

• PMI assessed the availability of malaria commodities and diagnostics and treatment using the annual End Use Verification surveys.

• PMI supported the biweekly stock analysis and risk mitigation plan for malaria commodities.

• PMI supported the tracking of ITNs to the last mile and maintenance of the ITN dashboard to allow for timely decision-making. End-to-end visibility into the ITN campaign progress was established using an Interactive Voice Response technology, mBrana, combined with other existing information systems that can readily provide near real-time visibility into ITN stock movements from the central level of the national supply chain down to quantities dispensed to households.

• PMI supported the development of the FANOS programmatic dashboard (health commodity management information system) to strengthen supply chain data visibility at levels of the health system.

PMI-Supported Planned Activities in CY 2021 (with currently available funds)

• Support the quantification and distribution of malaria commodities to their SDPs.

• Continue supporting the routine distribution of malaria products from central to EPSA hubs and from EPSA hubs to SDPs (through seconded staff).

• Provide continued support for the NMEP and EPSA in maintaining the ITN distribution tracking and monitoring system (ITNs dashboard) as well as investing in more effective distribution to ensure that all procured ITNs reach the end user.

• Coordinate and support ITN-specific SBC activities during mass campaigns focusing on community empowerment and mobilization using existing SBC tools to increase ITN utilization.

• Continue supporting Global Supply Chain Standards (GS1)-related activities in alignment with the mission’s health system strengthening priorities.

• Develop and implement detailed long-term investment plans to improve on shelf availability of commodities and meet the targets set for the stockout reduction strategy.

Key Goal
Ensure continual availability of quality products needed for malaria control and elimination (ACTs, RDTs, Art. Inj., and ITNs) at health facilities and community levels.
Key Question 1

Has the central level, (or subcentral level, if appropriate) been stocked according to plan for ACTs, RDTs, and Art. Inj. over the last year (2020)? If not, have they been under, over, or stocked out?

ACTs, RDTs, and injectable artesunate were stocked according to plan at the central level for most of the past calendar year. Procurement delays caused AL 6x4 to be understocked at the beginning of 2020 and AL 6x3 to be understocked at the end of 2020. Shipments were received shortly after reporting bringing the products back up to acceptable levels. Additionally, injectable artesunate was overstocked at the start of 2021 due to a large order being received in the last quarter of 2020. Future procurements of injectable artesunate are being monitored to avoid expiry and to ensure the product returns to being stocked according to plan.

Key Question 2

What are the trends in service delivery point stockout rates for ACTs (including ability to treat), RDTs, Art. Inj., and CQ over the last year (if tracked)? Is there a seasonal or geographic difference in stockout rates?

Absence of complete and accurate consumption and morbidity data from SDPs has challenged malaria commodities forecasting and procurement supply plan outputs; it is also one factor contributing to stockouts at SDPs. Quarterly reports from the LMIS over the past year have shown facility stockout rates for all presentations of AL consistently below 25 percent and RDTs under 15 percent. However, complete data for these products has not been consistently provided through the LMIS’s report and requisition forms. To address this concern PMI, through its stockout reduction strategy, will provide updated inventory control tools as well as enhanced site-level support to both RHBs and facilities to improve their data quality.

PMI supported an end-use verification assessment in March 2020 that reported on the availability of malaria commodities and malaria case management at 158 selected HFs. The findings from the assessment showed that more than half of the SDPs were stocked out of some presentations of AL on the day of visit with stockout of 58 percent for AL 6x1 and 53 percent for AL 6x2 and AL 6x3. The stockout of AL 6x4 was 12 percent whereas artesunate injectables and RDTs were stocked out at 17 percent and 26 percent, respectively. Chloroquine tablets were available at most of the SDPs with a stockout rate of only 4 percent. The ACT availability index showed that only 3 percent of the facilities (5/158) reported having none of the ACT presentations, implying the ability to treat 97 percent of patients with P. falciparum malaria infection.

Key Question 3

What is the difference between quantities for ACTs consumed and malaria cases, and RDTs consumed and numbers tested? What is driving any differences seen?

Supporting Data

A rapid assessment was conducted to investigate the presence, extent of discrepancies, and the possible root factors contributing to the differences between LMIS (consumption) data and DHIS2 (morbidity) data sets at the health facilities. The assessment was done through desk review, field-level data collection, interviews, and focus group discussions. The findings from the desk review evaluation on the LMIS and DHIS data indicated a large discrepancy of 61 percent and 53 percent for 2019 and 2020, respectively, from facilities distributing AL during the review period (Table A-14).
Table A-14. Discrepancies between LMIS and DHIS2 data

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>DHIS total malaria cases (Pf+Mixed+Unspecified)</td>
<td>906,561</td>
<td>1,360,167.06</td>
<td>1,218,119</td>
<td>1,693,673.64</td>
</tr>
<tr>
<td>LMIS (Total distributed ACTs (AL) from EPSA)</td>
<td>3,650,070.00</td>
<td>3,467,566.50</td>
<td>3,761,622</td>
<td>3,573,540.90</td>
</tr>
<tr>
<td>Discrepancy (LMIS-total Cases)</td>
<td>2,743,509.00</td>
<td>2,107,399.44</td>
<td>2,543,503.00</td>
<td>1,879,867.26</td>
</tr>
<tr>
<td>Discrepancy ((LMIS-total cases)/LMIS) %</td>
<td>75%</td>
<td>61%</td>
<td>68%</td>
<td>52%</td>
</tr>
</tbody>
</table>

*Adjusted data indicates data obtained after considering malaria case reporting rate, unreported malaria cases from refugee camps, and a medicine wastage rate of 5 percent.

The preliminary findings from the field assessment showed the following:

- Discrepancies between the ACTs reported as distributed to health facilities and reported malaria cases in 2019 at the health facilities in the survey areas. The aggregated discrepancy percentage at health centers and hospitals is 52 percent (61 percent at hospitals and 47 percent at health centers).
- More discrepancies were observed in hospitals than health centers indicating more consumed ACTs in hospitals are not being accounted for in malaria cases reported during the review period than at the health center.

Several factors contributing to the discrepancies were identified relating to recording and reporting, product distribution, system (coordination and monitoring), and human resource limitations. In addition to the logistics and program management-related factors, a major factor contributing to the discrepancies was the empirical treatment of malaria cases (clinical cases and blood film negative cases) without recording in outpatient department registers and reporting in DHIS2.

Key Question 4

To what extent does a functional LMIS provide visibility into timely and quality logistics data from various levels of the system? To what extent is commodity data visibility dependent on surveys or supervisory data rather than routine data reported by an LMIS?

Malaria commodities are integrated in the Health Commodity Management Information System, which has visibility at hubs and facility level. In Ethiopia commodity data visibility is more dependent on routine data reported through LMIS rather than supervisory or survey data. The LMIS provides routine information on the malaria commodities supply chain at the national, regional, and facility levels including inventory data. Because of scale, the routine LMIS might not offer comprehensive facility-level visibility, but this can be bridged by analysis of the issue data from EPSA. PMI is also planning to continue supporting the end-to-end visibility of malaria commodities by enabling data exchange between the different supply chain systems at the various levels in the FANOS commodity management information system. FANOS is an online dashboard interface used to manage
data from PFSA’s supply chain management platforms: Vitas (manages supplies at warehouses) and mBrana and Dagu (at health centers and HPs).

Commodity data visibility is dependent on routine data reported through LMIS rather than supervisory or survey data. Ethiopia’s LMIS reporting rate has consistently been between 80 percent and 90 percent over the past few years; however, this rate only refers to the reporting of the report and requisition forms which come from a limited number of health facilities and does not include HPs. Ethiopia’s challenges in reporting come from limited support at the administrative levels, high staff turnover, low commitment of health workers, and security issues in certain parts of the country. PMI is working to address Ethiopia’s challenges with accurate and timely reporting through working with RHBs to build SDP staff capacity, embedding seconded staff to enhance technical capacity and ensure effective onboarding of new staff, and providing site-level support to SDPs.

Key Question 5
What are the main supply chain technical assistance functions supported by PMI? Are there additional investments that PMI should make (e.g., increasing visibility of demand at health facilities) to ensure continual availability of quality products needed for malaria control and elimination at health facilities and the community level? In areas performing well, is it dependent on PMI/donor funding (e.g., PMI and Global Fund pay for warehousing and distribution)? Should more be done to foster self-reliance in domestic systems and, if so, what approaches should be considered?

PMI’s primary investment in supply chain TA over the past three years has been supporting the annual distribution of LLINs to the last mile for Ethiopia’s mass campaigns. In addition to investments in warehousing and distribution, strategic planning, and procurement of malaria commodities, PMI supports further MIS improvements including the FANOS malaria dashboard to increase visibility at the different levels of the health system. A malaria commodities monitoring dashboard within DHIS2 is also under development that would help program managers review both stock and case data. Most initiatives to improve the supply chain system are donor-supported (Figure A-22).
As per the stockout reduction strategy, baseline analysis, and proposed investment plan the following areas have been identified for prioritization of supply chain TA funding to ensure consistent availability of malaria products at health facilities:

- Improve the capacity of the national malaria forecasting team to organize and analyze required data for annual quantification exercises.
- Strengthen the capacity of the procurement agency to improve its supplier relationship management.
- Provide TA and build the technical capacity of EPSA to ensure efficient custom clearance processes.
- Provide TA on route optimization and fleet management at central and subnational warehouses.
- Enhance the technical capacity of staff to properly manage inventories and process orders on time.
- Embed seconded staffs to address staff shortage, skill gaps and enhance the technical capacity on supply chain skills.
- Work with RHBs to build the capacity of SDPs staff for improved inventory management, proper prescribing, and dispensing practices at SDPs.
- Develop and provide updated versions of inventory control tools for improved data recording and reporting quality at SDP.
- Support RHBs and facilities to improve data verification and triangulation practices.

Key Question 6
Are there any other considerations that impact funding allocation in this category?

Supporting Data
N/A
Conclusions for Supply Chain Investments

PMI has provided technical and financial support to the FMOH in annual commodity forecasting, quarterly supply planning, monitoring and evaluation exercises, integrated warehousing and stock management, logistics management information systems, and procurement and distribution of commodities to the last mile. This includes support to EPSA for the mass distribution of ITNs to households and other malaria commodities to their SDPs.

In addition to continuing support for these supply chain activities, PMI will be allocating more resources for improving data visibility through investing in a malaria module within the electronic Community Health Information System (eCHIS) for community-level supply chain data. While EPSA has a Health Commodity Information System, there have been challenges with reporting. Due to these challenges, PMI plans to continue investing in the End Use Verification survey along with its investments into the eCHIS to obtain facility-level LMIS data.

PMI will also put additional investments in pharmaceutical management systems strengthening to improve the regulation of malaria commodities as a response to discrepancies in morbidity and consumption data.

Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.

3.2. SURVEILLANCE, MONITORING, AND EVALUATION (SM&E)

NMEP Objective

The NMSP (2021–2025) highlights the need for strong SM&E systems and emphasizes the constant need for detection and response to focal and widespread malaria epidemics in control districts and a robust surveillance system for real-time data reporting in malaria elimination districts to measure progress toward achieving desired goals.

NMEP Approach

The NMSP describes the following SM&E core activity areas:

- Collecting data actively and passively to monitor the operational aspects of the program and measuring impact, outcome, or process indicators to ensure that the activities are yielding desired results and moving the program toward achieving its operational targets and objectives.
- Monitoring changes in epidemiological indicators and appropriately interpreting results and informing revisions in policies or strategies, when needed, to help ensure progress.
- Supporting progress toward malaria elimination through case and foci investigation and classification. In addition to malaria morbidity and mortality impact indicators, elimination-specific indicators are to be tracked.

PMI Objectives in Support of NMEP

- Strengthen the malaria SM&E system of Ethiopia as per the national strategic plan.
• Build the capacity of FMOH/EPHI and RHBs in malaria monitoring and evaluation (M&E) including conducting surveillance, surveys, and evaluations.

PMI-Supported Recent Progress (progress with FY 2019 funding)

• PMI provided substantial support for SM&E strengthening activities including training of health workers from NMEP, EPHI, and RHB on data quality, data analysis, real-time data transfer, and strengthening routine surveillance systems. Accordingly, 1,884 health workers from 351 health centers and 2,227 HEWs from 1,796 HPs were trained on data quality assessment and data utilization. PMI's support provides national coverage but focused intensive support to 100 woredas (62 malarious and 38 targeted for elimination). PMI also supported surveillance systems strengthening, including the DHIS2 rollout, climate data integration, and developing a malaria module of eCHIS for reporting malaria cases from the HP to the health centers and case notification and investigation in low-transmission districts. The eCHIS was implemented in 11 woredas with plans to scale up with other partner support. A real-time malaria dashboard has also been developed within DHIS2 for national and regional-level analyses and data use.

• PMI developed a malaria elimination assessment tool and conducted a baseline assessment through EPHI. Data cleaning, analysis, and report writing was completed and each elimination district received reports of findings with recommendations. PMI supported strengthening malaria surveillance, monitoring and evaluation, and data quality in 245 Primary Healthcare Units (a woreda/district plus a primary hospital, catchment health centers, and health posts) in 50 districts. PMI also supported training for health staff at different levels and provided job aids and register books. PMI provided supportive supervision and mentorship and conducted quarterly review meetings in collaboration with RHBs. PMI's PHEM support was targeted to enhance reporting from rural HPs, where half of all malaria morbidity is detected and treated, to enable reporting of indicators on a weekly basis, and build capacity at district and health facility level to generate quality data that can be analyzed and used for decision-making.

• PMI also supported the following:
  o Expansion of malaria surveillance support from 10 woredas to 76 woredas in all 10 regions.
  o Data quality improvement in 50 project-supported woredas, which demonstrated significant improvements in selected data quality indicators.
  o Introduction of malaria surveillance monitoring charts with four core and six quality indicators that were adopted by the Oromia RHB and NMEP.
  o An ITN durability study and disseminated report findings to the NMEP and other partners.
  o In-country Malaria Indicator Survey (MIS) 2015 analysis capacity with advanced data analysis training using STATA to EPHI and FMOH researchers.

• Due to COVID-19 restrictions, PMI supported the strengthening of the virtual mentorship program, which included 568 virtual mentorship sessions reaching all supported woredas every month. PMI supported routine data quality audits (RDQAs) at all project-supported woredas – some conducted by zonal focal persons with technical and logistic support from the project. PMI expanded surveillance support to 26 new woredas and initiated case and foci investigation in Chiro woreda of West Hararghe Zone as a learning center.

• PMI supported the development and field testing of the malaria module of eCHIS. The app and training manuals have been translated into different local languages. There is an ongoing platform enhancement for large-scale deployment of eCHIS. The malaria module of eCHIS is also made available for implementation by other partners (Government and all implementing partners) in their support areas.
PMI-Supported Planned Activities in CY 2021 (with currently available funds)

- Expand current SM&E support from 50 to 100 districts with Digital Health Activity (DHA) support that will scale up both health management information systems (DHIS2 and eCHIS) as well as train health workers from the new health facilities and districts from the expansion districts on quality data collection, analysis, reporting, and use. Of the total 100 supported districts, 79 are elimination districts.
- Initiate surveillance-based elimination implementation activities with focused malaria elimination surveillance and response support in 50 districts, including foci and case investigation in about 500 selected health facilities in PMI-supported districts using the nationally developed protocol.
- Expand deployment of eCHIS malaria modules in agrarian woredas and complete the development of a malaria module for pastoralist and urban eCHIS.
- Strengthen RDQAs to improve malaria data quality (national, regional, and woreda level) including completeness, timeliness, and consistency of service coverage and disease reports.
- Support cascade trainings through both workforce and subject matter expert support of revised malaria indicators and recording and reporting tools (e.g., tablets, dashboards, alerts) that improve data collection, real-time analysis, and timely response.
- Regularly conduct data triangulation between service/disease report and supply chain report and produce insights for better decision-making.
- Support EPHI to improve completeness and timeliness of weekly malaria reporting through PHEM and support the redesign of PHEM to enable patient level tracking with concurrent support from Global Health Security Agenda.
- Build capacity of malaria program teams at woreda and health facility levels to analyze and use malaria data for decision-making through supervision and mentorship both in person and virtually.

Key Goal
To support the NMEP to build their capacity to conduct surveillance as a core malaria intervention using high-quality data from both surveys and routine health information systems.

Key Question 1
Which data sources are available to inform estimates of intervention coverage, service availability and readiness, and morbidity and mortality?

Ethiopia has a wide array of data sources that have been rolled out, scaled up, and improved over time. The FMOH has a data use policy/plan that development partners support. PMI supports DHA to roll out and scale up DHIS2, which is now nationwide in hospitals, health centers, and health posts. DHA is now working to improve DHIS2 reporting in terms of timeliness and completeness, which is lacking. DHA is also rolling out eCHIS with a specific malaria module that was developed with input from PMI, NMEP, and other stakeholders. The eCHIS incorporates surveillance with line lists, foci investigation, and mapping as well as response with ITN distribution, IRS implementation, and larval source identification and mitigation. PMI will continue to support DHA and a focused malaria surveillance for elimination activity to improve data systems and improve data use and response.

Supporting Data
See Figure 4.
Table A-15. Available malaria surveillance sources

<table>
<thead>
<tr>
<th>Source</th>
<th>Data Collection Activity</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household Surveys</td>
<td>Demographic Health Survey (DHS)</td>
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<tr>
<td>Household Surveys</td>
<td>Malaria Indicator Survey (MIS)</td>
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<tr>
<td>Household Surveys</td>
<td>Multiple Indicator Cluster Survey (MICS)</td>
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<tr>
<td>Household Surveys</td>
<td>EPI survey</td>
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<tr>
<td>Health Facility Surveys</td>
<td>Service Provision Assessment (SPA)</td>
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<tr>
<td>Health Facility Surveys</td>
<td>Service Availability Readiness Assessment (SARA) survey</td>
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<tr>
<td>Health Facility Surveys</td>
<td>Other Health Facility Survey</td>
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<tr>
<td>Malaria Surveillance and Routine System Support</td>
<td>Therapeutic Efficacy Studies (TES)</td>
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<td>✔</td>
<td></td>
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<tr>
<td>Malaria Surveillance and Routine System Support</td>
<td>Support to Parallel Malaria Surveillance System</td>
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<tr>
<td>Malaria Surveillance and Routine System Support</td>
<td>Support to HMIS/eCHIS</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
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<tr>
<td>Malaria Surveillance and Routine System Support</td>
<td>Support to Integrated Disease Surveillance and Response (IDS/R/PHEM)</td>
<td>✔</td>
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<td>Malaria Surveillance and Routine System Support</td>
<td>Electronic Logistics Management Information System (eLMIS)</td>
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<td>Malaria Surveillance and Routine System Support</td>
<td>Malaria Rapid Reporting System</td>
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<tr>
<td>Other</td>
<td>End Use Verification (EUV)</td>
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<tr>
<td>Other</td>
<td>School-based Malaria Survey</td>
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<tr>
<td>Other</td>
<td>Knowledge, Attitudes and Practices Survey, Malaria Behavior Survey</td>
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<tr>
<td>Other</td>
<td>Malaria Program Review</td>
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<tr>
<td>Other</td>
<td>Entomologic Monitoring Surveys</td>
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<td>✔</td>
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</table>

* Asterisk denotes non-PMI funded activities, X denotes completed activities, and P denotes planned activities.

**Key Question 2**

What HMIS activities have been supported? What current priorities will be supported with FY 2022 MOP funding?

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

**Supporting Data**

There are major challenges regarding data quality and access in Ethiopia. Limitations exist at various levels with the capacity to analyze, interpret, and use the available data (Table A-16). PMI will continue supporting project-targeted districts, notably elimination districts, RHBs and the NMEP, in strengthening malaria SM&E and data quality improvement. PMI is also supporting a new malaria elimination surveillance activity that will empower the districts, health centers, health posts, and communities to strengthen real-time malaria surveillance to identify any confirmed malaria index cases and conduct foci investigations within 24 hours with testing and treatment of households and neighbors and persons within 500 meters. Additional elimination interventions such as ITNs, IRS, and tMDA could be implemented if required. The activity will identify best practices in surveillance and response and use them in other malaria elimination districts to shrink the malaria map by expanding malaria elimination.

**Key Question 3**

Are there specific outcomes of past/current HMIS strengthening efforts that can be identified?

PMI has supported the Ethiopian Field Epidemiology Training Program (EFETP) with residents in advanced cohorts that have significantly improved malaria surveillance through strengthening and using the Public Health Emergency Management (PHEM) system which is comparable to Integrated Disease Surveillance and Response. The PHEM system is implemented out of EPHI and numerous surveillance and external data evaluations have shown the benefits of PHEM data in terms of completeness, timeliness, and quality over HMIS. PHEM data is especially useful in possible malaria elimination districts with low malaria incidence to identify and respond timely within days rather than a month for DHIS2 to malaria index cases. PHEM data also underlies a novel malaria early warning system (EPIDEMIA) which also incorporates climate data to provide alerts and predictions with high reliability that would be impossible without quality PHEM data. PMI will continue multipronged support to Ethiopian data information systems (DHIS2, eCHIS, and PHEM), which provide critical information at different levels for malaria surveillance and response. PMI will also empower people at the districts, health centers, health posts, and communities to build a “data use culture” to identify and respond effectively to malaria.

**Supporting Data**

**Table A-16. Outcomes of HMIS strengthening efforts**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeliness % of reports received on time</td>
<td>66.9%</td>
<td>80.8%</td>
</tr>
<tr>
<td>Completeness “Confirmed malaria cases for children under five years of age” was reported in X [number or percent] of facility-months</td>
<td>86.2%</td>
<td>91.9%</td>
</tr>
<tr>
<td>Accuracy Most recent DQA data</td>
<td>Not done</td>
<td>112.8 (verification factor)*</td>
</tr>
</tbody>
</table>

*The verification factor is an average of an RDQA conducted in different regions. Because the RDQA was conducted in a few woredas it cannot be generalized as nationally representative. For a given indicator, the verification factor (VF) at a facility is computed as the
recounted number of events from source documents divided by the reported number of events from the HMIS. [VF = Recounted number of events from source documents/Reported number of events from the HMIS]. A VF > 1 implies that there is underreporting of events in the HMIS for the verification period. A VF < 1 implies that there is over-reporting of events in the HMIS for the period chosen for the analyses. Suggested range of acceptability: 100 percent +/- 10 percent (90 percent – 110 percent). So a VF of 112.8 percent implies that there is underreporting of events by about 13 percent in the HMIS for the verification period.

PMI continues work with partners to strengthen HMIS systems (DHIS2 and eCHIS) prioritizing data quality through DQAs, data charts, dashboards, and data review meetings. PMI will continue to capacitate staff at all levels on data analysis and use especially in low to very low malaria woredas targeted for malaria elimination in order to identify and respond timely and effectively to malaria surges.

Key Question 4
Are there any other considerations that impact your funding allocation in this category (e.g., strategic information or capacity-building in-country)?
N/A

Supporting Data
N/A

Conclusions for Surveillance, Monitoring, and Evaluation Investments
The FMOH, together with major donors (Global Fund, USAID, BMGF, and Gavi), are working to improve health information systems including systems related to supply chain management. USAID will collaborate with the FMOH’s Data Use Partnership, which brings together the diverse partners working across the health information systems spectrum in Ethiopia. PMI will continue supporting the electronic Health Information System (eHIS) to improve evidence-based decision-making by strengthening data collection, management, analysis and utilization of health data at all levels of the healthcare delivery system. PMI will continue to support surveillance improvements and mentoring at all levels. To contribute to improved data quality and access in Ethiopia, PMI is also supporting an integrated electronic health information data system to improve timeliness and accuracy of morbidity and mortality data. The EFETP is also supported to improve surveillance data quality and data analysis capacity at the health facility, regional and national levels. PMI is also supporting a new malaria surveillance elimination activity that will promote a paradigm shift from malaria control to elimination by strengthening real-time data systems and empowering people at the districts, health centers, health posts, and communities to identify and respond to malaria index cases timely and effectively.

Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.

3.3. OPERATIONAL RESEARCH

NMEP Objective
The NMSP (2021–2025) envisions the need for operational research (OR) studies to guide and improve program decisions.
NMEP Approach

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

PMI Objective in Support of NMEP

- Priority areas for PMI Ethiopia OR are informed by the PMI strategy and the PMI OR priorities with input from the NMEP and their NMSP.
- Since the launch of PMI, several OR studies across various technical areas have been conducted to address key gaps in knowledge or bottlenecks.

PMI-Supported Recent Progress (progress with FY 2019 and earlier funding)

- Current OR to evaluate the hematologc outcomes to assess the safety of the primaquine radical cure for *P. vivax* without testing for G6PD is underway in health centers in Amhara, Oromia, and SNNP regions and have noted no serious adverse events to date. A total of 600 *P. vivax* and mixed patients were recruited to the study to date. The interim analysis of the 300 study participants was shared with no G6PD deficiency detected to date.
- The baseline survey for the MOP-funded cluster randomized controlled trial to evaluate targeted mass drug administration compared to reactive case detection on malaria transmission and elimination in Oromia was conducted in 48 kebeles of East Hararghe Zone. A preliminary report of the baseline assessment was prepared and shared with researchers and the NMEP team. Interventions are currently underway.
- PMI Ethiopia supported an experimental hut trial led by Jimma University evaluating the impact of PBO ITNs and IRS on mosquito behavior and mortality. The study has been completed and preliminary data suggest no discernible impact of PBO exposure on susceptibility to the organophosphate insecticide pirimiphos-methyl (Actellic).
- PMI Ethiopia will also support a program evaluation to monitor the impact of PBO nets compared to IRS with standard ITNs in terms of a non-inferiority study which will include entomological and epidemiological outcomes. The protocol is being finalized, *kebeles* randomized, and the study investigators awaiting distribution of PBO LLINs before the spray period. Funding is through FY 2015–2016 funds.

PMI-Supported Planned Activities in CY 2021 (with currently available funds)

- PMI will support a PBO net evaluation primarily comparing PBO nets to IRS plus standard nets and secondarily IRS plus PBO nets to IRS plus standard nets to build the evidence for the role of PBO nets in Ethiopia.
PMI will support a field evaluation of larvicide treatments (SumiLarv 2MR and Bti) on controlling the emerging vector, *An. stephensi* in Kebridehar, Dire Dawa, and Awash towns. The concept note is currently under development and will be submitted to the PMI OR Committee for review.

PMI Goal
PMI will conduct PE/OR that helps to evaluate coverage of population at-risk, intervention quality, or delivery efficiency; study reducing malaria transmission and disease burden; test effectiveness of new or evolved priority interventions and strategies; or explore new metrics and mechanisms to assess intervention impact.

Key Question 1
In consultation with the NMEP, have technical challenges or operational bottlenecks in program interventions been identified that require PE/OR? How have they been prioritized?

Supporting Data

**Table A-17. Ongoing program evaluation and operational research**

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Implementing Institution</th>
<th>Research Question/Topic</th>
<th>Status/Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMI</td>
<td>Addis Continental</td>
<td>Reactive case detection vs. tMDA</td>
<td>Tentative completion 2022</td>
</tr>
<tr>
<td>PMI</td>
<td>Addis Continental</td>
<td>Radical <em>P. vivax</em> cure (G6PD)</td>
<td>Tentative completion 2021</td>
</tr>
<tr>
<td>WHO</td>
<td>EPHI</td>
<td>HRP2/HRP3 deletions</td>
<td>Tentative completion May 2021</td>
</tr>
<tr>
<td>BMGF</td>
<td>AHRI</td>
<td>HRP2/3 deletion surveillance and evaluation of next-generation PfLDH/PvLDH-based RDTs</td>
<td>End of 2021</td>
</tr>
<tr>
<td>BMGF</td>
<td>Malaria Control and Evaluation Partnership in Africa (MACEPA)/University of California San Francisco (UCSF)</td>
<td>Planning targeted surveillance and response in high-risk population; malaria risk factor analysis in high risk population; monitoring malaria transmission and intervention coverage in high-risk populations</td>
<td>2–3 years</td>
</tr>
<tr>
<td>Global Fund</td>
<td>NA</td>
<td>Health need assessment in migrant population</td>
<td>TBD (planned in Global Fund application)</td>
</tr>
</tbody>
</table>

Key Question 2
Are there specific challenges in any intervention areas that merit further exploration or research with the potential of establishing strategies or interventions applicable in the near future?

- PMI will consider supporting the NMEP to monitor the pilot implementation of Pf/Pv LDH-based RDTs in areas of high HRP2/3 deletion prevalence.
• Ethiopia has 30 percent to 40 percent of malaria due to \textit{P. vivax} and there is no radical cure intervention for pregnant women. PMI would like to assess the current barriers to implementing chloroquine suppression in pregnant women presenting with \textit{P. vivax} during pregnancy or while breastfeeding in Ethiopia.

• Additional PE/OR will be needed to determine the best approaches for controlling and eliminating \textit{An. stephensi}. Possibilities for consideration include IRS of animal shelters, covering water storage units (being tried in Djibouti), SBC measures for community-led larval source reduction, or larvivorous fish, which have been effective in India, Iran, and Sri Lanka.

Key Question 3

Are there any other considerations that impact your funding allocation in this category?

There are no resources available to address the many challenges identified above.

Supporting Data

N/A

Conclusions for Program Evaluation and Operational Research Investments

PMI continues to support a research network to share research findings, coordinate proposed PE and OR topics, and inform NMEP’s OR priorities to accelerate malaria control and elimination efforts toward achievement of national targets.

No activities are proposed with FY 2022 funding.

3.4. SOCIAL AND BEHAVIOR CHANGE (SBC)

NMEP Objective

According to the NMSP (2021–2025), the SBC objective states that “By 2025, achieve adoption of appropriate behavior and practices toward antimalarial interventions by 85 percent households living in malaria endemic areas.” The following are the key activities for malaria SBC in the NMSP (2021–2025):

• Develop a malaria communication strategy.
• Disseminate key malaria messages through various channels.
• Commemorate Malaria Week and World Malaria Day.
• Disseminate malaria SBC materials through schools, religious institutions, and workplaces.
• Integrate malaria prevention, control, and elimination activities into school programs.
• Conduct advocacy on malaria elimination at national, regional, zonal, and district levels.

NMEP Approach

The draft National Health Promotion and Communication Strategy 2021–2025 provides strategic directions for all areas of health, including malaria SBC. The goal of the strategy is to guide and harmonize SBC interventions. The objectives under this strategy include (1) improve knowledge, attitudes, and practices and enhanced health
system literacy; (2) improve community engagement; (3) improve SBC capacities at all levels; (4) enable systems and structures for SBC interventions; and (5) improve multi-sectoral collaboration to address social and gender norms as barriers for health priorities.

The national malaria SBC coordinating working group under the NMEP technical advisory committee provided TA during the development of the SBC component for the NMSP (2021–2025).

PMI Objective in Support of NMEP

Through the use of SBC interventions aligned with Ethiopia’s national malaria control communication strategy, PMI supports activities to increase the uptake with correct and consistent use of malaria interventions, thereby improving the overall quality of malaria prevention and control efforts that will contribute to reductions in malaria morbidity and mortality.

Since 2014, PMI has supported two local organizations’ community-based malaria SBC activities as part of the USAID/Ethiopia Local Capacity Development program. These community-based malaria SBC activities have been implemented in selected zones of Oromia and Amhara regions. PMI’s support to these activities complemented national level malaria SBC activities through capacity-building of selected schools and faith-based organizations in high malaria transmission areas. The capacity-building support includes training peer educators, providing mini-media materials for malaria school clubs, and training community representatives on malaria prevention and control and social mobilization. The support also includes provision of print and media materials.

Since July 2015, PMI has also supported an integrated SBC activity implemented in four major regions: Oromia, Amhara, SNNP, and Tigray. This support focused on building malaria communication capacity at national and subnational levels, messaging and implementation of SBC activities through integrated platforms and monitoring and evaluation of malaria SBC. The capacity-building support includes coordinating malaria SBC interventions through malaria message harmonization and standardization practices, TA for strengthening subnational technical working groups; providing training on malaria SBC skills for SBC focal persons at all levels; and training media outlets on malaria communication. PMI is also supporting malaria SBC interventions in 50 districts in high malaria burden areas of Benishangul-Gumuz, Gambela, western Amhara, Oromia, and SNNP regions.

PMI-Supported Recent Progress (progress with FY 2019 funding)

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

- Trained 2,845 individuals on basic malaria communication skills.
- Disseminated 66,040 information, education, and communication/SBC communication materials including print, audio, and outdoor media.
- Held 4,345 social mobilization event.
- Conducted 566 major campaigns in school and kebele settings.
- Provided capacity-building training on malaria SBC for 999 entities (organizations/institutions).
- Organized 300 sessions of literature competition events, reaching 72,564 school and community members with key messages on malaria in 220 schools.
• PMI supported 145 school-based mini-media clubs to disseminate malaria action messages because mass media campaigns are important for challenging deeply held beliefs and customs regarding malaria practices.

In PMI-supported districts of Amhara Region, many community members migrate seasonally to agricultural regions to work, which usually coincides with the malaria transmission season. Upon returning home, these seasonal workers can become a source of imported cases contributing to the local malaria burden. According to the Amhara RHB, approximately 33 percent of total malaria cases are imported cases from other agriculture development areas. To address this health challenge, students in the targeted 141 kebeles were taught to track and report when migrant workers return to their neighborhoods. HEWs then followed up to ensure appropriate diagnosis and treatment was provided through home visits. In 2020–2021, activities related to migrant worker tracking, diagnosis, and treatment were conducted in 85 of the 141 kebeles. Accordingly, 24,461 migrant workers who returned home were tracked on arrival by the school students and were referred to HPs. Of these returning workers, 23,516 (96 percent) were tested and 11,267 (48 percent) found to be malaria positive. All cases were treated for malaria.

This activity was also proactive during the COVID-19 public health emergency. Due to the nature of COVID-19 transmission and movement restrictions, this activity curtailed interpersonal communication, social mobilization, roadshow campaigns and community meetings, and household visits. The activity also immediately addressed conflicting messages of “stay at home” to reduce COVID-19 transmission vs. “seek treatment for fever promptly” messages for malaria diagnosis and treatment. The activity sought local solutions to ensure continued delivery of malaria interventions among communities, households, and individuals. The innovative local solution explored social capital, which is used by the community to disseminate messages in rural villages and modified the malaria SBC approach accordingly. To disseminate malaria messages in targeted kebeles (villages), 116 trumpeters (*Trumba Nefi*) or village criers were trained and deployed. DHIS2 data indicate that malaria service uptake in SBC targeted areas was not disrupted due to the COVID-19 pandemic.

PMI also supported several SBC activities including a weekly malaria radio programs in Amharic, Tigrigna, Afaan Oromo, Sidamigna, and Wolitigna languages (208 episodes). In collaboration with RHBs, PMI supported malaria roadshows in 44 selected woredas across four regions. In the reporting period, 104 malaria roadshows were conducted in market places and schools, reaching an estimated 160,855 people with various malaria prevention and treatment messages. An estimated 2,500 individuals attended the health bazaars where malaria related interventions are exhibited for demonstration. Five primary healthcare units and five schools attended the event. This activity distributed 189,107 print materials, which included malaria fliers and radio promotional materials.

In addition to this, PMI supported a radio reach and recall assessment with interviews of 380 randomly sampled individuals (50 percent female) from intervention regions. Findings from the selected subset of individuals indicate the overall reach of the radio program was 28.7 percent total coverage, of whom 54.1 percent recalled the key messages aired through the radio program. The majority of respondents acknowledged that the radio program is very relevant, educational, and of good quality.

PMI supported SBC and social mobilization activities in Benishangul-Gumuz and Gambela in support of ITN distribution campaigns. The support included the development of a set of cue cards for HEWs to use to engage villagers or ITN users before and during the ITN distribution, and provided orientation for HEWs on how to effectively use the cue cards. Other SBC materials were also developed and disseminated including banners and radio spots. A total of 1,555 SBC materials including the cue cards, banners, and radio spots were distributed.
PMI-Supported Planned Activities in CY 2021 (with currently available funds)

The school-based SBC project will continue to implement malaria SBC activities in 36 districts of high-risk malaria areas in the Amhara Region. PMI will also continue to support additional SBC activities focused in targeted regions using cue cards as a tool to educate and initiate discussions related to ITN use, air malaria radio spots, and promote the Hulu betera mobile app for interactive malaria messaging between families and couples. The following are major activities which will be implemented during the next 12 months:

- Continue to track, trace, test, and treat migrant workers for malaria in collaboration with school community and HEWs.
- Intensify the use of students as malaria SBC change agents and outreach messengers to their community.
- Enhance efforts to utilize local innovation for malaria communication and capacity-building through existing community structures (e.g., trumpeters).
- Document learning and sharing practices for malaria SBC.
- Conduct community engagement training for HEWs.
- Air radio programs and radio spots.
- Develop a Do-It-Yourself (DIY) guide for social mobilization
- Provide interpersonal communication and counseling training for healthcare providers on National Malaria Guidelines.
- Adapt and distribute a video series that facilitates client-provider interaction.
- Finalize repackaging and recording of radio program focusing on malaria (ITN use, IRS, and treatment-seeking).

Key Goal

Through the use of SBC interventions and in alignment with a country’s national malaria control communication strategy, PMI supports the uptake and correct and consistent use of malaria interventions, thereby improving the overall quality of malaria control efforts that will contribute to reductions in malaria.

Key Question 1

What behaviors is PMI proposing to prioritize through its SBC programming? What data support this prioritization? Will support be geographically targeted or national?

PMI is proposing three prioritized behaviors through its SBC programming (Table A-18):

**Community-based related priority behaviors:**

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

**Healthcare provider-based related priority behavior:**

3. Adhere to national case management guidelines.

This support is geographically targeted to Benishangul-Gumuz, Gambela, western Amhara, and Tigray regions.
Supporting Data

The data that supports this prioritization is low ITN use by children under five years of age at 59.3 percent in 2019 (C4H Midline report, 2019) and 45 percent and 44 percent for under five years of age and pregnant women, respectively, in 2015 (MIS, 2015). The percentage of household populations that slept under an ITN was 63 percent (C4H Midline, 2019) and 40 percent (MIS, 2015), respectively. Note that lack of ITN access also contributed to that response. According to the 2015 MIS and a PMI-supported study, no ITN access accounts for 70 percent to 80 percent of lack of use leaving behavioral-driven failure (with ITN access) ranging from 20 percent to 30 percent. Similarly, timely treatment seeking for fever within 24 hours was 44 percent (C4H Midline report, 2019) compared with 38 percent in 2015 (MIS, 2015).

Table A-18. Prioritized behaviors with FY 2022 funds

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Target Population</th>
<th>Geographic Focus</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct and consistent ITN use</td>
<td>Members of household</td>
<td>Benishangul-Gumuz, Gambela western Amhara &amp; Tigray</td>
<td>US ITN use 59.3% (C4H midline, 2019); 45% (MIS, 2015) and 44% pregnant women ITN use (MIS, 2015). Household ITN use 63% (C4H Midline, 2019) and 40% (MIS, 2015).</td>
</tr>
<tr>
<td>Seeking prompt treatment for fever</td>
<td>Mothers of children under five years of age</td>
<td>Benishangul-Gumuz, Gambela western Amhara &amp; Tigray</td>
<td>Timely treatment seeking for fever within 24 hours is 44.1% (C4H Midline report, 2019) and treatment was sought only for 38% of children with fever in 2015 (MIS, 2015).</td>
</tr>
<tr>
<td>Service provider adherence to national malaria diagnosis and treatment guidelines</td>
<td>Healthcare providers</td>
<td>Benishangul-Gumuz, Gambela, western Amhara, and Tigray</td>
<td>According to a 2018 health facilities survey (SARA) in malaria case management, all regions have a low average for performance (38.7%) in providing malaria diagnosis and treatment services according to national guidelines.</td>
</tr>
</tbody>
</table>

Key Question 2a

For Prioritized Behavior 1 (use ITN correctly and consistently): What gaps exist in understanding the barriers to the adoption and maintenance of malaria prevention and treatment behaviors?

There are gaps that exist in understanding the barriers for the adoption and maintenance of ITNs. According to MIS 2015 there are geographic variations in ITN use to access ratio as low as 0.71 and 0.58 in Harari and Diredawa, respectively, and as high as 1.15 and 0.96 in Afar and Benishangul-Gumuz, respectively. An MBS is currently planned to further understand behavioral determinants of use (e.g., knowledge, attitudes, self-efficacy, response efficacy, perceived risk, severity, and norms).

Supporting Data

With regard to ITN use and maintenance, the MIS 2015 and an ITN utilization study have shown approximately 64 percent of individuals with ITNs are using them properly.

According to the 2019 C4H Midline Report, knowledge about the cause of malaria, three or more signs or symptoms, and sleeping under an ITN to protect from malaria was 31.1 percent, 38.9 percent, and 20.5 percent, respectively. The 2015 MIS results indicate that 68 percent of women in malarious areas have heard about malaria. Of those who had heard about malaria, 75 percent were aware that mosquito bites may cause malaria and recognize fever is a symptom of the disease, and 77 percent knew that sleeping under mosquito nets could prevent malaria. A sociocultural qualitative study conducted in 2018 also supported the findings of the midline evaluation. It reported that most study participants either did not know the cause of malaria or believed that it is caused by cold weather and hunger. Incomplete distribution of insecticide-treated nets, especially in remote areas, and breeding sites were identified as causes for malaria.

The 2019 C4H Midline Report identified the low risk perception of malaria during dry season/low-transmission season as an internal factor that affects the adoption and maintenance of ITN use and care-seeking behaviors.

Key Question 2b

For Prioritized Behavior 2 (seek prompt and appropriate care for fever): What gaps exist in understanding the barriers to the adoption and maintenance of malaria prevention and treatment behaviors?

Detailed understanding of behavioral determinants (e.g., social, cultural, gender, structural, etc.) and regional differences for care-seeking is needed. PMI is planning to obtain this information through the MBS survey that will be conducted in 2022.

Supporting Data

Improving care-seeking behaviors to promote prompt testing and treatment for fever remains a priority. The SBC project midline report showed close to 12 percent of children under five years of age in malarious areas had a fever in the two weeks before the survey. Out of these children, only 44 percent sought timely treatment within 24 hours of fever incidence, with 70 percent eventually seeking treatment. The 2015 MIS data from these same districts showed 16 percent of children under five years of age had fever during the two weeks preceding the survey and treatment was sought for only 38 percent of children with fever. There are also geographical variations related to care-seeking. Results from the 2015 MIS showed that among children under five years of age with fever, 75.5 percent, 31.2 percent and 45 percent sought treatment in Harari, Tigray, and Benishangul-Gumuz regions, respectively.

Key Question 2c

For Prioritized Behavior 3 (service providers adhere to national case management guidelines): What gaps exist in understanding the barriers to the adoption and maintenance of malaria prevention and treatment behaviors?

There is limited understanding of the barriers related to service providers adherence to national guidelines.
Supporting Data

The 2018 SARA showed low adherence to national malaria diagnosis and treatment guidelines across all service facilities. Several factors were identified for the reported low adherence, including suboptimal training/coaching/mentorship, a focus on the quantity of work completed rather than quality, and low provider motivation. A separate clinical audit of private health facilities in Amhara revealed a low level of adherence to malaria diagnosis and treatment national guidelines.8

Additional assessments are needed to understand internal, structural, and social determinants of health behaviors related to service provider adherence to national case management guidelines. These assessments will help identify the appropriately targeted SBC intervention(s) needed to address the low adherence of national malaria case management guidelines and the quality of patient-provider interactions. Potential factors include social and gender norms. PMI is considering conducting a formative assessment to understand the provider’s sense of self-efficacy, provider perceptions and norms related to patients, and provider adherence to RDT results.

Key Question 3

What is the country’s capacity to design, implement, and monitor SBC interventions at the national and subnational level?

For the last five years PMI support has strengthened almost non-existent SBC capacities and structures at the national, subnational, and district levels through advocacy and a close working relationship with the Government of Ethiopia. Leadership in health communication training was provided at all levels to enhance local capacity in SBC. SBC technical working groups were established at national and regional levels. Mass media, mobile applications, and social mobilization for malaria interventions were implemented at various levels. PMI supported a wide range of SBC capacity-building interventions, which contributed to sustainability and ownership of SBC at different levels. However, malaria SBC capacities at the district level remain a challenge. Continued support of SBC capacities and cascading of existing capacity are needed to achieve and maintain the acceptance, uptake, and correct and consistent use of proven malaria interventions. The monitoring capacity includes information from routine health information systems, surveys (including MIS) and activity-level rapid assessment, baseline survey, literature review, and other formative assessments used to provide direction for the overall strategy and initial design and implementation of malaria SBC activities. For example, the C4H Activity has conducted reach and recall assessments and pre- and post-tests, as well as a sociocultural qualitative study to inform the design and implementation of SBC activities including the radio program, gender campaign, mobile app, community engagement approaches, and the development of print materials.

Supporting Data

PMI supported an organizational capacity assessment that evaluated the structural, technical, and SBC leadership capacity at national and subnational levels. Several major gaps were identified including: weak coordination of SBC activities; absence of subnational SBC Technical Working Groups; and limited SBC technical capacity in the design, implementation, and monitoring of SBC interventions. Leadership in strategic health communication training was provided at all levels for 2,641 health communication practitioners who are involved in SBC activities. After a year, results from key informant interviews showed that 94 percent of respondents said the training was

very relevant to their work, 78 percent thought the training continued to be highly applicable, and over 75 percent said they applied the SBC capacity training resources to train other staff.

Conclusions for SBC Investments

With FY 2022 funding, malaria SBC interventions will focus on capacity strengthening at the district and community levels to improve acceptance, uptake, and use of malaria products and services; designing and implementing evidence based, high-quality malaria SBC tools and materials to increase adoption of malaria prevention behaviors at the household level; improving care-seeking for treatment of malaria and SBC; and improving provider adherence to case management national guidelines. Additional understanding of determinants of health for malaria interventions service acceptance, uptake and use is needed as well as the factors associated with service provider behaviors. A MBS will be conducted in 2022 to generate this evidence.

PMI will support SBC capacity-building at the district and community levels. Since PMI supported national and subnational level capacity-building activities in previous years, limited capacity-building is envisioned at national and subnational level during this period. The limited support at the national level will include TA for malaria communication technical working groups and support related to the development of national malaria SBC strategy.

Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.

3.5. OTHER HEALTH SYSTEMS STRENGTHENING

NMEP Objective

The NMSP (2021–2025) envisions a strengthened health system including an adequate number of well-qualified and committed health workers to support malaria control efforts nationwide. It also recognizes insufficient technical support and capacity-building as well as shortages of human resources and high turnover of experienced staff as major weaknesses in Ethiopia’s health system.

NMEP Approach

- The Ethiopian government has focused on improving and retaining a skilled health workforce for service delivery of key health services, including malaria. This involves both pre- and in-service training.
- The FMOH documented a shortage of malarialogists and epidemiologists experienced in managing community-wide and large-scale malaria epidemics and complex health emergencies. Subsequently, Ethiopia began its own field epidemiology laboratory training in October 2008, known locally as the Ethiopian Field Epidemiology Training Program (EFETP), with TA from CDC as a two-year, full-time, postgraduate competency-based training program consisting of about 25 percent classwork and 75 percent fieldwork. The EFETP training is an in-service epidemiology training program for health workers. Trainees are supervised and provide epidemiology service to the FMOH. Graduates of EFETP receive a Master’s Degree in Public Health and Field Epidemiology over the two-year training period.
PMI Objective in Support of NMEP

PMI supports health information systems strengthening, drug quality monitoring, EFETP, U.S. Peace Corps Volunteers, and NMEP capacity-building.

PMI-Supported Recent Progress (progress with FY 2019 funding)

- EFETP residents have conducted numerous malaria research projects in Ethiopia providing data for decision-makers and have made significant contributions to the PHEM surveillance system, including developing weekly bulletins which include malaria data. PMI has provided support to EFETP residents annually since 2008 to enhance their training and expertise in malaria and related outbreaks of acute febrile illness that can be confused with malaria. In its current structure, EFETP includes over 400 residents from eight different universities, with PMI providing malaria-related mentorship, training, and TA to create malaria expertise to a targeted subset of fellows among these future public health leaders. EFETP also receives support from Global Health Security Agenda and is advocating for more Global Fund support through the COVID-19 Response Mechanism. Former EFETP residents currently hold leadership positions in the FMOH, and their malaria experience makes them valuable advocates for malaria prevention and control goals. EFETP has 46 current residents and 12 are currently on the PMI malaria track, with 21 ongoing malaria projects from different cohorts. The range of malaria project topics are listed in the table below:

Table A-19. Range of malaria project topics

<table>
<thead>
<tr>
<th>University</th>
<th>EFETP Cohort Class</th>
<th>Malaria Project/Mini-Grant Title</th>
<th>Malaria Elimination District</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haramaya</td>
<td>4</td>
<td>Evaluation active and passive malaria Surveillance Systems of Haramaya district</td>
<td>No</td>
</tr>
<tr>
<td>Hawassa</td>
<td>4</td>
<td>Evaluation of malaria surveillance system of Kembata Tembaro Zone, South Ethiopia, 2017–2019 as it targets malaria elimination</td>
<td>Yes – moderate transmission</td>
</tr>
<tr>
<td>Hawassa</td>
<td>4</td>
<td>Malaria Surveillance System Evaluation in Hawassa Region, Sidama zone, Zuria District</td>
<td>Yes – moderate transmission</td>
</tr>
<tr>
<td>Jimma</td>
<td>4</td>
<td>Evaluation of malaria Surveillance System Mesela Woreda West Hararghe in 2020</td>
<td>Yes – low transmission</td>
</tr>
<tr>
<td>Jimma</td>
<td>4</td>
<td>Evaluation of the Surveillance system of malaria Elimination toward Ivermectin mass-drug administration in Amhara Regional state, Ethiopia, 2020</td>
<td>No</td>
</tr>
<tr>
<td>Haramaya</td>
<td>4</td>
<td>Surveillance system evaluation of malaria at Hawi Gudina Woreda, West Hararghe</td>
<td>Yes – low transmission</td>
</tr>
<tr>
<td>University</td>
<td>EFETP Cohort Class</td>
<td>Malaria Project/Mini-Grant Title</td>
<td>Malaria Elimination District</td>
</tr>
<tr>
<td>------------</td>
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<td>-----------------------------</td>
</tr>
<tr>
<td>Gondar</td>
<td>5</td>
<td>Strategies to improve LLIN use (e.g., communication strategies, school activities, etc.) and evaluate 1 net per 2 person coverage within a defined population</td>
<td>No</td>
</tr>
<tr>
<td>AAU</td>
<td>10</td>
<td>Performance of Laboratory Professionals and Health Extension workers working on Malaria Microscopy and RDT at public and private health facilities at West Gojam Zone, Amhara Region, Ethiopia</td>
<td>Yes – low transmission</td>
</tr>
<tr>
<td>AAU</td>
<td>10</td>
<td>Evaluation of the proficiency of laboratory professionals on malaria microscopy usage at selected public and private health facilities in districts selected for malaria elimination in Amhara region, 2020</td>
<td>Yes – low transmission</td>
</tr>
<tr>
<td>SPMMC</td>
<td>4</td>
<td>Assessment of Adherence to the National Guidelines for Malaria Case Management in selected private clinics of Gambella town, Gambella region – facility based cross-sectional study</td>
<td>No</td>
</tr>
</tbody>
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- The Ethiopian Food and Drug Administration (EFDA) conducted and expanded post-market surveillance with PMI support in the past. Although post-market surveillance activities were not conducted in the past 12 months, PMI will resume this support in the future (with FY 2020 funding).
- Peace Corps volunteers have helped with ITN distributions in some communities, and have helped to promote ITN use through programs aimed at school-aged children. However, all Peace Corps volunteers were evacuated worldwide in March 2020. Peace Corps Ethiopia plans to introduce new Peace Corps cohorts in early 2022.
- PMI supported the development of a malaria module that allows the HEWs to electronically register patients and record service information regarding malaria case detection and treatment, vector control, and adult mosquito control. Through the malaria module, HEWs are able to map breeding sites and larviciding, targeted ITN distribution, and possible IRS in response to malaria outbreaks. The malaria modules were piloted in Lome woreda, Hadiya Zone, SNNP Region. As part of the pilot implementation, training was provided for five days in three rounds for a total of 14 tuberculosis and malaria experts from the health centers in the woreda, three woreda officials, and 33 HEWs.
- In collaboration with other health programs, PMI supported the improvement of eCHIS software with the addition of malaria screening features for HPs and health centers.

PMI-Supported Planned Activities in CY 2021 (with currently available funds)
- PMI will continue to support the EFDA to ensure quality malaria (and other) medications in the public and private sector. PMI has supported EFDA to conduct post-market surveillance, which has identified counterfeit and substandard malaria medications that have been removed from the shelves and banned from importation. PMI plans to support EFDA in updating drug policy to mandate and incorporate post-
market surveillance and enforcement of inferior quality medications costs into EFDA drug registration and licensing therefore ensuring quality medications on the Ethiopian market through sustainable PSM and enforcement.

- PMI will continue to support workforce development through the Health Workforce Improvement Program, which aims to build individual and institutional capacity to improve quality of pre-service education to create competent health professionals and strengthen human resources for health management and regulation for improved distribution and performance of the health workforce. PMI is supporting pre-service education of health workers through the Health Workforce Improvement Program for six cadres of professionals (medical doctors, health officers, nurses, midwives, and laboratory and pharmacy professionals).

- PMI will continue to support Advanced EFETP residents (four per year) by conducting malaria training, providing technical expertise to support malaria research and outbreak response, supporting small grants to conduct malaria projects, and mentoring residents to improve national capacity for malaria prevention, control, and elimination. PMI will support EFETP Frontline, which targets lower-level healthcare workers (20 district surveillance officers per cohort) to identify and respond timely and effectively to malaria hot spots and index cases. This cadre is key in achieving and expanding malaria elimination woredas, which is a major priority for the NMEP and PMI.

Key Goal

PMI supports health system strengthening activities aligned with the objectives of the NMSP (2021–2025) focused on improving health information systems strengthening, drug quality monitoring, NMEP capacity-building, and support to the EFETP and U.S. Peace Corps Volunteers.

Key Question I

Open question to address other considerations for health systems strengthening to possibly include support to address emergencies (Ebola outbreak, cyclone events, etc.), support that engages capacity strengthening such as EFETP or Peace Corps programs, or support to extend access to care via community health outreach.

PMI, in collaboration with other health programs, supported the Tigray Regional Health Bureau in strengthening the coordination platform for supply chain operations through providing technical support in site-level assessment, report generation, and review of the progress of the recovery process to ensure access to malaria medicine during the emergency in the Tigray Region. Additionally, a regular supply chain update, including stock status analysis, is being done on a regular basis to inform coordinated effort and avoid duplication.

Supporting Data

N/A

Conclusions for Additional Health Systems Strengthening Investments

The EFETP residents provide critical surveillance and data support for the NMEP, EPHI, and FMOH. The EFETP residents continue to provide malaria and technical expertise working for the FMOH or other organizations in Ethiopia after graduation from the program. PMI continues to support the NMEP priority or workforce capacity-building with a focus on malaria through an integrated workforce improvement program that strengthens pre-service and in-service training.

Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.