This Malaria Operational Plan has been approved by the U.S. Global Malaria Coordinator and reflects collaborative discussions with the national malaria control programs and partners in country. The final funding available to support the plan outlined here is pending final FY 2018 appropriation. If any further changes are made to this plan it will be reflected in a revised posting.

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U.S. PRESIDENT'S MALARIA INITIATIVE

PRESIDENT'S MALARIA INITIATIVE

Malawi

Malaria Operational Plan FY 2018

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ABBREVIATIONS and ACRONYMS

ACT	Artemisinin-based combination therapy
AL	Artemether-lumefantrine
ANC	Antenatal care
AS/AQ	Artesunate-amodiaquine
CDC	Centers for Disease Control and Prevention
CMED	Central Monitoring and Evaluation Department
CMST	Central Medical Stores Trust
DHS	Demographic and Health Survey
DP	Dihydroartemisinin-piperaquine
DQA	Data quality assessment
EHP	Essential health package
EUV	End-use verification
FANC	Focused antenatal care
FY	Fiscal year
Global Fund	Global Fund to Fight AIDS, Tuberculosis and Malaria
GoM	Government of Malawi
HSA	Health surveillance assistants
HSSP	Health Sector Strategic Plan
HTSS	Health Technical Support Services
iCCM	Integrated community case management
IPTp	Intermittent preventive treatment for pregnant women
IRS	Indoor residual spraying
ITN	Insecticide-treated mosquito net
IVM	Integrated vector management
LMIS	Logistics management information system
MIP	Malaria in pregnancy
MIS	Malaria indicator survey
MoH	Ministry of Health
MOP	Malaria Operational Plan
MSP	Malaria Strategic Plan
NFM	New Funding Model
NMCP	National Malaria Control Program
OTSS	Outreach training and supportive supervision
PMI	President's Malaria Initiative
RBM	Roll Back Malaria
RDT	Rapid diagnostic test
RLC	Radio listeners' clubs
SBCC	Social and behavior change communication
SM&E	Surveillance, monitoring, and evaluation
SP	Sulfadoxine-pyrimethamine
SPA	Service provision assessment
TES	Therapeutic efficacy study
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VHC	Village health clinics
WHO	World Health Organization

I. EXECUTIVE SUMMARY

When it was launched in 2005, the goal of the President's Malaria Initiative (PMI) was to reduce malaria-related mortality by 50% across 15 high-burden countries in sub-Saharan Africa through a rapid scale-up of four proven and highly effective malaria prevention and treatment measures: insecticide-treated mosquito nets (ITNs); indoor residual spraying (IRS); accurate diagnosis and prompt treatment with artemisinin-based combination therapies (ACTs); and intermittent preventive treatment of pregnant women (IPTp). With the passage of the Tom Lantos and Henry J. Hyde Global Leadership against HIV/AIDS, Tuberculosis, and Malaria Act in 2008, PMI developed a U.S. Government Malaria Strategy for 2009–2014. This strategy included a long-term vision for malaria control in which sustained high coverage with malaria prevention and treatment interventions would progressively lead to malaria-free zones in Africa, with the ultimate goal of worldwide malaria eradication by 2040-2050. Consistent with this strategy and the increase in annual appropriations supporting PMI, four new sub-Saharan African countries and one regional program in the Greater Mekong Subregion of Southeast Asia were added in 2011. The contributions of PMI, together with those of other partners, have led to dramatic improvements in the coverage of malaria control interventions in PMI focus countries, and all 15 original countries have documented substantial declines in all-cause mortality rates among children less than five years of age.

In 2015, PMI launched the next six-year strategy, setting forth a bold and ambitious goal and objectives. The PMI Strategy for 2015-2020 takes into account the progress over the past decade and the new challenges that have arisen. Malaria prevention and control remains a major U.S. foreign assistance objective and PMI's Strategy fully aligns with the U.S. Government's vision of ending preventable child and maternal deaths and ending extreme poverty. It is also in line with the goals articulated in the Roll Back Malaria (RBM) Partnership's second generation global malaria action plan, *Action and Investment to defeat Malaria (AIM) 2016-2030: for a Malaria-Free World* and WHO's updated *Global Technical Strategy: 2016-2030*. Under the PMI Strategy 2015-2020, the U.S. Government's goal is to work with PMI focus countries and partners to further reduce malaria deaths and substantially decrease malaria morbidity, towards the long-term goal of elimination.

Malawi began implementation as a PMI focus country in FY 2006.

This FY 2018 Malaria Operational Plan (MOP) presents a detailed implementation plan for Malawi, based on the strategies of PMI and the National Malaria Control Program (NMCP). It was developed in consultation with the NMCP and with the participation of national and international partners involved in malaria prevention and control in the country. The activities that PMI is proposing to support fit in well with the National Malaria Control strategy and plan and build on investments made by PMI and other partners to improve and expand malaria-related services, including the Global Fund to Fight AIDS, Tuberculosis, and Malaria (Global Fund) malaria grants. This document briefly reviews the current status of malaria control policies and interventions in Malawi, describes progress to date, identifies challenges and unmet needs to achieving the targets of the NMCP and PMI, and provides a description of activities that are planned with FY 2018 funding.

The proposed FY 2018 PMI budget for Malawi is $20 million. PMI will support the following intervention areas with these funds:

Entomologic monitoring and insecticide resistance management: Over the past six years, PMI-supported entomological monitoring has documented increasing vector insecticide resistance, including the rise and spread of pyrethroid and carbamate resistance in *An. funestus*, which is the primary malaria vector across most of the country. *An. funestus* is also resistant to carbamate insecticides. As of 2015, all

An. funestus populations tested against the organophosphates malathion and pirimiphos-methyl have been fully susceptible. These data indicate organophosphates are the only technically sound options currently available for IRS in Malawi. Preliminary resistance data from 2017 indicate continued resistance of *An. funestus* to permethrin, deltamethrin, and bendiocarb. Bottle bioassays are being utilized to better quantify the intensity of resistance to permethrin, deltamethrin, and alphacypermethrin. Furthermore, cone bioassays using wild caught *An. funestus* against 6 different ITN brands indicated low mortality (<30%) to all products except a combination net treated with piperonyl butoxide (PBO).

With FY 2018 funding, PMI will continue to support entomological monitoring in five targeted districts. In each district, PMI continues to support insecticide resistance monitoring, including measurement of resistance intensity and synergist assays once per year, as well as monthly measurements of species distribution, abundance, and mosquito behavior. In the district where IRS is implemented, PMI will provide support for quality assurance of the intervention through monthly wall bioassays. PMI will also continue to provide technical assistance to the NMCP for its entomological monitoring program, which aims to map insecticide resistance in all districts on a rotating annual basis, and which will cover any potential IRS districts.

Insecticide-treated nets (ITNs): According to the Malawi Vector Control Strategy 2015-2019 and implementation plan, the distribution and promotion of ITN use are the primary malaria prevention interventions in the country. PMI has consistently supported NMCP efforts through the procurement and distribution of ITNs for continuous distribution to pregnant women and children under the age of one year at antenatal care clinics and delivery or expanded program on immunization visits. Over the past 10 years, an estimated 8 million ITNs have been distributed countrywide in Malawi through the routine channels. During the same period, PMI has provided Malawi with technical support for planning and management of routine and mass distribution mechanisms, as well as targeted funding for implementation to cover critical gaps and minimize delays. In addition, PMI has funded social and behavior change communication (SBCC) and community mobilization efforts to improve the uptake and utilization of ITNs.

With FY 2018 funding, PMI will continue to support the NMCP's efforts to ensure high coverage of pregnant women and children less than one year of age through the procurement and distribution of ITNs through routine channels (1.2 million nets), and support for the training and supervision of health workers on ITN distribution. Based on lessons learned, PMI will support technical assistance and logistical support for the 2018 mass distribution campaign. Furthermore, PMI will support the final data collection for ITN durability monitoring following 2016 mass campaign. SBCC activities will continue to be supported at the national and community levels to promote ITN use among all household members and enhance net demand, use, and care.

Indoor residual spraying (IRS): In its Malaria Strategic Plan 2017-2022, the Ministry of Health (MoH) plans to implement quality IRS in selected, suitable epidemiological areas, spraying at the appropriate time of the year and in line with international standards. The Malawi Malaria Vector Control Strategy outlines goals for IRS, including spraying with non-pyrethroid, non-carbamate insecticides, procurement of WHO Pesticide Evaluation Scheme-recommended insecticides and equipment, and district selection based on epidemiological and entomological data. Given the current availability of a long-lasting organophosphate that could provide protection for the full duration of the rainy season, widespread resistance to pyrethroids, and the NMCP's commitment to continue to advocate for resources from traditional and non-traditional donors, PMI plans to support implementation of IRS in Malawi again.

With FY 2018 funds, PMI plans to implement IRS in one district, including procurement of long-lasting organophosphate insecticide, implementation of spraying in a timely and effective manner and in compliance with accepted environmental and worker safety standards, and support for microplanning, geographical reconnaissance, training, and other logistical activities. The district will be selected based on the following criteria: high malaria burden, demonstrated area of pyrethroid resistance, and a dense, non-urban population to decrease operational costs per household. Furthermore, the selected district will be one of the 10 PMI focus districts, which have support for improving case management and routine M&E systems, in order to better track the impact of IRS. It will also be one of the five where PMI already supports entomological monitoring, to ensure that baseline entomological data is available.

Malaria in pregnancy (MIP): Through focused antenatal care (FANC), PMI supports all aspects of the Ministry of Health's three-pronged approach to reducing the burden of malaria in pregnancy: use of intermittent preventive treatment in pregnant women (IPTp) during antenatal care (ANC), distribution of ITNs to pregnant women, and effective case management of malarial illness and anemia. PMI, in conjunction with the NMCP and Reproductive Health Directorate, has worked to increase uptake of IPTp through training and supervision of providers and assistance with directly observed treatment. With support from PMI, the Ministry of Health (MoH) updated the national policy on IPTp to reflect the new WHO guidelines, and trained nearly all health workers in these new guidelines in 2014-15; the remainder were trained in 2016. The revised policy removes previous barriers to IPTp uptake, under which women were only to receive IPTp at specific intervals during pregnancy. Nevertheless, despite two decades of IPTp policy in Malawi, coverage goals have yet to be met. There are still systemic barriers to seeking ANC in the first trimester and increasing sulfadoxine-pyrimethamine (SP) resistance represents another significant threat to IPTp in Malawi.

With FY 2018 funding, PMI will continue integrated and malaria-specific social and behavior change communication activities in support of IPTp, case management, and ITN use at national and community levels; provide free ITNs for routine distribution at ANC visits and at labor and delivery for newborns; procure sulfadoxine-pyrimethamine (2.4 million treatments) and supplies to ensure directly observed therapy and IPTp uptake at ANC; support supervision and mentorship activities for malaria in pregnancy interventions as part of the focused antenatal care package; and help improve the collection of data on IPTp through support to strengthen the Health Management Information System (HMIS) system.

Case management:

a. Diagnosis and treatment

Increasing capacity to ensure prompt and effective case management and reduce the presumptive use of antimalarial medications is a key priority in Malawi's 2017-2022 Malaria Strategic Plan. PMI has supported the Government of Malawi (GoM) through procurement of malaria commodities including rapid diagnostic tests (RDTs), artemisinin-based combination therapy (ACT) treatments, injectable artesunate, and artesunate suppositories; training of health facility workers; outreach training and supportive supervision (OTSS) to laboratory and clinical supervisors; and support to village health clinics. Since Malawi became a PMI focus country in 2006, PMI has supported the procurement of malaria commodities including RDTs and malaria medicines. Through September 2016, PMI procured 27.9 million RDTs and 45.1 million ACT treatments. To strengthen diagnostic capacity, in 2010, PMI supported the introduction of a quality assurance program designed to improve Malawi's clinical and laboratory diagnostic services. This program focused on the provision of outreach training and supportive supervision (OTSS) to laboratory and clinical supervisors.

Malawi implements integrated community case management (iCCM), with national guidance emphasizing implementation in areas more than five kilometers from a healthcare facility. Approximately 3,190 village health clinics exist nationwide and PMI currently provides support to nearly all of the 1,940 village health clinics located in the 16 districts targeted by PMI's integrated service delivery partner. In 2015-2016, Health Surveillance Assistants (HSAs) were trained on the use of RDTs and pre-referral use of rectal artesunate. Currently, PMI is supporting follow up supervision and quality improvement for iCCM as well as community mobilization activities to increase malaria prevention and care-seeking behaviors by community members.

With FY 2018 funding, PMI will continue to focus on improving community and facility-based case management services in ten priority districts, those with the highest malaria burden in the country. Case management commodities, specifically RDTs and ACTs, will be supplied nationwide and supply chain technical assistance will be provided to all districts through zonal supply chain staff. Parenteral and rectal artesunate for severe malaria treatment are expected to be supported by other donors.

In order to expand diagnostic and treatment capabilities for children under five in the community, PMI will continue to support supervision of HSAs in the use of RDTs and pre-referral use of rectal artesunate. PMI will continue to support outreach training and supportive supervision (OTSS) to strengthen diagnostic capacity using RDT and microscopy and improve health workers' adherence to test results.

PMI funding will also target SBCC interventions focused on appropriate care-seeking behavior and medication adherence for both uncomplicated and severe malaria at the community level.

b. Pharmaceutical management

The 2017-2022 Malaria Strategic Plan (MSP) calls for a reliable, secure, and accountable pharmaceutical and supply chain management system to ensure the consistent availability of essential commodities and supplies for malaria control and prevention activities. To achieve this objective, the NMCP plans to strengthen the logistics management information systems in collaboration with Health Technical Support Services (HTSS), conduct regular supportive supervision to ensure facilities adhere to supply chain standard operating procedures, conduct annual forecasting and quantification and quarterly pipeline reviews, develop annual procurement plans in collaboration with partners, validate reports from facilities to improve transparency and accountability, and support national and international efforts to strengthen the procurement and supply chain system.

Supply chain issues have been a key concern in Malawi. Due to issues of leakage and general mismanagement, a PMI-Global Fund parallel supply chain was created in 2010 to distribute all U.S. Government and Global Fund-supported malaria commodities. PMI continues to use a parallel supply chain that distributes USAID-procured health commodities, and has sought opportunities to improve coordination between the multiple other supply chains for malaria commodities. In addition to support for Central Medical Stores Trust (CMST) reform, the U.S. Government has supported efforts to improve the overall supply chain through continued support to the MoH to strengthen planning and coordination centrally and improve commodity management and reporting at the district and facility levels. Support to the central level has included technical assistance to implement annual national quantification and forecasting of all essential medicines, conduct supply planning and commodity monitoring, and provide financial support to employ two technical assistants seconded to HTSS, which has supervisory authority over the CMST and has responsibility for the overall supply system to public health facilities in Malawi. Support to the district, health center, and community levels have included quarterly supervision,

mentoring, and end-use verification (EUV) surveys; expanded access to and use of logistics management information system (LMIS); and improved access to malaria commodities through iCCM.

The NMCP and PMI continued to focus on improving accountability for malaria commodities at the facility level, minimizing stockouts of malaria commodities at service delivery points, and strengthening supply planning and commodity management through planning, training, and supportive supervision. PMI-supported activities in the past year included monthly commodity distributions, integrated supportive supervision and peer mentoring, LMIS reporting, and capacity building at the central, district, and facility levels. PMI continued to support quarterly data reviews in each focus district, emphasizing the need for high quality data and accountability for medicines.

After several years of large gaps between the malaria treatments issued and the malaria cases seen in facilities and communities, 2016 saw improvement, with unaccounted-for treatments dropping from over 30% to less than 10%. Over the past year, the Drug Theft Investigation Unit (DTIU) has continued auditing facilities and pursuing legal actions: at least 40 people have been convicted and many more cases are pending in the court system. The DTIU has ensured that health facility staff who are found guilty are removed from their positions.

With FY 2018 funds, PMI will continue to support operation of the PMI-USAID parallel supply chain and strengthen MoH commodity management and planning at all levels of the system. At the zonal, district, facility, and community levels, PMI will continue to focus on improving provider behavior, accountability for medicines, and improved data management and use.

Health systems strengthening and capacity building: PMI supports a broad array of health system strengthening activities that cut across intervention areas, such as training of health workers, supply chain management and health information systems strengthening, drug quality monitoring, and NCMP capacity building. As part of the U.S. Government's integrated approach to contribute to efficient systems strengthening across the Malawian health sector, the U.S. Government has helped to train and retain health care workers; incentivized health workers to deliver higher quality services; built the capacity of the MoH to effectively utilize the LMIS and improve coordination of donor drug procurement; expanded health information systems and linked these systems across health programs; and provided broad-based support to the national laboratory system. The U.S. Government also has supported the development of leadership and management systems at the MoH and district levels, including systems for human resources; surveillance, monitoring and evaluation; and financial management.

With FY 2018 funds, PMI will support the implementation of the Health Sector Strategic Plan-2 2017–2022 (HSSP2). As PMI continues to address malaria-specific challenges, nationwide progress still requires ongoing investment to strengthen the overall health system with in-country partners. Starting in FY 2017, PMI Malawi began focusing and concentrating its service delivery strengthening efforts in 10 high malaria burden districts, building government capacity at the district level for facility-based case management; FANC and delivery of IPTp; community mobilization and iCCM; and surveillance, monitoring, and evaluation. These capacity-building efforts will include expanded supportive supervision and mentoring to relevant cadres (e.g., facility and community health care workers, pharmacy technicians and assistants, etc.). Simultaneously, at the central level, PMI will strengthen pharmaceutical supply chain management and reinforce the HMIS and surveillance, monitoring and evaluation; in addition to continuing to provide technical support to the NMCP and other key parts of the MoH (such as CMED and IMCI).

Social and behavior change communication (SBCC): The HSSP2 emphasizes the need to recognize and scale up health promotion interventions in the implementation of the Essential Health Package. The HSSP2 identified the limited capacity of existing communication efforts to reach all segments of the population as a threat to the successful delivery of essential health packages through public health interventions. In line with the HSSP2, the 2017-2022 MSP calls for strengthening advocacy, communication, and social mobilization capacities to move towards optimal coverage for all malaria interventions. This is aimed at achieving above 80% of the population practicing positive behavior to prevent and control malaria by 2022. The MSP aims to educate communities to practice appropriate preventive behaviors and to seek prompt diagnosis and treatment of malaria at the onset of signs and symptoms.

To achieve this, the NMCP developed the Malaria Communication Strategy (2015-2020) to improve community mobilization interventions through advocacy and social mobilization. PMI-funded activities helped strengthen national-level and targeted district-level SBCC planning. Specific activities include: support for inclusion of SBCC in health sector district implementation plans and health promotion and communication technical working group meetings. PMI also supported the MOH's efforts to develop and produce evidence-based SBCC packages under a multi-level media campaign to ensure effective, integrated SBCC implementation through mass media and facility and community level interventions.

With FY 2018 funds, PMI will continue to support NMCP efforts in sustaining gains on malaria knowledge and focus on increasing uptake and utilization of malaria interventions and promoting communities' sense of ownership and accountability of malaria commodities. PMI plans to support an integrated SBCC approach at the national level and at the community level in 10 focus districts with ITN, IPTp, and case management messaging. National level efforts will focus on advocacy, mass media communication, and materials development, while community level efforts will focus on interpersonal, small group interventions and strategies to engage traditional authorities to support and promote importance of malaria prevention activities.

Surveillance, monitoring, and evaluation (SM&E): The 2017-2020 Malaria Strategic Plan calls for improved malaria monitoring and evaluation systems towards achieving enhanced data and program accountability by 2022. This plan follows RBM M&E guidance to provide a comprehensive framework for obtaining reliable and consistent data in order to assess progress toward achieving universal coverage of malaria interventions and reducing disease burden. PMI provides targeted programmatic and technical support to the NMCP, HTSS, and CMED to support improvements to surveillance, monitoring, and evaluation systems; implement population-based surveys to measure progress on key malaria indicators; and enhance the coordination of Government of Malawi efforts.

With FY 2018 funding, PMI plans to continue to support strengthening of routine health management information systems, with an emphasis on improving the quality, timeliness, and use of malaria-specific surveillance data, as well as assessments of availability of commodities at health facilities. For district-level activities conducted in the 10 PMI focus districts, PMI will work closely with CMED, HTSS, NMC, and other malaria partners to ensure that these activities are in line with the priorities of the GoM, support national level initiatives, and are coordinated with the activities of other partners working in the non-focus districts. Additionally, PMI will continue support for the 2016-2021 impact evaluation of the integrated district-level service delivery and systems strengthening activities, which will produce rigorous evidence of the impact of the project on the availability and quality of health services and the performance of health systems in the 10 PMI focus districts.

Operational research (OR): The 2017-2022 Malaria Strategic Plan calls for strengthening operational research through the support for local capacity building and the creation of stronger coordination between NMCP and researchers to harmonize and prioritize operational research efforts, including interoperability between HMIS and complementary systems. PMI-funded operational research has provided important data for decision-making, including studies measuring the durability of long-lasting ITNs, the impact of IRS, the effectiveness of the IPTp strategy, the quality of health facility case management practices for uncomplicated and severe malaria, the ability of patients to complete recommended first-line treatment for malaria, the distribution of potentially drug-resistant parasites and mosquitoes, and the effectiveness of ITNs in an area with significant pyrethroid resistance.

PMI Malawi is supporting two studies with previous years' funding. The first study, using FY 2015 and FY 2016 funds, is assessing the efficacy of IPTp-DP compared to SP, to help determine whether this might be an alternative to IPTp-SP, in light of the relatively high rates of SP resistance among parasites in Malawi. The second study, supported by FY 2016 funds, focuses on increasing IPTp uptake through community delivery of IPTp-SP. Although a high proportion of women attend ANC at least once in pregnancy, according to the 2015-16 DHS, only about 24% of women attended ANC in the first trimester and 51% attended four visits, limiting the number of women who could receive three or more doses of IPTp during pregnancy. To address this, PMI Malawi has developed a protocol to conduct a pilot assessment of the effect of community delivery of IPTp-SP on IPTp uptake and ANC attendance.

In FY 2018, the two studies described above and supported with prior year's funding, will continue. There are no additional OR activities with FY 2018 funding.

II. STRATEGY

1. Introduction

When it was launched in 2005, the goal of PMI was to reduce malaria-related mortality by 50% across 15 high-burden countries in sub-Saharan Africa through a rapid scale-up of four proven and highly effective malaria prevention and treatment measures: insecticide-treated mosquito nets (ITNs); indoor residual spraying (IRS); accurate diagnosis and prompt treatment with artemisinin-based combination therapies (ACTs); and intermittent preventive treatment of pregnant women (IPTp). With the passage of the Tom Lantos and Henry J. Hyde Global Leadership against HIV/AIDS, Tuberculosis, and Malaria Act in 2008, PMI developed a U.S. Government Malaria Strategy for 2009–2014. This strategy included a long-term vision for malaria control in which sustained high coverage with malaria prevention and treatment interventions would progressively lead to malaria-free zones in Africa, with the ultimate goal of worldwide malaria eradication by 2040-2050. Consistent with this strategy and the increase in annual appropriations supporting PMI, four new sub-Saharan African countries and one regional program in the Greater Mekong Subregion of Southeast Asia were added in 2011. The contributions of PMI, together with those of other partners, have led to dramatic improvements in the coverage of malaria control interventions in PMI focus countries, and all 15 original countries have documented substantial declines in all-cause mortality rates among children less than five years of age.

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2. Malaria situation in Malawi

Malawi is a landlocked country bordered by Tanzania to the north, Zambia to the west, and Mozambique to the east and south. The population in 2018 is projected to be 17.9 million, comprised of approximately 51% women and approximately 20% children under five years of age (National

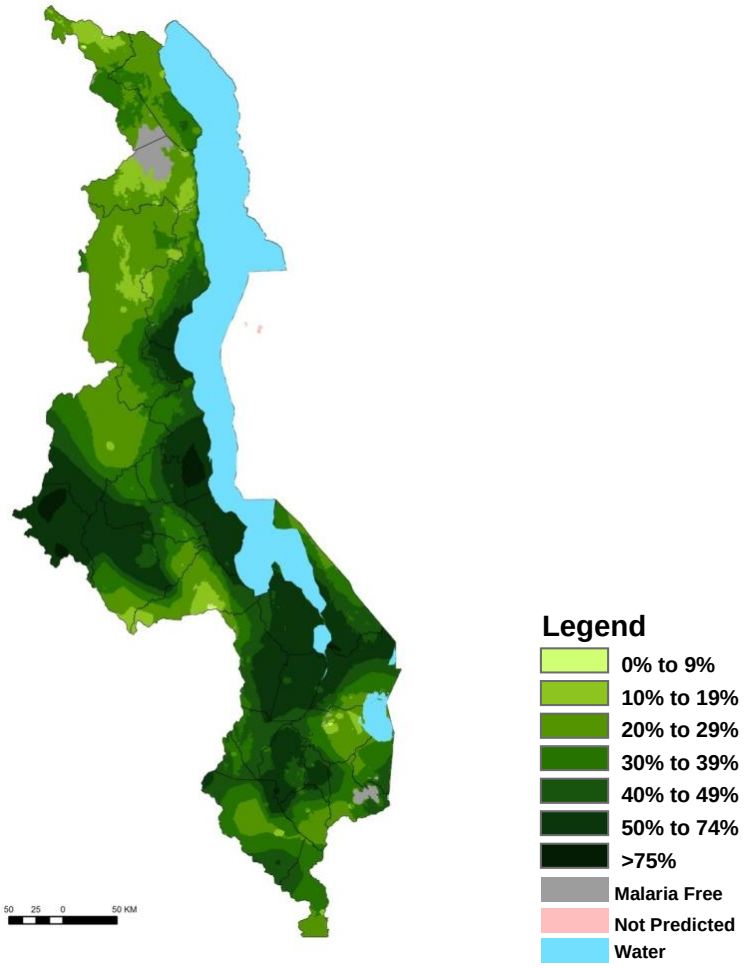
Statistical Office of Malawi). Rapid population growth continues to be a challenge, with an average of 4 children per woman (2015-16 Malawi Demographic and Health Survey[MDHS]) and a crude birth rate of 32.2 per 1,000 population, thus the proportion of children less than five years old continues to grow.

Malaria is endemic in more than 95% of the country (Figure 1). Transmission is perennial in most parts of the country and peaks after the start of the annual rains that typically begin in November and last through April. The highest transmission areas are found along the hotter, wetter, and more humid low-lying areas (lakeshore, Shire River Valley, and central plain), while the lowest risk areas fall along the highlands of Rumphi, Mzimba, Chitipa, and Kirk Range.[1] *Anopheles funestus* is considered to be the primary vector species; *An. gambiae* s.s. and *An. arabiensis* also are present and may predominate in some areas at certain times of the year. *Plasmodium falciparum* is the most common species of malaria, accounting for 98% of the infections and all severe disease and deaths.

Over the past seven years, PMI-supported entomological monitoring has documented increasing vector insecticide resistance, including the rise and spread of pyrethroid and carbamate resistance in *An. funestus.* Pyrethroid resistance in *An. funestus* was first identified in 2010-2011 and recent data from 2015 demonstrated low mortality in all sites (0 to 41% for deltamethrin, 0 to 44% for permethrin). Pyrethroid and piperonyl butoxide (PBO) synergist bioassays conducted in Nkhotakota and Chikwawa districts showed a significant increase in mortality, indicating that pyrethroid resistance is partially mediated by mixed-function oxidases. Resistance to carbamate insecticides was first documented in 2011, and data from 2014-15 showed mortality rates of 5% to 19% in the three districts sampled. All *An. funestus* populations tested against the organophosphates malathion and pirimiphos-methyl have been fully susceptible, while susceptibility to DDT has varied by site and over time, from 65% to 100% mortality.

[1] Kazembe LN1, Kleinschmidt I, Holtz TH, Sharp BL. 2006. *Spatial analysis and mapping of malaria risk in Malawi using point-referenced prevalence of infection data*. Int J Health Geogr. 2006 Sep 20;5:41.

Figure 1: Predicted population-weighted *Plasmodium falciparum* parasite prevalence in children two to ten years of age, Malawi 2010-2012[2,3]



Malaria continues to be a major public health problem and is responsible for approximately 6.2[4] million presumed and confirmed cases reported annually from health facilities and by the community case management program, and 30% of all outpatient visits across all ages (2016 Health Management Information System [HMIS] data, unpublished). Among children under five years, malaria parasite prevalence by microscopy was 33% nationally (2014 MIS).

[2] Okiro EA, Noor AM, Malinga J, Mitto B, Mundia CW, Mathanga D, Mzilahowa T, Snow RW (2014). *An epidemiological*

[3] Electronic and manual searches for published and unpublished reports were used to identify available malaria prevalence surveys (including the 2010 and 2012 Malawi Malaria Indicator Surveys). Age-corrected survey data (sample size and numbers positive) at known locations (longitude and latitude) and times (year) with a minimal set of conservative, long-term climate and human settlement covariates were used. Covariates statistically significant to the age-corrected infection prevalence were identified (in this case urbanization). Empirical data and spatially matched covariates were used within a Bayesian hierarchical space–time model to produce continuous maps of $Pf\text{PR}_{2-10}$ for 2010-2012.

[4] According to HMIS, there were 5.4 million cases reported from facilities (a combination of parasitologically confirmed and presumed) and 824,640 cases reported from iCCM (nearly all presumed).

Pregnant women and their fetuses are at high risk of the negative consequences of malaria. From 1996-2007, the incidence of placental malaria fell from 25% to 7% at the main referral hospital in Blantyre.[5] Although this is a selected population with unusually easy access to the best medical services available in the public sector in Malawi, a similar low level of acute placental malaria (5%) was measured in a rural area in Machinga District that was evaluated as part of a study monitoring the continued effectiveness of sulfadoxine-pyrimethamine (SP).[6]

3. Country health system delivery structure and Ministry of Health (MoH) organization

The Malawi health service delivery system is pyramidal, consisting of tertiary, secondary, primary, and community care levels. There are approximately 679 public sector health facilities, 509 of which are administered by the GoM. District and central hospitals provide secondary and tertiary care services, respectively, but also provide primary care to individuals within their catchment area. Primary care is delivered through clinics and health centers where curative, maternity, and preventive services are offered. Access to health facilities is limited: approximately half of Malawians live within a five-kilometer radius of a health facility. In response, Malawi has more than 3,500 health surveillance assistants (HSAs) in hard-to-reach areas who provide integrated community case management (iCCM), in addition to other services, through village health clinics (VHCs). HSAs are trained to assess, classify, and provide first-line treatment for selected childhood illnesses, including malaria, in addition to referral to the next level of care. Local community-based organizations also provide non-clinical malaria services such as social and behavior change communication (SBCC) on key malaria messages, counseling, and net distribution. The Malawi health system is highly and increasingly decentralized with many programming, human resources, and budgeting decisions made at the district level and coordination and supervision done by the zonal level (there are five zones). The Christian Health Association of Malawi operates 170 health facilities mainly in rural areas nationwide and provides approximately one-third of health services, including free provision of Essential Health Package (EHP) services in many places. The EHP covers conditions affecting the majority of the population of Malawi, especially the poor, including: vaccine preventable diseases, acute respiratory infections, malaria, tuberculosis, diarrhea, sexually transmitted infections, perinatal conditions, and HIV/AIDS. Fees are charged where service level agreements with the government have not been established.

The NMCP is located under the Ministry of Health's (MoH) Directorate of Preventive Health Services. The NMCP Program Manager is thus, a Deputy Director of Preventive Health Services. The program is staffed by a core group of 10 technical officers. The NMCP sets policies, establishes strategies, coordinates activities, and provides technical guidance for the MoH with respect to malaria prevention and control interventions. The management structure is comprised of 29 District Malaria Coordinators to direct activities in each district, as well as 29 District ITN Coordinators.

The District Malaria Coordinator positions were officially converted by the central MOH to full-time in 2015. However, the transition has not been fully adopted in all districts and many of the Malaria Coordinators are still unofficially required to perform clinical or other, non-malaria duties. The ITN Coordinator positions are filled by staff members with other primary designations. Other staff at the

[5] Feng G, Simpson JA, Chaluluka E, Molyneux ME, Rogerson SJ. 2010. *Decreasing burden of malaria in pregnancy in Malawian women and its relationship to use of intermittent preventive therapy or bed nets*. PLoS One. 2010 Aug 6;5(8):e12012.

[6] Gutman J, Mwandama D, Wiegand RE, Ali D, Mathanga DP, Skarbinski J. 2013. *Effectiveness of intermittent preventive treatment with sulfadoxine-pyrimethamine during pregnancy on maternal and birth outcomes in Machinga district, Malawi*. J Infect Dis. 2013 Sep;208(6):907-16.

district level, including the District Health Officer, District Medical Officer, District Pharmacist, and District HMIS Officer, are critical to the malaria program.

4. National malaria control strategy

The 2017-2022 National Malaria Strategic Plan (MSP) builds on the successes achieved and lessons learned during implementation of previous strategic plans. Within the 2017-2022 plan, Malawi continues to focus on moving towards the provision of universal access to proven interventions so that all Malawians at risk of malaria have equitable access to malaria prevention, care, and treatment. The NMCP activities were designed to be implemented within the newly developed Health Sector Strategic Plan 2 (HSSP2), including the provision of the EHP. Specifically, the MSP objectives were to ensure that by 2022:

- At least 90% pf the population use one or more malaria preventative interventions;
- At least 95% of suspected malaria cases will be tested and 100% of confirmed cases treated;
- Sixty percent of pregnant women receive at least three doses of IPTp, up from 12% in 2014;
- The annual average LA stock out rate is reduced from 7% in 2016 to 3%;
- Caregivers of under-five children who take action to seek appropriate malaria treatment within 24 hours of onset of fever increases from 31.2% to 50% by 2022;
- Data quality improves by increasing accuracy from 7% to 60% by 2022; and
- Program performance improves through implementing planned MSP activities from 43% to at least 90% by 2022.

Within the MSP, seven primary intervention areas were targeted: 1) integrated vector management (IVM); 2) case management; 3) malaria in pregnancy; 4) procurement and supply chain management; 5) social mobilization and advocacy; 6) surveillance, monitoring, evaluation, and operations research; and 7) program management.

IVM: The NMCP ITN policy promotes free distribution of ITNs for children born in health facilities, children attending their first visit under the Expanded Program on Immunization (EPI) (if an ITN was not received at birth), and to pregnant women at their first visit to an antenatal care (ANC) clinic. [Note: In practice, ITNs are distributed for newborns following delivery at a health facility and at ANC, but not through EPI visits.] The policy also supports time-limited, national, free distribution campaigns that are conducted every two to three years. Malawi aims to achieve universal coverage with ITNs, defined as one net for every two people, with the objective of increasing net ownership and net usage among pregnant women and children under five years of age to at least 90%.

Within the 2017-2022 MSP, Malawi intends to revamp IRS in selected, suitable epidemiology areas, with a target of spraying in eleven high burden districts by 2022. The NMCP developed and adopted an evidence-based IVM strategy that guides the future vector control activities and entomologic monitoring. Given the emergence and expansion of pyrethroid and carbamate resistance, the high cost of alternative insecticides, and the limited funding from the Government of Malawi (GoM), the drafted IVM implementation plan calls for a more limited and targeted expansion of IRS.

Although ITN distribution and IRS remain the main malaria vector control interventions in Malawi, larval source management will be used as a complementary strategy, as resources from GoM and other donors allow.

Case management: The MSP calls for all suspected cases to be tested using rapid diagnostic tests (RDTs) at health facility and community level, while microscopy will be used to confirm treatment failure and diagnosis of severe cases, with an objective of testing at least 95% of suspected malaria cases and 100% of confirmed cases treated in line with national treatment guidelines by 2022. NMCP will also broaden access to testing and treatment services at community level by further increasing the number of village clinics and by training auxiliary nurses and patient attendants in RDTs.

The MSP also called for strengthening of the systems for quality assurance for both diagnosis and treatment. This will be accomplished through quarterly outreach trainings and supportive supervision (OTSS) on malaria case management at all levels. In addition, health worker capacity for patient care as well as post-marketing surveillance and pharmacovigilance were strengthened. NMCP also plans to build a team of WHO-accredited microscopists who will provide on job training and mentorship to microscopists in health facilities.

Malaria in pregnancy: As part of a comprehensive focused ANC (FANC) package, Malawi is committed to increasing the provision of SP in all health facilities. Malawi will begin to explore different channels for IPTp delivery, as it is currently limited to ANC clinics only. Quality of FANC will be improved through training, supervision, and mentorship of ANC heath service providers.

Procurement and Supply Chain Management: Efficient and effective procurement and supply chain management (PSM) are fundamental to the program performance in the fight against malaria. Malawi intends to decrease annual stockout rates through an increased focus on data collection and improved data management systems. Health workers and procurement personnel will be trained in forecasting, quantification, procurement of malaria commodities, and the logistics management information system (LMIS). NMCP will also collaborate with relevant departments to review all procurement and supply chain systems to enhance timely delivery of quality medicines, commodities and proper storage capacity at all service delivery points.

Social mobilization and advocacy: The MSP and the 2015-2020 Malaria Health Communication Strategy recommend social mobilization, advocacy, and community-based monitoring strategies to increase the use of all malaria interventions through increased efforts aimed at qualitative and quantitative research, prioritization for promotion of targeted positive behaviors, and capacity building. The key behavior change objectives of focus highlighted in the current Malaria Health Communication Strategy (2015-2020) are as follows:

i) Heads of households should ensure that LLINs are hanging up and that everyone in the household sleeps under an LLIN every night all year round
ii) All suspected malaria cases should take prompt action and demand malaria testing
iii) Only confirmed positive malaria cases receive recommended malaria treatment within 24 hours of onset of signs and symptoms, and complete the prescribed dosage
iv) Health workers should treat cases of malaria according to approved treatment guidelines
v) Heads of households should allow their houses to be sprayed
vi) Women of child-bearing age should start attending ANC services during the first three months of pregnancy and attend at least four focused visits so that they can receive at least three doses of SP during pregnancy

Surveillance, monitoring and evaluation, and operations research: The MSP aims to improve routine data systems, surveillance, and operations research, while promoting use of information and strengthening capacities for data use at all levels towards achievement of enhanced data and program

accountability by 2022. The NMCP, with support from PMI, will continue to work closely with the Central Monitoring and Evaluation Department (CMED) in the MoH and other partners to strengthen the routine Health Management Information System (HMIS) and improve the quality, accuracy, and use of malaria data in the DHIS2. A Monitoring and Evaluation Plan to support the new MSP is yet to be developed.

Program management: The MSP also emphasizes strengthening human resource capacity; program planning and reviews; partnership and coordination; procurement and supply chain management; resource mobilization; and cross-border initiatives. The NMCP has linked its management objectives to existing national and international development strategies to enhance its policy direction.

5. Updates in the strategy section

There have been three developments of note in the past 12 months:

- With technical support from PMI and other malaria stakeholders, Malawi submitted a malaria Funding Request for the Global Fund in March 2017. The Funding Request is being revised following comments from the Global Fund Technical Review Panel. This funding is critical to the successful implementation of malaria prevention and control activities in Malawi, and PMI continues to support the GoM to help ensure timely and effective grant implementation.

- In 2016, the gap between malaria reported cases and ACT consumption data has narrowed, suggesting improvements in issues of theft and accountability for malaria commodities. Improved supervision at the district, facility, and community levels; better use and review of data for decision-making; and audits of facilities with discrepancies between consumption and reported cases have contributed to the observed improvements in commodity accountability. The MoH continues to conduct facility audits across the county that have led to arrests and administrative actions against MoH staff. Malawian leaders at the highest levels have consistently reinforced messages that drug theft and misappropriation must stop. Within the MOH, the Minister and the Secretary for Health have been strong supporters of efforts to improve accountability.

- PMI's primary service delivery, health systems strengthening, and SBCC partners were redesigned and awarded late in 2016. At the time of writing, the two major flagship projects (for service delivery district HSS and SBCC) are completing the startup phases and beginning technical activities. As part of the new design, PMI will implement malaria service delivery, district health systems strengthening, and community mobilization interventions in ten high burden malaria districts. The PMI team anticipates that this more epidemiologically-driven and focused approach will increase the impact of the limited PMI funding on overall malaria transmission.

6. Integration, collaboration, and coordination

In Malawi, the MOH and donors coordinate through a series of technical working groups that provide technical guidance and decision-making on key technical issues. Development partners also participate in the Health Donor Group; PMI is represented in this group by the Director of USAID's Office of Health, Population, and Nutrition (HPN).

Malaria-specific partners

PMI actively coordinates with development partners in Malawi on malaria and cross-cutting health issues. For malaria-specific activities, the Global Fund is the other key development partner. To date, the Global Fund has allocated a total of approximately $247 million for malaria activities in Malawi, including approximately $70 million for 2018-2020 allocation period. Approximately $154 million of the total approved funding has been disbursed. The majority of resources under the current and future grants will be used for malaria commodities and distribution, with additional resources available for iCCM, SBCC, and SM&E strengthening, as well as program management activities. Malawi has two principal recipients: MoH for commodities and management support, and WorldVision for programmatic activities.

The NMCP receives additional technical assistance from a number of partners:

- The United Nations Children's Fund (UNICEF) supports resource and programmatic management within the MoH, as well as malaria prevention and control efforts at the district level, including integrated community case management (iCCM) and development of SBCC materials.
- The World Health Organization (WHO) provides assistance on a variety of technical issues.
- Save the Children, with support from the WHO Global Malaria Programme and the Government of Canada, implements the Rapid Access Expansion (RAcE) program to support the scale-up of integrated community case management (iCCM) in eight districts. With internal funds, Save the Children also supports the scale-up of iCCM and community health activities in four additional districts, as well as the piloting and implementation of school-based malaria control in one district with additional funding from the Berglund Family Foundation.
- United Purpose, with support from the Against Malaria Foundation, implements rolling mass ITN distributions in four districts and provides technical assistance to the NMCP, primarily around ITN distribution.

Other relevant health partners

In addition to malaria, the United States Government in Malawi supports a robust health program with emphasis on HIV/AIDS; maternal, newborn, and child health; family planning; nutrition; water, sanitation, and hygiene; and health systems strengthening. Malawi is a President's Emergency Plan for AIDS Relief (PEPFAR) long-term strategy country, receiving over $85 million in FY 2017 for care and treatment of HIV, key population prevention, voluntary medical male circumcision, community-based care, and support and health systems strengthening. USAID HPN received approximately $40 million in FY 2017 funds for other health sectors and supports service delivery improvements, community mobilization, and systems strengthening in focus districts, in addition to significant central level support. PEPFAR, USAID HPN, and PMI share several implementing partners working on integrated or common platforms to support improved health outcomes in Malawi. The PMI team works closely with PEPFAR and the USAID health teams to coordinate activities.

The United Kingdom Department for International Development (DFID) is a key partner in the broader health sector, with extensive focus on improving the health supply chain. In addition to procurement and distribution of essential medicines, DFID provides substantial technical assistance to the Central Medical Stores Trust (CMST) and with the funding through USAID, DFID will support installation of 215 prefabricated pharmacy storage units in health facilities across Malawi between 2016 and 2018 to improve quality and security commodity storage. As part of efforts to ensure commodity security and

accountability of medicines in the public sectors, DFID provides technical assistance to the MoH's DTIU and supports district-level governance and accountability structures, primarily in non-USAID focus districts.

7. PMI goal, objectives, strategic areas, and key indicators

Under the PMI Strategy for 2015-2020, the U.S. Government's goal is to work with PMI focus countries and partners to further reduce malaria deaths and substantially decrease malaria morbidity, towards the long-term goal of elimination. Building upon the progress to date in PMI focus countries, PMI will work with NMCPs and partners to accomplish the following objectives by 2020:

1. Reduce malaria mortality by one-third from 2015 levels in PMI focus countries, achieving a greater than 80% reduction from PMI's original 2000 baseline levels.
2. Reduce malaria morbidity in PMI focus countries by 40% from 2015 levels.
3. Assist at least five PMI focus countries to meet the World Health Organization's (WHO) criteria for national or sub-national pre-elimination.[7]

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

1. Achieving and sustaining scale of proven interventions
2. Adapting to changing epidemiology and incorporating new tools
3. Improving countries' capacity to collect and use information
4. Mitigating risk against the current malaria control gains
5. Building capacity and health systems towards full country ownership

To track progress toward achieving and sustaining scale of proven interventions (area of strategic focus #1), PMI will continue to track the key indicators recommended by the Roll Back Malaria Monitoring and Evaluation Reference Group (RBM MERG) as listed below:

- Proportion of households with at least one ITN
- Proportion of households with at least one ITN for every two people
- Proportion of children under five years of age who slept under an ITN the previous night
- Proportion of pregnant women who slept under an ITN the previous night
- Proportion of households in targeted districts protected by IRS
- Proportion of children under five years old with fever in the last two weeks for whom advice or treatment was sought
- Proportion of children under five with fever in the last two weeks who had a finger or heel stick
- Proportion receiving an ACT among children under five years old with fever in the last two weeks who received any antimalarial drugs
- Proportion of women who received two or more doses of IPTp for malaria during ANC visits during their last pregnancy

[7] http://whqlibdoc.who.int/publications/2007/9789241596084_eng.pdf

8. Progress on coverage/impact indicators to date

Table 1: Evolution of Key Survey Based Malaria Indicators in Malawi from 2006 to 2016

Indicator	2006 MICS	2010 MIS*	2010 DHS	2012 MIS	2014 MICS	2014 MIS	2015-16 DHS**
% Households with at least one ITN	38	58	57	55	78	70	57
% Households with at least one ITN for every two people	N/A	N/A	N/A	19	34	30	24
% Children under five who slept under an ITN the previous night	25	55	38	56	66	67	43
% Pregnant women who slept under an ITN the previous night	8	49	35	51	61	62	44
% Households in targeted districts protected by IRS	N/A	N/A	2.2	9	N/A	9	5
% Children under five years old with fever in the last two weeks for whom advice or treatment was sought	N/A	26*	65	50	75	59	67
% Children under five with fever in the last two weeks who had a finger or heel stick	N/A	7	17	21	42	33	52
% Children receiving an ACT among children under five years old with fever in the last two weeks who received any antimalarial drugs	N/A	N/A	N/A	91	88	92	92
% Women who received two or more doses of IPTp during their last pregnancy in the last two years	48	60	55	54	59	63	63
% Women who received three or more doses of IPTp during their last pregnancy in the last two years			18	13	19	12	30
Under-five mortality rate per 1,000 live births	122	N/A	112	N/A	85	N/A	62
% children under five with parasitemia (by **microscopy,** if done)	N/A	43	N/A	28	N/A	33	N/A
% children under five with parasitemia (by **RDT**, if done)	N/A	N/A	N/A	43	N/A	37	N/A

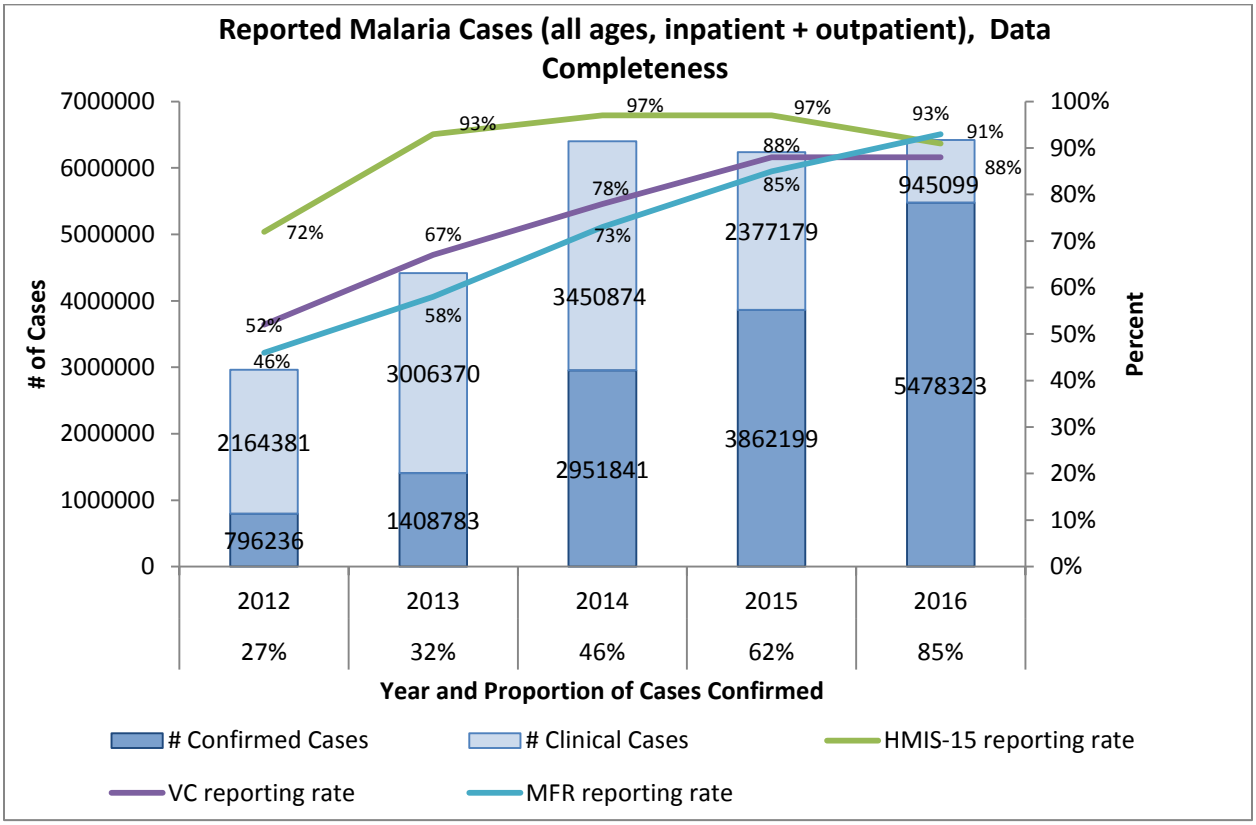
*The 2010 MIS collected data only on care-seeking within 24 hours of fever onset. Data reported here from subsequent surveys does not specify the period of care-seeking.
** For ITN indicators, it should be noted that data collection for the 2015-16 DHS was conducted from October 2015 – January 2016, several months prior to a mass ITN distribution campaign conducted from March 2016 to May 2016 in 19 of Malawi's 29 districts. Additionally, given the DHS occurs during the low transmission period, while the MIS typically occurs near peak transmission season, some indicators are affected.

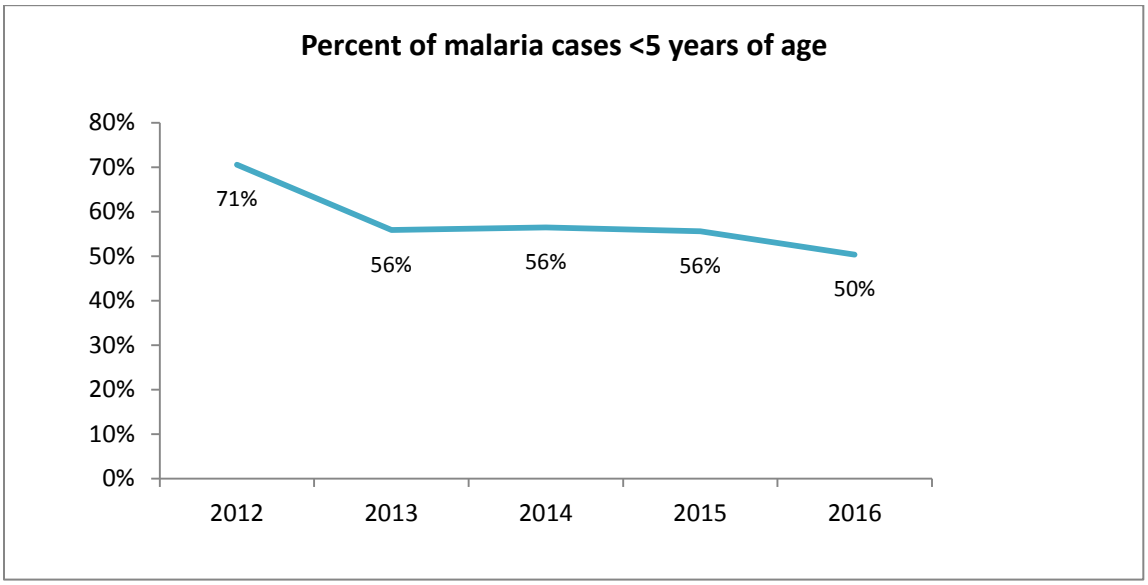
Table 2: Evolution of Key Malaria Indicators reported through routine surveillance systems in Malawi from 2012 to 2016

Indicator	2012	2013	2014	2015	2016
Total # Cases	2,960,617	4,415,153	6,402,715	6,239,378	6,423,422
Total # Confirmed Cases	796,236	1,408,783	2,951,841	3,862,199	5,478,323
Total # Clinical Cases*	2,164,381	3,006,370	3,450,874	2,377,179	945,099
Total # <5 Cases	2,088,868	2,465,927	3,614,983	3,469,283	3,231,445
Total # inpatient malaria deaths	7,174	6,656	10,510	14,092	18,875
Data Completeness** (%)					
HMIS-15 Form	72%	93%	97%	97%	91%
Village Clinic (VC) Form	52%	67%	78%	88%	88%
Malaria Facility Report (MFR) Form	46%	58%	73%	85%	93%
Test Positivity Rate (TPR)	46%	43%	52%	50%	54%

* Malaria case data in Malawi is submitted into the DHIS2 on three different forms:
The HMIS-15 form includes malaria cases (clinical and confirmed) and inpatient malaria deaths; both disaggregated by under / over 5 years.
The malaria facility reporting form includes suspected cases tested, facility-level confirmed cases, and inpatient malaria deaths; disaggregated by under / over 5 years.
The village clinic reporting form includes under five malaria cases confirmed and unconfirmed.
The clinical case numbers shown here have been generated manipulating data from the three sources, which have different reporting and completeness rates, and thus do not reflect an accurate estimate of clinical malaria cases. For example, if a facility only submits the HMIS-15 form, which includes all cases, but not the malaria facility report, which includes confirmed cases, all cases from that facility would be counted as clinical here. Similarly, if a facility only submits the malaria facility report form, but an incomplete HMIS-15 form, that facility could have noclinical cases for that month.
**Percentage of health facilities reporting each month.

Figures 1a and b: Trends in Key Routine Based Malaria Indicators





9. Other relevant evidence on progress

PMI Malawi has supported two national health facility surveys to assess the status of case management of malaria in public health facilities. The first was conducted in 2011 (prior to the national roll out of RDTs to

health facilities) and focused on the management of uncomplicated malaria. In total, 107 health facilities, 2,019 outpatients, and 135 health workers were surveyed. Key findings include:

- Only 42% of patients attended facilities with functional microscopy. The quality of facility microscopy was poor compared to expert microscopists (sensitivity = 47% and specificity = 84%).
- Thirty-four percent of all patients seeking curative care at outpatient departments during the high transmission season had parasitologically-confirmed, uncomplicated malaria.
- Sixty-seven percent of patients with malaria confirmed by microscopy were correctly treated with an ACT; 95% were correctly dosed. The main cause of incorrect treatment was malaria cases missed by clinicians.
- Thirty-one percent of patients without malaria received an ACT.
- Most patients were seen by health workers (69%) explicitly trained on the malaria treatment guidelines.

The second national health facility survey was conducted in 2012 and focused on the management of severe malaria. In total, 200 health workers were surveyed at 36 hospitals that admit patients with severe malaria and 1,252 inpatient records were reviewed. Key findings include:

- Forty-two percent of all patients were given an admission diagnosis of malaria.
- RDTs were available in 97% of the facilities, but were out of stock at least once in the prior three months in 44% of facilities. Microscopy supplies were available in 89 % of the facilities, but were out of stock in 22% of facilities in the prior three months.
- Sixty-five percent of patients had parasitological confirmation of their diagnosis on admission.
- Quinine was available in 92% of the hospitals on the day of the survey, but 26% of facilities reported at least one stockout of all severe malaria treatments within the prior three months. Seventy-six percent of all severe malaria patients received intravenous quinine, the first-line medication (during the time of the survey) for the treatment of severe malaria.
- On-the-job malaria training was reported by 57% of health workers, primarily on the use of RDTs. Only 5% reported malaria supervision in the prior six months.
- Health workers cited availability of treatment (58%), availability of diagnostic supplies (32%), and knowledge gaps (30%) as the main obstacles to malaria care.

With funding and support from PMI, Malawi and the Roll Back Malaria (RBM) partnership completed an impact evaluation of malaria control efforts between 2000 and 2010. The *Progress and Impact Series* report was launched in April 2013. Key findings included a 41% reduction in under-five mortality from 188 to 112 deaths per 1,000 live births over the period 1996-2000 and 2006-2010, and modeling, which estimated that approximately 21,600 deaths among children under five years of age were prevented by malaria control interventions.

The 2013-14 Service Provision Assessment (SPA) was designed to be a census of all formal sector health facilities in Malawi. The assessment used health facility inventory, health provider and client exit interview questionnaires, and observations protocols. Key findings include:

- Of all facilities, 96% offer malaria diagnosis and/or treatment services. Only 65% of facilities offer ANC services.
- Among all facilities offering malaria diagnosis and/or treatment, 61% had staff trained on malaria case management. First-line ACTs and RDTs were available in 92% and 88% of these facilities, respectively. Parenteral quinine for the treatment of severe malaria was

available in 90% of facilities. Parenteral artesunate, which is being rolled out as the new first-line agent for severe malaria, was available in only 10% of facilities.

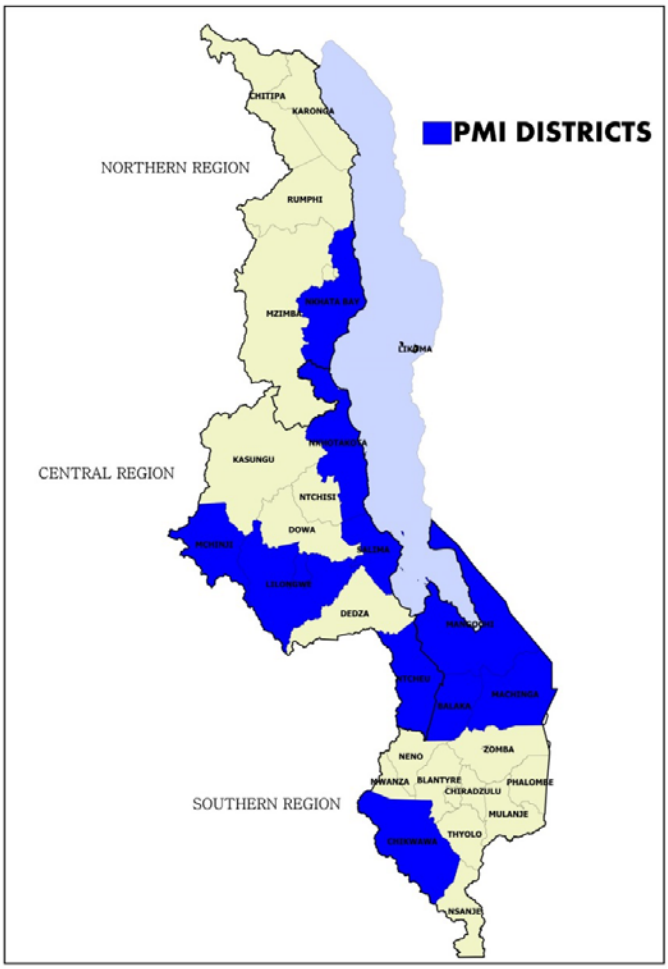
- Among facilities offering ANC services, 75 and 84% of hospitals and health centers, respectively, had ITNs available. SP for IPTp was available in 99% of these facilities.

III. OPERATIONAL PLAN

PMI Support Strategy

PMI's strategy is to support the MoH and the NMCP to implement the Malaria Strategic Plan (MSP). While maintaining nationwide support for certain interventions (e.g., commodity procurement and distribution), PMI has adapted its strategy to focus key interventions in ten of the districts with the highest malaria burden. Service delivery support, community mobilization, and district-level health systems strengthening activities are being prioritized in these focus districts. The PMI team anticipates that this more epidemiologically-driven and focused approach will increase the impact of the limited PMI funding on overall malaria transmission. PMI will work closely with the MoH and other malaria partners to ensure PMI-funded activities in the focus districts are in line with the priorities of the GoM, support national level initiatives, and are coordinated with the activities of other partners working in the non-focus districts.

Figure 2: PMI focus districts under current service delivery, systems strengthening, and communications implementing partners



1. Vector monitoring and control

NMCP/PMI objectives

The 2017-2022 MSP promotes an integrated vector management strategy, including vector surveillance, insecticide resistance management, routine and mass distribution of ITNs, geographically targeted IRS, and larval source management. PMI supports the use of all of these interventions, with the exception of larval source management. In 2014, the NMCP, with technical and financial support from PMI, developed the Malawi Integrated Vector Management Strategy 2015-2019. The Strategy outlines nine major actions for vector control: advocacy for funding; attainment of universal coverage of ITNs across the country; scale-up of IRS to all target districts; implementation of larval source and environmental management; establishment of broad stakeholder engagement; enhanced community engagement; increased resistance monitoring and implementation of a resistance management plan; collection of entomological data to monitor impact; and capacity building for implementation. PMI also supported the drafting of an implementation plan for this strategy in May 2015.

The primary malaria prevention intervention in Malawi is distribution of ITNs and promotion of ITN use. The MSP calls for universal coverage with ITNs (defined as one net for every two individuals), and outlined specific targets, including 90% household ownership of at least one ITN, and 90% ITN use among pregnant women and children less than five years of age. The country has a two-pronged strategy for ITN distribution: (1) free routine distribution to pregnant women through ANC and to newborns at the time of delivery; and (2) time-limited, intermittent mass campaigns targeting universal coverage every two to three years. Although it is not a formal distribution channel, the NMCP also distributes ITNs to affected populations during disasters, most notably during floods that have occurred in multiple recent years.

a. Entomologic monitoring and insecticide resistance management

Progress since PMI was launched

Over the past six years, PMI-supported entomological monitoring has documented increasing vector insecticide resistance, including the rise and spread of pyrethroid and carbamate resistance in *An. funestus*, which is the primary malaria vector across most of the country. Pyrethroid resistance in *An. funestus* was first identified in 2010-2011, with permethrin mortality rates of 40-92%, deltamethrin mortality rates of 41-80%, and lambdacyhalothrin mortality rates of 32-70%. According to WHO guidelines, all tested populations of *An. funestus* were classified as resistant to pyrethroids. More recent data from 2015 has shown even higher resistance rates (0-41% mortality for deltamethrin, 0-44% mortality for permethrin). Piperonyl butoxide (PBO) synergist bioassays conducted in Nkhotakota and Chikwawa districts showed a significant increase in mortality over pyrethroid-only bioassays, indicating that pyrethroid resistance is partially mediated by mixed-function oxidases (Chikwawa: 14-18% mortality with pyrethroid alone vs. 80-84% mortality with pyrethroid plus PBO; Nkhotakota: 2-3% mortality with pyrethroid alone vs. 63% mortality with pyrethroid plus PBO).

An. funestus is also resistant to carbamate insecticides. Entomological monitoring data from seven districts collected in 2011 showed that only the population in Mangochi District was fully susceptible to bendiocarb (100% mortality). The mortality rate for the Salima population was 96%, indicating the possible emergence of resistance, and populations from the remaining five districts were resistant according to the WHO guidelines, with less than 90% mortality. In 2012, monitoring in five districts, including Salima, identified resistance to bendiocarb in all sites. More recently, data on carbamate resistance has been limited due to low mosquito numbers and prioritizing samples for pyrethroid resistance testing, but data from 2014-15 showed a steady decline in susceptibility, with mortality rates of 5% to 19% in the three districts sampled.

An. arabiensis is the main vector in Karonga District (northern Malawi) and a minor vector in the rest of the country. In 2011, *An. arabiensis* in Karonga were 98%-100% susceptible to pyrethroids. In 2015, *An. gambiae* s.l. (presumed to be mainly *An. arabiensis*) in Karonga were still classified as suspected resistant to deltamethrin (95%-97% mortality). However, data from other areas of the country show emerging resistance, with 57%-100% mortality to deltamethrin and 44%-100% mortality to permethrin. Data on *An. arabiensis* susceptibility to bendiocarb are limited, with a single report of resistance in 2014.

Data on DDT resistance from 2012 showed widespread susceptibility of *An. funestus*, however, data from 2013-15 suggest emerging resistance (75%-81% mortality, in three districts). Regardless, DDT cannot be used for malaria control, as it is currently not registered in Malawi due to environmental concerns and strong opposition from the agricultural sector, which fears that contamination of crops may result in the loss of export markets.

As of 2015, all *An. funestus* populations tested against the organophosphates malathion and pirimiphos-methyl have been fully susceptible. These data indicate organophosphates are the only technically sound options currently available for IRS in Malawi.

In 2013-2014, CDC funded an entomological study evaluating PBO synergist nets vs. pyrethroid-only nets in Balaka and Machinga districts. In contrast to results from PBO synergist assays conducted in the routine monitoring districts, in the Balaka study site, PBO restored *An. funestus* pyrethroid mortality to 94%-99%. In laboratory tests, PBO-treated ITNs killed 100% of wild *An. funestus*. However, in community trials, mosquito density was low and data were inconclusive; parity data showed that there may be a benefit of PBO nets, but the trend was not statistically significant. The inconclusive results may have been due to high heterogeneity between villages, or continued efficacy of pyrethroid-only ITNs.

In 2015, PMI supported entomological surveillance in seven districts, including measurements of mosquito density and insecticide resistance (Table 3). Field data from sites in southern Malawi indicated high numbers of *An. funestus* and *An. arabiensis* by light traps with significantly lower numbers by pyrethrum spray catch. The data suggest that either light traps are simply more efficient tools for collection of malaria vectors in Malawi or that behavioral shifts resulted in reduced resting of mosquitoes inside houses. Future plans include exit traps as part of entomological monitoring to determine what proportion of mosquitoes exit houses during the night.

Table 3: Results of PMI and NMCP 2015 Insecticide Resistance Testing for *An. funestus*.
(For each district, WHO bioassays were performed at 1-4 sites; the range for percent mortality is shown.)

District*	deltamethrin	permethrin	bendiocarb	DDT	malathion
Nkhata Bay	11-14%	14%	-	-	-
Nkhotakota	0-8%	25%	-	-	-
Salima	8-41%	25-32%	-	-	-
Mangochi	37%	44%	-	-	-
Machinga	7%	0%	-	-	-
Chikwawa	12-26%	0-29%	19%	75%	100%

* PMI also supported entomological surveillance in Karonga for *An. gambiae*; data are not included here.

Progress during the last 12-18 months

Due to delayed disbursement of funding to PMI's entomological monitoring partner, no surveillance activities were conducted for the period of October 2015 through June 2016. In past years, the entomology team has had difficulty collecting enough *An. funestus* to carry out resistance assays in all districts. Because the GoM does not have firm plans to conduct IRS in the previously sampled districts, PMI has reduced the number of districts from seven to five, while intensifying collections in these districts to ensure adequate mosquito sample sizes are collected for all resistance assays. Preliminary resistance data

from 2017 indicate continued resistance of *An. funestus* to permethrin, deltamethrin, and bendiocarb. Bottle bioassays are being implemented to better quantify the intensity of resistance to permethrin, deltamethrin, and alphacypermethrin with results to date showing some survivorship after 30-minute exposures to 2X concentrations of deltamethrin, as well as survivorship 24 hours after a 1 hour exposure to 2X concentrations of permethrin (Table 4). Furthermore, cone bioassays using wild caught *An. funestus* against 6 different ITN brands indicated low mortality (<30%) to all products except a combination net treated with PBO. Preliminary testing with *An. funestus* against alphacypermethrin has demonstrated high intensity resistance with survivorship at 5X and 10X concentrations. Retesting is under way to confirm these results and expand testing with higher concentrations to other pyrethroids. However, progress has been slow due to the difficulty of collecting large numbers of adult *An. funestus* and the difficulty in rearing F1 generation mosquitoes for testing.

Table 4: Results to date of PMI 2017 Insecticide Resistance Testing (Bottle Bioassays)

District	Village	Species	Insecticide	% Knockdown at 30 minutes[1]	% Mortality at 24 hours[2]
Chikwawa	Maseya	*An. funestus*	Deltamethrin (1X)	35.0	45.0
Chikwawa	Ntwana	*An. funestus*	Deltamethrin (1X)	90.1	52.7
Chikwawa	Ntwana	*An. funestus*	Deltamethrin (2X)	68.1	63.0
Chikwawa	Ntwana	*An. funestus*	Permethrin (1X)	81.9	54.3
Chikwawa	Ntwana	*An. funestus*	Permethrin (2X)	100	55.9
Nkhotakota	Chimkwende	*An. funestus*	Deltamethrin (1X)	56.6	71.7
Nkhotakota	Chimkwende	*An. funestus*	Deltamethrin (2X)	71.0	72.6
Nkhotakota	Chimkwende	*An. funestus*	Permethrin (1X)	62.0	77.0
Nkhotakota	Vwawa	*An. funestus*	Deltamethrin (1X)	44.9	77.6
Nkhotakota	Chimkwende	*An. gambiae* s.l.	Deltamethrin (1X)	91.2	80.7
Chikwawa	Ntwana	*An. gambiae* s.l.	Deltamethrin (1X)	97.1	87.4
Karonga	Wovwe	*An. gambiae* s.l.	Deltamethrin (1X)	80.0	100.0

[1] Knockdown was measured 30 minutes after mosquitoes were introduced into the bottle.
[2] Mortality measured 24 hours after a 1 hour exposure in the bottles.

To ascertain more detailed information on insecticide resistance throughout Malawi, the NMCP has initiated mapping of insecticide resistance with funding from the Global Fund Round 9/Phase 2 and New Funding Model grants. The NMCP plans to conduct this surveillance annually in several districts, rotating the districts sampled from year to year. The first surveillance round was conducted in May 2015 in eight districts not already sampled under the PMI-funded activities, and included only phenotypic susceptibility testing for pyrethroids among *An. arabiensis* populations. Thirty-one populations were tested against deltamethrin and 11 against permethrin. Confirmed resistance (defined as 24-hour mortality < 90%) to deltamethrin was observed in 17 populations, while confirmed resistance to permethrin was observed in 7 populations. The PMI team continues to work closely with the NMCP and PMI's entomological surveillance implementing partner to ensure that all monitoring efforts in Malawi are complementary, well-coordinated, and provide the evidence needed for effective programmatic decision-making.

Plans and justification

To monitor the implementation of the Vector Control Strategy 2015-2019, PMI will continue to support entomological monitoring in five targeted districts. In each district, PMI continues to support insecticide resistance monitoring, including measurement of resistance intensity and synergist assays once per year, as well as monthly measurements of species distribution, abundance, and mosquito behavior. In the district where IRS is implemented, PMI will provide support for quality assurance of the intervention through monthly wall bioassays. PMI will also continue to provide technical assistance to the NMCP

for its entomological monitoring program, which aims to map insecticide resistance in all districts on a rotating annual basis, and which will cover any potential IRS districts.

Proposed activities with FY 2018 funding: ***($379,000)***

- Continued support for entomological monitoring in five targeted districts (Chikwawa, Nkhotakota, Karonga, Balaka, and Ntcheu), including routine surveys of vector density, behavior, insecticide resistance frequency, resistance intensity, and sporozoite rate, as well as wall bioassays in the district covered by IRS; technical assistance to the NMCP in support of their entomological surveillance program in additional districts *($350,000);* and
- CDC technical assistance for entomological monitoring *($29,000).*

b. Insecticide-treated nets

Progress since PMI was launched

PMI has consistently supported NMCP efforts through the procurement and distribution of ITNs for continuous distribution to pregnant women and children under the age of one year. The ITN policy includes free distribution of ITNs for pregnant women at their first visit to an ANC clinic and for newborns at delivery in health facilities. Over the past 10 years, an estimated 8 million ITNs have been distributed countrywide in Malawi through the routine channels. During the same period, PMI has provided Malawi with technical support for planning and management of routine and mass distribution mechanisms, as well as targeted funding for implementation to cover critical gaps and minimize delays. In addition, PMI has funded social and behavior change communication and community mobilization efforts to improve the uptake and utilization of ITNs.

Malawi conducted its first nationwide mass distribution of free ITNs in 2012 with financial support provided primarily by the Global Fund. PMI procured and distributed ITNs for rural areas of Lilongwe District and provided technical assistance for overall campaign planning and operations. In total, 5.6 million ITNs were distributed by all partners.

In 2014, the NMCP conducted a "mini-mass campaign" using ITNs that were originally intended for a mop-up campaign following the 2012 mass distribution. Funding delays resulted in the postponement of this mop-up effort and these nets were distributed in the six districts that were among the first to receive ITNs in the 2012 mass campaign, where it had been three years since a mass distribution. PMI funded the registration and verification activities for this effort, in which over 1.2 million ITNs were distributed. This "mini-mass campaign" served as the first phase of a universal distribution campaign, which was completed in 2016.

Between 2010 and 2014, household ownership of at least one ITN increased from 58% to 70% (MIS 2010, MIS 2014). In the 2015-16 DHS, household ownership decreased to 59%; however, this decrease was not surprising given that data collection for the DHS was completed 2 months prior to the mass distribution of approximately 8.7 million ITNs in 19 of Malawi's 29 districts. According to a post-campaign assessment conducted after the distribution, 85% of the sampled households had at least one ITN, 68% of households reported owning more than one ITN, and 56% had adequate intra-household access to ITNs with a ratio of one ITN per two household members (PSI, *2016 Mosquito Net Coverage Report*, forthcoming).

Compared to the 2012 MIS, reported ITN utilization in the 2014 MIS improved among children less than five years of age (from 56% to 67%) and pregnant women (from 51% to 62%). However, in the 2015-16 DHS, utilization decreased to 43% and 44% for children less than five years of age and

pregnant women, respectively, in line with the decreases in reported ownership. In households where at least one ITN was available, 69% of children less than five years of age and 70% of pregnant women slept under an ITN the night before the survey (DHS 2015-16). Although this is a substantial decrease from the 2014 MIS (87% for children less than five years of age and 85% for pregnant women), it must be noted that the 2014 MIS was conducted toward the end of Malawi's rainy season, while the 2015-16 DHS was conducted in the months before the rainy season. Thus, seasonal variation in ITN use may have contributed to this reduction. A similar reduction in ITN use was reported for children under five years of age between the 2010 MIS (82%) and 2010 DHS (59%), which were also conducted during the rainy and dry seasons, respectively.

According to the *ITN Access and Use Report* (VectorWorks, April 21, 2017), Malawi continues to have a very high use to access ratio across all categories (wealth, residence) and regions. A use:access ratio of ≥0.80 is good, with at least 80% of those with access to an ITN using one the previous night. Malawi's use:access ratios have been: 2010 DHS: 0.77; 2012 MIS: 1.10; 2013-14 MICS: 0.95; 2014 MIS: 1.01; and 2015-16 DHS: 0.87. Thus, use of nets, given access, has been consistently strong since 2012. According to the post-campaign assessment, 68% of household heads reported that household members use their ITNs every night. Observations indicated that 78% of the received ITNs were hung up, with 40% of household heads reporting that they hung the ITN the day they received it.

Progress during the last 12-18 months

Continuous Distribution

In the past year, PMI funded the procurement and distribution of approximately 930,000 ITNs to pregnant women and children less than one year of age through the routine distribution system. PMI also provided technical assistance to the NMCP for ITN quantification and distribution planning, monitoring of ITN distribution through spot checks, supportive supervision of ANC, and the implementation of an online data collection system for distribution monitoring of ITNs.

PMI continued to work with the NMCP to strengthen partnerships that exist between the NMCP and stakeholders around ITN procurement and distribution, including support for meetings of the National Malaria Vector Control Sub-Technical Working Group. PMI supported the NMCP to develop ITN distribution guidelines that will help partners, implementers, and health workers involved in routine distribution of ITNs to better quantify, monitor, and report on distribution of ITNs. In 2017, these guidelines were finalized, printed, and distributed to health facilities. PMI continued to fund national mass media and print media campaigns to emphasize nightly ITN use by all household members, as well as proper care of nets. In coordination with the USAID-funded FISH project, messages were also developed emphasizing that mosquito nets should be used as protection from malaria, not for fishing; fishing with mosquito nets is illegal. Posters illustrating these messages were produced and hung in health facilities. In addition, PMI funded community-based organizations and local non-governmental organizations to increase awareness of and promote correct and consistent ITN use and proper care.

Mass Distribution

In addition to the 2014 NMCP/MoH campaign in six districts, the Against Malaria Foundation, through Concern Universal (presently known as United Purpose), managed the distribution of ITNs in four other districts. As of January 2016, Concern Universal distributed approximately 1.8 million ITNs over a period of 18 months.

In 2016, the NMCP/MoH conducted a universal coverage campaign in the 19 districts that had not been covered by NMCP/MoH or Concern Universal, distributing approximately 8.5 million ITNs. Although

distribution was supposed to have been completed by October 2015, there were significant delays, and the campaign did not begin until March 2016 and was not completed until mid-May. In total, 11.5 million ITNs were distributed nationwide between 2014 and 2016 (see Table 5).

Table 5: Malawi ITN Mass Distribution Campaigns (2014 – 2016)

Phase of campaign	Mini campaign (2014)	Concern Universal campaign (2015 - 2016)	Main campaign (2016)
Quantities of nets distributed	1.2 million ITNs	1.8 million ITNs	8.5 million ITNs
Districts covered	Likoma Mchinji Mwanza Neno Nkhotakota Phalombe	Balaka Dedza Dowa Ntcheu	Blantyre Chikwawa Chitipa Chiradzulu Kasungu Karonga Lilongwe Machinga Mangochi Mulanje Mzimba North Mzimba South Nkhata Bay Nsanje Ntchisi Rumphi Salima Thyolo Zomba

Commodity gap analysis

Table 6. ITN Gap Analysis

Calendar Year	2017	2018	2019
Total Targeted Population[1]	17,373,185	17,931,637	18,508,613
Continuous Distribution Needs			
Channel #1: ANC[2]	825,226	851,753	879,159
Channel #2: Labor & delivery[3]	391,155	400,650	410,333
Estimated Total Need for Continuous	1,216,381	1,252,403	1,289,492
Mass Distribution Needs			
2018 mass distribution campaign		11,854,804[4]	
Estimated Total Need for Campaigns	0	11,854,804	0
Total Calculated Need: Continuous and Campaign	**1,216,381**	**13,107,207**	**1,289,492**
Partner Contributions			
ITNs carried over from previous year	*872,863*	*456,482*	*404,079*
ITNs from Government			
ITNs from Global Fund 2018-2020 Funding Request		11,854,804	
ITNs planned with PMI funding	800,000	1,200,000	1,200,000
Total ITNs Available	1,672,863	13,511,286	1,604,079
Total ITN Surplus[5]	456,482	404,079	314,587

1. 2008 National Census used as a baseline; applied annual population growth rate of 3.2%.
2. Number of pregnant women is estimated as 5% of the total population.
3. Assume approximately 3% of total population receives an ITN at labor and delivery (a portion of all pregnant women). Although all newborns should receive an ITN at the time of delivery, historically this has not been the case; projections are based on past coverage.
4. Assumes 1 net for 1.8 people to account for odd number of people in households and a buffer of 19% considering population census used data collected more than 9 years ago. The RBM-recommended 10% buffer was not used based on previous country experience from 2014 and 2016 campaigns. PMI-procured nets are reserved for routine systems; ITNs for the mass campaign will be procured by Global Fund (pending Funding Request approval).
5. This "surplus" is the approximate months of stock needed at the end of each year.

Plans and justification

PMI will continue to support the NMCP's efforts to ensure high coverage of pregnant women and children less than one year of age through the procurement and distribution of ITNs through routine channels, and support for the training and supervision of health workers on ITN distribution. At the time of writing, the future of the Global Fund's commitment in Malawi in 2018 and beyond is unknown; it is anticipated that funding will be forthcoming from the Global Fund to support procurement of ITNs for the next mass distribution campaign, planned for September – November 2018 and intended to cover the entire country. To help ensure smooth implementation, PMI plans to provide technical assistance for the 2018 mass campaign with FY 2017 funds. PMI will also support continued ITN durability monitoring following the March – May 2016 mass campaign (see Table 7 for details on timing of the monitoring activities). SBCC activities will continue to be supported through national-level communication and the community-based small grants program that promotes ITN use among all household members and enhance net demand, use, and care (please see SBCC section).

Table 7: ITN Durability Monitoring in Malawi 2016 – 2019

Year	Period	Activities	Status
Year 0	July 2016	Net tagging	Complete
(baseline)		Net bioassays 0	
Year 1	April 2017	Attrition and physical integrity survey 1	Complete (report forthcoming)
(12 months)		Net bioassays 1	
Year 2	April 2018	Attrition and physical integrity survey 2	Planned
(24 months)		Net bioassays 2	
Year 3	April 2019	Attrition and physical integrity survey 3	Planned
(36 months)		Net bioassays 3	
	September 2019	Dissemination	

Proposed activities with FY 2018 funding: ***($5,070,000)***

- Procurement of 1.2 million ITNs for distribution to pregnant women and children under one year of age through routine channels (ANC and labor & delivery) *($3,720,000*);
- Support management, oversight, and distribution of PMI-procured ITNs to health facilities for routine distribution. Includes customs clearing, warehousing, transport, distribution, and ITN tracking, as well as technical assistance to the NMCP for ITN quantification and distribution planning, monitoring of ITN distribution, and supportive supervision of ANC staff *($1,200,000*);
- Year 3 ITN durability monitoring: Continue to monitor ITN durability following the 2016 mass campaign *($150,000*); and
- Support for national-level SBCC activities to improve demand for ITNs and increase use (see Social and Behavioral Change Communication section).

c. Indoor residual spraying

Progress since PMI was launched

In 2007, PMI piloted IRS with a pyrethroid insecticide in a portion of one high transmission district in Malawi, eventually scaling up to cover two districts. Given the early success of the PMI IRS program, the GoM began supporting IRS in an additional five districts in 2010, for a total of seven high burden districts. However, high levels of pyrethroid and carbamate resistance in *An. funestus* necessitated a shift to organophosphate insecticides in the two PMI districts in 2010. At that time, only a short-acting organophosphate was available. Given the high cost and short duration of residual efficacy, PMI suspended direct support for IRS in Malawi after the 2012 spray season.

Following the cessation of PMI-funded IRS, the GoM continued to implement IRS using pyrethroids, with limited technical assistance from PMI. However, in recent years, GoM funding for IRS has also declined, and GoM spray operations have experienced challenges due to budget reductions and disbursement delays.

The GoM planned for an IRS campaign in October 2014, using the remaining pyrethroid insecticide procured for previous campaigns. Due to delays in Global Fund disbursements, the campaign was not implemented until mid-way through 2015. The NMCP targeted the districts of Mchinji and Karonga. *An. gambiae* is the predominant vector in Karonga and given the pyrethroid resistance profile of *An. funestus* in other areas of the country, spraying with pyrethroids was still expected to be effective in this district. Mchinji was selected based on reports of recent increases in malaria transmission. The estimated household coverage was 85% in Mchinji and 77% in Karonga.

Despite these challenges, the GoM continues to include IRS as one of the main strategies to reduce malaria transmission in high burden districts and considers it an important complement to ITNs within its integrated vector control strategy. Malawi has a history of spraying but needs sustained support in order to maintain their program (see Table 8). Previous PMI-funded IRS efforts improved human resource capacity within the NMCP (one staff member remains dedicated to IRS activities).

According to a 2016 publication, *An. funestus* is highly resistant to pyrethroids and carbamates across the country with resistance increasing sharply from 2011 to 2015. *An. arabiensis* was moderately resistant to pyrethroids. It is likely that the spread of resistance is driven by the use of ITNs throughout Malawi as these are the only widespread source of insecticide selection pressure in Malawi.[8] Furthermore, an analysis of DHIS2 data from 2014 - 2016 has shown that there was a drop in malaria cases reported where ITNs were distributed during the mini-mass campaign, but cases then increased the second year, which could indicate that torn or damaged ITNs are not providing the protection expected due to insecticide resistance. Thus, new insecticides and new tools are essential to ensure that Malawi can sustain the gains made in malaria control and prevention.

Given the high levels of pyrethroid resistance observed in *An. funestus* and the recommendations of the WHO Global Plan for Insecticide Resistance Management, PMI provided support for the development of an evidence-based IVM strategy for Malawi. The Malaria Vector Control Strategy 2015-2019 was completed in July 2014.

The Malawi Malaria Vector Control Strategy outlines goals for IRS, including spraying with non-pyrethroid, non-carbamate insecticides, procurement of WHO Pesticide Evaluation Scheme-recommended insecticides and equipment, and district selection based on epidemiological and

[8] Themba Mzilahowa, Martin Chiumia, Rex B. Mbewe, Veronica T. Uzalili, Madalitso Luka-Banda, Anna Kutengule, Don P. Mathanga, Doreen Ali, John Chiphwanya, John Zoya, Shadreck Mulenga, Wilfred Dodoli, Jennifer Bergeson-Lockwood, Peter Troell, Jessica Oyugi, Kim Lindblade and John E. Gimnig (2016) Increasing insecticide resistance in *Anopheles funestus* and *Anopheles arabiensis* in Malawi, 2011–2015. Malaria Journal 15:563.

entomological data, likely in the high-burden areas primarily along the lakeshore and lower Shire Valley. IRS activities in the strategy include: 1) strengthening policy and planning for IRS through needs assessments, timely forecasting, selection, and procurement of IRS commodities; 2) building capacity at national and district levels to implement IRS through improved training and supervision; 3) implementing SBCC to increase household acceptance of IRS; 4) ensuring compliance with health and safety of personnel and environmental safeguards; 5) monitoring and evaluating IRS implementation; and 6) undertaking regular entomological monitoring and insecticide resistance surveillance to guide selection of insecticides for IRS and spray areas.

In May 2015, the NMCP developed an implementation plan for the Malaria Vector Control Strategy, which details specific plans, timelines, budgets, and geographic scope for IRS and other vector control activities.

Table 8: PMI-supported IRS activities 2006 – 2019

Calendar Year	Number of Districts Sprayed	Insecticide Used	Number of Structures Sprayed	Coverage Rate	Population Protected
2007	1 (Nkhotakota - PMI-supported)	Lambda-cyhalothrin	28,520	93%	130,506
2008	1 (Nkhotakota - PMI-supported)	Lambda-cyhalothrin	42,044	98%	211,019
2009	1 (Nkhotakota - PMI-supported)	Alpha-cypermethrin	74,772	91%	299,744
2010	2 (Nkhotakota & Salima - PMI-supported)	Pirimiphos-methyl (Actellic 50EC)	97,329	73%	364,349
2010	5 (Karonga, Nkhata Bay, Mangochi, Chikhwawa, Nsanje - MoH supported)	Alpha-cypermethrin	430,043	85%	1,967,154
2011	1 (Nkhotakota - PMI-supported)	Pirimiphos-methyl (Actellic 50EC)	77,647	94%	321,919
2012	6 (Chikwawa, Mangochi, Salima, Nkhata Bay, Karonga, Nsanje - MoH supported,)	Alphacypermethrin,	N/A	N/A	N/A
	1 (Nkhotakota - PMI supported)	Pirimiphos-methyl (Actellic 50EC)			
2013	1 (Salima - MoH-supported)	Alphacypermethrin	78,965	77%	302,938
2015*	2 (Karonga, Mchinji – MOH supported)	Alphacypermethrin	N/A	76-85%	N/A
2018**	1	Organophosphate	114,000***	TBD	420,000***
2019**	1	Organophosphate	118,000***	TBD	432,000***

* The 2015 campaign was delayed from 2014. A 2015-16 IRS campaign was cancelled due to a lack of GoM funding.

**Represents planning outlined in the draft implementation plan for the Vector Control Strategy 2015-2019, which calls for spraying with long-lasting organophosphates in up to three districts. Funding for CY 2018 spraying proposed with reprogrammed FY 2017 funding; CY 2019 would be the second year of spraying.
*** Number of structures and population protected estimated based on past history of spraying; district for spraying has yet to be selected at time of writing. The number of structures increases in 2019 due to anticipated population growth.

Progress during the last 12-18 months

In its Malaria Strategic Plan 2017-2022, the Ministry of Health plans to implement quality IRS in selected, suitable epidemiological areas, spraying at the appropriate time of the year and in line with international standards. It has included IRS in the prioritized above allocation request (PAAR) in its Global Fund Malaria Funding Request (2018-2020). As part of its Malaria Vector Control Strategy, the NMCP plans to target IRS in high burden districts/areas and scale up in phases. The government plans to revise its guidelines for IRS implementation in line with current knowledge to address insecticide resistance, conduct environmental compliance inspections, and ensure high community compliance to the spraying campaign through intensified community mobilization efforts.

Given the current availability of a long-lasting organophosphate that could provide protection for the full duration of the rainy season (i.e., December – June), widespread resistance to pyrethroids, and the NMCP's commitment to continue to advocate for resources from traditional and non-traditional donors, PMI plans to support implementation of IRS in Malawi again.

Plans and justification

As part its IVM implementation plan, the GoM has proposed resuming IRS with long-acting organophosphates in one high-burden district in 2018. MOH included a request for IRS in four high burden districts in the Global Fund prioritized above allocation request (PAAR). Despite resource constraints, the GoM remains committed to resume spraying. Therefore, PMI plans to implement IRS in one district, including procurement of long-lasting organophosphate insecticide, implementation of spraying in a timely and effective manner and in compliance with accepted environmental and worker safety standards, and support for microplanning, geographical reconnaissance, training, and other logistical activities. The district will be selected based on the following criteria: high malaria burden, demonstrated area of pyrethroid resistance, and a dense, non-urban population to decrease operational costs per household. Furthermore, the selected district will be one of the ten PMI focus districts, which have support for improving case management and routine M&E systems, in order to better track the impact of IRS. It will also be one of the five where PMI already supports entomological monitoring, to ensure that baseline entomological data is available. Districts with planned or ongoing operational research/malaria intervention pilots will likely not be chosen, to avoid confounding experimental results. PMI plans to support the first round of spraying in calendar year 2018, using reprogrammed funds, and also use reprogrammed funds to procure insecticide and equipment for the second round of spraying in calendar year 2019. PMI/Malawi anticipates partnering with the UNITAID-funded NgenIRS Project to increase the market and accelerate the uptake of long-lasting, non-pyrethroid insecticides for IRS. UNITAID will provide a 35% co-payment on long-lasting non-pyrethroids directly to the manufacturer, effectively lowering the cost of insecticide.

Proposed activities with FY 2018 funding: ($1,050,000)

- IRS operations: PMI will support the planning, implementing, and evaluation of IRS in one district to cover about 118,000 structures and protect approximately 430,000 people. PMI will procure IRS equipment, personal protective equipment (PPE), and long-lasting insecticide (with support from the NGenIRS project). *($1,015,000)* (Note, the remaining $3,000,000 balance of the $4,000,000 budget will come from reprogrammed FY 2017 funds.); and

- Environmental compliance: PMI will support an external environmental compliance inspection field visit to observe and monitor environmental compliance. *($35,000)*

2. Malaria in pregnancy

NMCP/PMI objectives

The MoH has a three-pronged approach to reducing the burden of malaria in pregnancy: use of IPTp during ANC, distribution of ITNs to pregnant women, and effective case management of malarial illness and anemia. PMI supports all aspects of this approach through focused ANC (FANC). The goal of FANC is to provide an integrated package of high impact interventions through four targeted ANC visits. For malaria, IPTp, use of ITNs (for prevention), and effective malaria case management are integrated into FANC. The MoH has updated the national policy on IPTp to reflect the new WHO guidelines. The MoH's objective for IPTp is for at least 80% of pregnant women to receive at least three doses of SP during pregnancy. In addition, behavior change messages are communicated at ANC visits and at the community level to maintain and expand demand for IPTp. ITNs are provided to pregnant women at their first ANC visit and again at delivery.

For uncomplicated malaria, the treatment guidelines recommend that during the first trimester quinine plus clindamycin be administered for seven days. In the second and third trimesters of pregnancy, AL is recommended. Malawi has updated the national policy to recommend the use of parenteral artesunate for at least 24 hours for women in all trimesters of pregnancy. When the patient is able to take oral medication, she is transitioned to an oral antimalarial to complete the treatment; quinine and clindamycin are given in the first trimester and AL is given in the second and third trimesters of pregnancy.

The malaria in pregnancy guidelines recommend the use of iron and folic acid supplementation for the treatment of anemia during pregnancy. Currently, the MoH procures 400 microgram folic acid tablets through the Reproductive Health Directorate's essential drug program.

Progress since PMI was launched

PMI, in conjunction with the NMCP and Reproductive Health Directorate, has worked to increase uptake of IPTp through training and supervision of providers and assistance with directly observed treatment. Nearly all health workers in the country were trained in the updated IPTp guidance as part of case management trainings in 2014-2015. Furthermore, additional trainings were conducted in 2016 targeting IPTp service providers such as Safe Motherhood Coordinators, Maternal and Child Health Coordinators, and District Malaria Coordinators on new guidelines specifically designed for malaria in pregnancy. Through community-based organizations and the small grants program, funds have been made available at the local level to increase demand for ANC and IPTp, encourage women to attend ANC early in their pregnancy in order to receive at least three doses of SP, and promote ITN use among reproductive aged women. PMI has also provided significant support for nationwide SBCC efforts to encourage women to adopt these practices.

Nevertheless, despite two decades of IPTp policy in Malawi, coverage goals have yet to be met, even for two doses of IPTp. There are still systemic barriers to seeking ANC in the first trimester, which, in turn, constrain the number of women who can complete the recommended four ANC visits and three or more IPTp doses prior to delivery. Key barriers to ANC attendance include: difficult geographic access to services, particularly in hard-to-reach areas where women may need to travel long distances; lack of supplies and services at facilities; poor attitudes and treatment by health workers, especially toward early care-seeking; traditions and cultural norms that discourage revealing a pregnancy in the first

trimester; and lack of agency among women who must wait for consent of their husband or husband's relatives before seeking care.

The percent of women making four or more visits to ANC has remained largely unchanged, from 55% in 2000 (DHS 2000) to 51% in 2015 (DHS 2015-16). Coverage of two doses of IPTp-SP is high in Malawi relative to the rest of sub-Saharan Africa, with 63% of pregnant women receiving at least two doses in the 2015 DHS. However, this coverage has not changed substantially over the past five years (60% in the 2010 MIS, 54% in the 2012 MIS, and 63% in 2014 MIS). Since the change in policy, data from the DHIS2 suggests that uptake of IPTp2 has improved slightly, from 55% in 2014 to 67% in 2015, but has dropped slightly to 60% in 2016 as a result of SP stockouts at facility level. Encouragingly, the percentage of women who received three doses of IPTp increased rapidly from 12% in the 2014 MIS to 30% in the 2015-16 DHS.

Increasing SP resistance represents another significant threat to IPTp in Malawi. Recent studies from Tanzania and Malawi suggest that the presence of the sextuple mutation in the *P. falciparum* population can result in the failure of SP when given as IPTp. Currently, the presence of the sextuple mutant in Malawi is less than 10%; however, there is concern that the prevalence of resistance markers will increase over time. In 2012, more than 94% of malaria parasites in pregnant women with asymptomatic parasitemia presenting for their first ANC visit at Machinga District Hospital had quintuple mutations for SP resistance, indicating that resistance is almost fixed in this population.[9] A delivery cross-sectional survey at the same hospital found that two or more doses of IPTp with SP during pregnancy compared to zero or one dose was not associated with any reduction in placental malaria for any gravidity.[10] However, two or more doses of IPTp with SP were found to reduce the prevalence of a composite birth outcome among primigravidae (i.e., any of the following: small for gestational age, prematurity, or low birth weight). The conclusion from this study is that two or more doses of IPTp with SP currently provides some small benefit to neonates but does not show the same effect seen in studies conducted when SP was more efficacious in treating *P. falciparum*. A second cross-sectional study in 2015 similarly found that 18% had evidence of malaria at delivery; malaria was more common among women who received fewer than three doses of IPTp-SP compared to those who received three or more doses. This finding was significant when assessing patent parasitemia, but not significant when infections detected by polymerase chain reaction were included. Furthermore, birth weight was significantly higher among women who had received three or more doses of IPTp-SP (3121gm) compared to those who received less than three doses (3032gm, p=0.03). This suggests that IPTp-SP continues to provide benefit to Malawian pregnant women. Furthermore, the prevalence of the dhpsA581G mutation, which indicates a more highly resistant parasite, was only 2% (2/82) in 2015, as compared to ~8% in 2012. This is an encouraging finding suggesting that the prevalence of this highly mutant parasite is not increasing.

Awareness campaigns and provision of ITNs through ANC clinics and at delivery support the use of ITNs during pregnancy and post-partum. In the 2014 MIS, 62% of pregnant women reported sleeping under an ITN the night before, however, this figure jumps to 85% when considering only pregnant women in households with at least one ITN. Thus, access seems to be a significant factor in the overall utilization.

[9] Desai M, Gutman J, Taylor SM, Wiegand RE, Khairallah C, Kayentao K, et al. (2016) Impact of Sulfadoxine-Pyrimethamine Resistance on Effectiveness of Intermittent Preventive Therapy for Malaria in Pregnancy at Clearing Infections and Preventing Low Birth Weight. Clin Infect Dis 62: 323-333.

[10] Gutman J, Mwandama D, Wiegand R, Ali D, Mathanga DP, Skarbinski J (2013) Effectiveness of intermittent preventive treatment with sulfadoxine-pyrimethamine in pregnancy on maternal and infant birth outcomes in Machinga District, Malawi. J Inf Dis 208: 907-916.

Progress during the last 12-18 months

PMI delayed its planned procurement of SP, as CMST unexpectedly procured a full supply for the country in 2016. However, the unexpected shift in distribution systems, from the donor-supported push system to CMST's pull system, led to facility-level stockouts in 2016 and into 2017. PMI supported distribution of more than 290,000 treatments of SP for IPTp, and trained 691 health care workers in IPTp across 15 districts. In the past year, PMI has worked with the NMCP and Reproductive Health Division to modify the longitudinal ANC registers and data collection sheets to allow reporting of the proportion of women who received three or more doses of IPTp (previously only the proportion who received two doses of IPTp was captured on the summary form). This is in the process of being implemented. This change will allow the DHIS2 to capture information on the proportion of women who receive IPTp3.

PMI continued to support routine distribution of ITNs through ANC and at labor and delivery (please see ITN section). PMI also continued to support appropriate case management of malaria in pregnant women through the procurement of antimalarial drugs, outreach training, supportive supervision in health facilities, and social and behavior change communication for prompt care-seeking through the integrated communication platform.

Although a high proportion of women attend ANC at least once in pregnancy, according to HMIS data, in 2016, only about 22% of women attended ANC in the first trimester, and only 53% attend at least three visits, limiting the number of women who could receive three or more doses of IPTp during pregnancy. The 2015-16 DHS validates the increase in early ANC attendance, showing an increase from 12% in 2010 to 24% in 2015-16. Though the DHS does not break out three ANC visits, 51% of women reported four or more ANC visits in their last pregnancy.

Table 9: Status of IPTp policy in Malawi

Status of training on updated IPTp policy		**Number and proportion of HCW trained on new policy in the last year if training on new policy is not yet completed**	**Are the revised guidelines available at the facility level?**	**ANC register updated to capture 3 doses of IPTp-SP**	**HMIS/ DHIS updated to capture 3 doses of IPTp-SP**
Completed/Not Completed	**Date (If completed, when, if not completed, when expected)**				
Completed	2015	Not applicable	Yes	Yes	In process; forms have been updated but are yet to be rolled out

Commodity gap analysis

Table 10. SP Gap Analysis for Malaria in Pregnancy

Calendar Year	2017	2018	2019
Total Population	17,373,185	17,931,637	18,508,613
SP Needs			
Total number of pregnant women attending ANC	825,226	851,753	879,159
Total SP Need (in treatments)[1]	2,475,679	2,555,258	2,637,477
Desired End Of Year Stock (DEOYS)[2]	1,703,506	1,758,318	1,758,318
Total Need including DEOYS	4,179,184	4,313,577	4,395,796
Partner Contributions			
SP carried over from previous year	*2,469,667*	*1,993,988*	*1,838,730*
SP from Government			
SP from Global Fund			
SP from Other Donors			
SP planned with PMI funding	2,000,000	2,400,000	2,400,000
Total SP Available	4,469,667	4,393,988	4,238,730
Total SP Surplus (Gap)	290,482	80,411	(157,066)

1 Total SP Need is based on 2017 national quantification; 2018 and 2019 are based on RBM tool with increasing IPTp coverage over time.
2 Assumes desired end of year stock at 8 MOS. 2018 and 2019 needs used to calculate DEOYS in 2017 and 2018 respectively.

Plans and justification

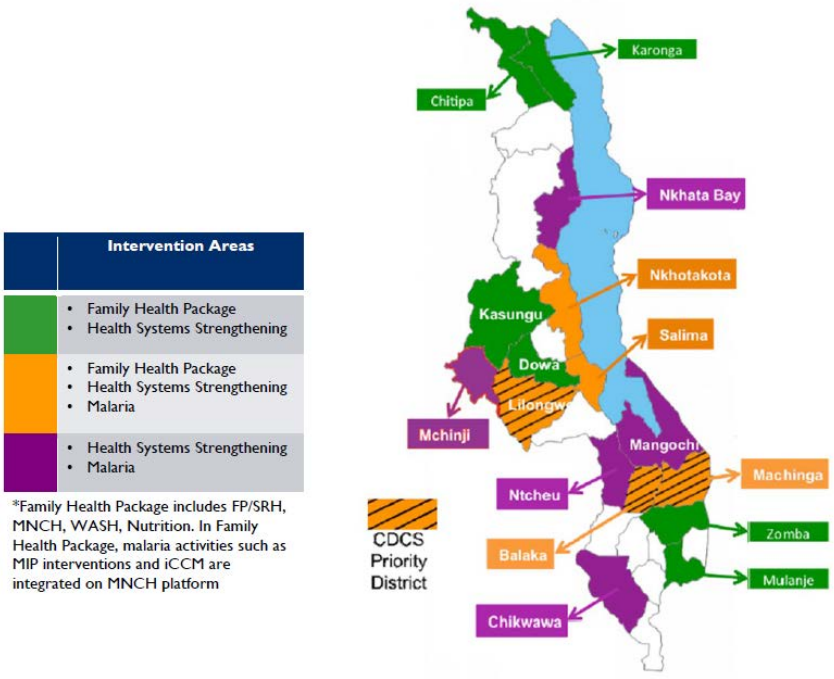
Despite high first attendance at ANC clinics (95%), IPTp goals in Malawi have not yet been met. Although the integration of IPTp into focused ANC services helps assure that SP for IPTp is available in all health centers and administered by trained personnel, IPTp is but one among many services offered at ANC and there may be dilution of impact. PMI will continue to support supervision and mentoring of ANC providers on the revised IPTp guidelines.

With FY 2018 funding, PMI plans to continue integrated and malaria-specific social and behavior change communication activities in support of IPTp, case management, and ITN use at national and community levels (see SBCC section). In addition, PMI will continue to provide free ITNs for routine distribution at ANC visits and at labor and delivery for newborns (see ITN section). Given the difficulties with the CMST pull system and resulting stockouts, PMI will procure SP and supplies to ensure directly observed therapy and improved IPTp uptake at ANC.

PMI will continue funding to support supervision activities for malaria in pregnancy interventions as part of the focused antenatal care package, as well as reinforce the need for three doses of IPTp-SP, and strengthen documentation and data use. Quarterly district review meetings will help to ensure that data

are used appropriately, and poor performing facilities will receive regular follow-up to allow for coaching and mentoring on correct documentation. Efforts to improve IPTp uptake will be targeted to 16 districts, as indicated on the map below (support to improve IPTp uptake will occur as part of both the malaria and family health packages).

Figure 3. Map of USAID-Supported Geographic Coverage



In addition, PMI is funding a study comparing the effectiveness of IPTp with DP compared to IPTp-SP to help determine whether this is an alternative strategy as resistance increases, as well as a pilot of community delivery of IPTp-SP (see OR section for further details).

Proposed activities with FY 2018 funding: ***($658,000)***

- Continue to support routine distribution of ITNs through ANC and maternity clinics (funding in ITN section);
- Procurement of SP for IPTp (2.4 million treatments) *($288,000);*
- Procurement of ANC supplies (cups and water buckets) to help improve IPTp uptake through directly observed treatment *($50,000);*
- Continued support for strengthening focused antenatal care in 10 PMI focus districts through production of standard operating procedures, training, supervision visits, mentoring health providers, and improving documentation *($300,000);*
- CDC TDYs to provide technical assistance for MIP research *($20,000);*
- Continue to support SBCC for malaria in pregnancy interventions: early case management, IPTp, and ITNs (funding in SBCC section); and
- Continue to support central level routine HMIS to collect routine data on MIP (funding in SM&E section).

3. Case management

b. Diagnosis and treatment

NMCP/PMI objectives

Increasing capacity to ensure prompt and effective case management and reduce the presumptive use of antimalarial medications is a key priority in Malawi's 2017-2022 Malaria Strategic Plan. To achieve this increased capacity, the MOH is focusing its efforts in the following areas:

1) Ensuring consistent availability of high-quality diagnostic and treatment commodities through proper quantification, procurement, and distribution
2) Strengthening quality assurance for malaria diagnostics
3) Training and supervising health workers on malaria case management at all levels of the health system
4) Supporting and expanding community case management in hard-to-reach areas (i.e., community level)

In the current *Guidelines for the Treatment of Malaria in Malawi,* revised in 2013 with assistance from PMI, the MOH recommends testing all suspected malaria cases using an RDT prior to initiating treatment. Microscopy is recommended for the following purposes: 1) to confirm malaria diagnosis in hospitalized patients with suspected severe malaria; 2) to monitor treatment progress in severe malaria cases receiving parenteral treatment; and 3) to confirm first-line treatment failures. The *Guidelines for the Treatment of Malaria in Malawi* recommends AL as the first-line treatment and artesunate-amodiaquine (ASAQ) as the second-line treatment. Oral quinine plus clindamycin is recommended for the treatment of uncomplicated malaria in pregnant women in the first trimester. For the management of patients with severe malaria, parenteral artesunate is recommended as the definitive treatment and as pre-referral treatment in health centers while rectal artesunate is a recommended pre-referral treatment for suspected severe malaria cases in under five children at community level. The NMCP plans to revise the current treatment guidelines to include changes consistent with the WHO *Guidelines for the Treatment of Malaria, Third Edition (2015).* These changes include: treating infants weighing less than 5 kilograms with uncomplicated *P. falciparum* malaria with an ACT at the same mg/kg body weight target dose as for children weighing 5 kilograms, and treating children weighing less than 20 kilograms with suspected severe malaria with a higher dose of injectable artesunate (3 mg/kg) than larger children and adults (2.4 mg/kg). Currently, health workers are being trained and supervised in line with the revised 2015 WHO guidelines. However, these revised guidelines still need to be incorporated as an addendum to the *2013 Guidelines for the Treatment of Malaria in Malawi*.

Table 11. Status of Case Management Policy in Malawi

Status of Case Management Policy in Malawi according to *Guidelines for the Treatment of Malaria in Malawi* (2013)	
What is the first-line treatment for uncomplicated *P. falciparum* malaria?	Artemether-lumefantrine
What is the second-line treatment for uncomplicated *P.falciparum* malaria?	Artesunate-amodiaquine
What is the first-line treatment for severe malaria?	Parenteral artesunate
In pregnancy, what is the first-line treatment for uncomplicated *P. falciparum* malaria in the first trimester?	Quinine plus Clindamycin
In pregnancy, what is the first-line treatment for uncomplicated *P. falciparum* malaria in the second and third trimesters?	Artemether-lumefantrine
In pregnancy, what is the first-line treatment for severe malaria?	Parenteral quinine in first trimester and parenteral artesunate in second and third trimester
Is pre-referral treatment of severe disease recommended at peripheral health facilities? If so, with what drug(s)?	Yes, parenteral artesunate
Is pre-referral treatment of severe disease recommended for community health workers? If so, with what drug(s)?	Yes, rectal artesunate
If pre-referral rectal artesunate is recommended, for what age group? (note: current international guidelines do not recommend administrating to those ≥ 6 years)	Under-five children

Progress since PMI was launched

Since Malawi became a PMI focus country in 2006, PMI has supported the procurement of malaria commodities including RDTs and malaria medicines. Through September 2016, PMI procured 27.9 million RDTs and 45.1 million ACT treatments.

In 2007, Malawi changed the first-line medication for uncomplicated malaria from SP to AL, with ASAQ as the second-line treatment. PMI has supported the training and supervision of health workers on the appropriate management of malaria and the promotion of appropriate care seeking and treatment adherence behaviors through national-level mass media and community mobilization channels.

Malawi has monitored the efficacy of its first (AL) and second-line (ASAQ) antimalarial drugs through in vivo drug efficacy studies. The first therapeutic efficacy study (TES) was conducted in six sites (PMI and GoM contributed funds); data were collected in 2011. PCR-corrected cure rates at day 28 were greater than 90% for both drugs.[11] In 2014, PMI supported additional therapeutic efficacy monitoring for AL and ASAQ in three sites, one in each region of Malawi. This study demonstrated excellent efficacy of both AL and ASAQ, with PCR-corrected survival rates at day 28 of 99.3% (95% CI: 98.3–100 %) for AL, with 98-100% efficacy in each region, and 99% (95 % CI: 97.2–100%) for ASAQ,

[11] Dambe R, Sande J, Ali D, et al. Monitoring the efficacy of artemether-lumefantrine for the treatment of uncomplicated malaria in Malawian children. *Malaria Journal.* 2015;14:175.

supporting the continued use of these drugs as first and second line therapies.[12] No policy change was recommended based on these data. With support from Global Fund, NMCP conducted another TES in 2016; data is not yet available.

Before 2010, Malawi's national malaria policy recommended diagnostic testing prior to treatment only for individuals over five years of age. Guidelines recommended presumptive treatment for children less than five years of age, due in part to the high prevalence of malaria and limited diagnostic capacity in-country. In 2010, the GoM updated its policy to include the use of RDTs for malaria diagnosis for all suspected cases. To help ensure an effective transition from largely presumptive treatment to universal diagnostic testing, the MOH adopted a phased approach for the roll-out of malaria RDTs. Phase one, which began in July 2011, focused on the distribution and use of malaria RDTs at health facilities. PMI supported this phase of the roll-out, including technical assistance for guideline development, commodity procurement and distribution, and healthcare worker training. Following a successful feasibility study of the use of RDTs by HSAs, RDTs finally were rolled out to the community level in 2015. Training of all HSAs who provide community case management of malaria was completed in July 2016 with support from the Global Fund.

To strengthen diagnostic capacity, in 2010, PMI supported the introduction of a quality assurance program designed to improve Malawi's clinical and laboratory diagnostic services. This program focused on the provision of outreach training and supportive supervision (OTSS) to laboratory and clinical supervisors. The OTSS intervention provides on-site training and long-term, ongoing support to strengthen diagnostic and treatment services in health facilities. During scheduled visits, supervisors identify areas for improvement and provide immediate feedback to laboratory and clinical staff. Currently, OTSS occurs at all health facilities in Malawi. In general, facilities receive four quarterly visits at enrollment and then two per year after minimum compliance standards are met.

Progress during the last 12-18 months

PMI has worked closely with the NMCP and the Global Fund to coordinate procurement and delivery schedules to ensure that appropriate central stock levels of antimalarials and RDTs were maintained. In the past year, PMI procured approximately 4.1 million RDTs and 3.3 million ACTs. Following the completion of training of over 8,760 facility-based healthcare workers in July 2015, PMI supported the training of about 1,085 recent graduates, and 89 lecturers, tutors, and clinical instructors from institutions of higher learning to facilitate updates of case management curricula at training institutions to align with the updated guidance. PMI also supported the presentation of revised malaria content for pre-service institutions to regulatory bodies to align certification requirements with the updated guidance. The rollout of parenteral and rectal artesunate has been completed nationwide; training of HSAs on rectal artesunate was completed in July 2016.

PMI continued to support the strengthening of diagnostic services through the OTSS program. PMI supported the fourteenth, fifteenth and sixteenth rounds of OTSS, including visits to 411 health facilities in 29 districts, the supervision and training of nearly 1,200 health workers, the training of 20 laboratory supervisors in advanced malaria diagnostic training. These endeavors, in combination with previous efforts, have continued to focus on negative test adherence, RDT use (preparation and interpretation) in health facilities, and microscopy (preparation, staining, and reading). A new severe malaria component

[12] Paczkowski M, Mwandama D, Marthey D, Luka M, Makuta G, Sande J, Ali D, Troell P, Mathanga DP, Gutman J. In vivo efficacy of artemether-lumefantrine and artesunate-amodiaquine for uncomplicated Plasmodium falciparum malaria in Malawi, 2014. *Malaria Journal* 2016; 15:236.

was incorporated into the OTSS supervision tool to support the recent introduction of parenteral artesunate and improve diagnosis and management of severe disease. Thus far, PMI has supported 3 rounds of clinical mentorship reaching about 141 health workers in 47 low performing health facilities to improve management of severe malaria. Finally, to improve the efficiency of supervision and OTSS data collection and analysis, a tablet-based electronic data system was launched. PMI supported the training of over 85 health workers on access, analysis and use of OTSS data through the use of electronic data system to emphasize evidence-based implementation of intervention at district level.

Currently, approximately 30% of health facilities have the capacity to provide malaria microscopy by trained and qualified laboratory staff. Expansion of microscopy services to additional facilities is limited by the lack of trained health workers, inconsistent electrical supply, and inadequate laboratory equipment and supplies. Even within facilities with trained and qualified staff, power supply interruptions and supply stockouts limit the feasibility of extensive use of microscopy.

The rollout of RDTs to all health facilities has expanded diagnostic capacity, particularly for facilities lacking the capacity to perform malaria microscopy. Overall, this has reduced the reliance on presumptive diagnosis and moved Malawi closer to universal diagnostic coverage. In order to further enhance microscopy capabilities, a national archive of malaria slides (NAMS) was created within the National Public Health Reference Laboratory for external quality assurance schemes (EQAS) such as proficiency testing, refresher training, pre-service training, or identification of highly skilled individuals for research studies. PMI supported initial efforts focusing on procurement of equipment for training and later efforts focusing on donor collection and validation as well as bench-marking visits of laboratory technicians to well established NAMS in Ghana. PMI also supported four qualified laboratory technicians to achieve WHO level 1 or 2 accreditation to assist with quality assurance for microscopy and certifies them as international trainers for microscopy. Challenges to reaching the goal of universal diagnostic coverage over the past year included inadequate diagnostic technical capacity (including human resources), shortages of diagnostic supplies at health facilities, and the significant delays in completing the training of HSAs in the use of RDTs.

Malawi implements integrated community case management (iCCM), with national guidance emphasizing implementation in areas more than five kilometers from a healthcare facility. Approximately 3,190 village health clinics exist nationwide and PMI currently provides support to nearly all of the 1,940 village health clinics located in the 16 districts targeted by PMI's integrated service delivery partner. Activities include equipping village health clinics, providing training, printing registers, and providing supervision/monitoring of HSAs. HSAs, who are paid health workers, have been trained on a full package of iCCM including the administration of ACTs and are permitted to treat malaria among children under five years of age at the community. After initial delays, training of HSAs on the use of RDTs and pre-referral use of rectal artesunate commenced in selected districts in 2015, with support from the RACE project. Additional trainings in the remaining districts were completed in July 2016 with support from Global Fund. Currently, PMI is supporting follow up supervision and quality improvement for iCCM in four districts in order to document lessons learned before quality improvements interventions are rolled out nationally. In addition, PMI supported community mobilization activities in 16 targeted districts to increase malaria prevention and care-seeking behaviors by community members.

The NMCP plans to conduct additional therapeutic efficacy monitoring for AL and ASAQ in 2018 with Global Fund support. The PMI in-country team will provide direct technical support for this activity and discussions will be undertaken with NMCP and the TES Principle Investigator regarding the inclusion of artemisinin resistance testing.

For most of calendar year 2016, Malawi experienced shortages of ACTs and RDTs, due to delayed implementation of the 2015 ITN mass distribution campaign as well as historically high consumption of ACTs from theft. Following significant action from the GoM to address theft and improvements in the alignment of ACTs used with the malaria cases reported, donors responded in the fourth quarter of calendar year 2016 with emergency ACTs and RDTs to alleviate the shortages and fill the pipeline going into calendar year 2017. (See pharmaceutical management section.)

Table 12. Therapeutic Efficacy Studies

Completed TESs			
Year	**Site name**	**Treatment arm(s)**	**Donor**
2010	Karonga, Rumphi, Nkhotakota, Kawale, Mangochi, Machinga	Artemether-Lumafantrine	Global Fund, PMI (Machinga only)
2012	Machinga, Nkhotakota, Karonga	Artemether-Lumafantrine, Artesunate-Amodiaquine, Dihydroartemisinin-piperaquine	UNICEF, Global Fund
2014	Machinga, Nkhotakota, Karonga	Artemether-Lumafantrine, Artesunate-Amodiaquine	PMI
Ongoing TESs			
Year	**Site name**	**Treatment arm(s)**	
2016	Karonga, Rumphi, Nkhotakota, Mangochi	Artemether-Lumafantrine, Artesunate-Amodiaquine	Global Fund
Planned TESs FY 2018			
Year	**Site name**	**Treatment arm(s)**	
2018	TBD	Artemether-Lumafantrine, Artesunate-Amodiaquine, Dihydroartemisinin-piperaquine, Injectable artesunate (proposed)	Global Fund (proposed)

Commodity gap analysis

Table 13: RDT Gap Analysis

Calendar Year	2017	2018	2019
RDT Needs			
Total country population	17,373,185	17,931,637	18,508,613
Population at risk for malaria	17,373,186	17,931,638	18,508,614
PMI-targeted at-risk population	17,373,187	17,931,639	18,508,615
Total number of projected fever cases	12,527,667	11,469,775	11,813,868
Percent of fever cases tested with an RDT	87.9%	99.1%	99.3%
Total RDT Needs[1]	11,016,763	11,369,299	11,733,117
Desired End Of Year Stock (DEOYS)[2]	8,561,082	8,835,037	8,835,037
Total Needs including DEOYS	**19,577,845**	**20,204,336**	**20,568,154**
Partner Contributions			
RDTs carried over from previous year	*3,193,550*	*5,975,455*	*8,881,056*
RDTs from Government	4,105,404		
RDTs from Global Fund[3]	4,105,404	7,274,900	6,896,286
RDTs from African Development Bank	1,487,860		
RDTs planned with PMI funding[4]	4,100,000	7,000,000	4,000,000
Total RDTs Available	16,992,218	20,250,355	19,777,342
Total RDT Surplus (Gap)	(2,585,627)	46,019	(790,812)

[1] RDT needs are from the 2017 National Quantification, which used historical service delivery statistics, not projected fever cases to estimate future need for RDTs.
[2] In line with national policy, desired end of year stock is 8 months. Seasonality Index has been used to estimate consumption for the first 8 months.
[3] Contributions for Global Fund for 2018 and 2019 are in the recently submitted Funding Request, which is not yet approved.
[4] RDTs planned for 2018 includes 4 million approved in FY 2017 MOP plus an expected additional 3 million RDTs procured with other year's funding.

Table 14: ACT Gap Analysis

Calendar Year	2017	2018	2019
ACT Needs			
Total country population	17,373,187	17,931,639	18,508,615
Population at risk for malaria	17,373,187	17,931,639	18,508,615
PMI-targeted at-risk population	17,373,187	17,931,639	18,508,615
Total projected number of malaria cases	7,858,431	8,109,900	7,439,482
Total ACT Needs[1]	7,858,431	8,109,900	7,439,482
Desired End Of Year Stock (DEOYS)[2]	6,106,755	5,601,930	5,601,930
Total Needs including DEOYS	**13,965,186**	**13,711,830**	**13,041,412**
Partner Contributions			
ACTs carried over from previous year	*6,571,440*	*9,553,603*	*9,611,961*
ACTs from Government	3,864,044		
ACTs from Global Fund[3]	3,675,080	5,168,258	4,478,494
ACTs from Other Donors			
ACTs planned with PMI funding	3,301,470	3,000,000	650,000
Total ACTs Available	17,412,034	17,721,861	14,740,455
Total ACT Surplus (Gap)	3,446,848	4,010,031	1,699,043

[1]Total ACT needs are from the 2017 National Quantification, which used the Roll Back Malaria quantification tool to estimate ACT needs. These estimates of need are expected to slightly increase in the mid-year review, based on updated data.
[2] In line with national policy, desired end of year stock is 8 months. Seasonality Index has been used to estimate consumption for the first 8 months.
[3] Contributions for Global Fund for 2018 and 2019 are in the recently submitted Funding Request, which is not yet approved.

Plans and justification

PMI remains committed to supporting MoH efforts to provide prompt, appropriate, and effective malaria treatment. With FY 2018 funding, PMI will continue to focus on improving community and facility-based case management services in ten priority districts, those with the highest malaria burden in the country. Case management commodities, specifically RDTs and ACTs, will still be supplied nationwide and supply chain technical assistance will be provided to all districts through zonal supply chain staff. Parenteral and rectal artesunate for severe malaria treatment will not be procured with PMI funds because other donor support for these commodities (e.g., Global Fund, Medicines for Malaria Venture) is expected.

In order to expand diagnostic and treatment capabilities for children under five in the community, PMI will continue to support supervision of HSAs in the use of RDTs and pre-referral use of rectal artesunate. Although nearly all facility-based healthcare workers have received initial training in case management, PMI will continue to support outreach training and supportive supervision (OTSS), which

strengthens diagnostic capacity using RDT and microscopy as well as health workers' adherence to test results. PMI will continue to support and expand a core group of microscopy trainers to improve the quality of microscopy services. NAMS will continue to be maintained and utilized.

The NMCP prefers to conduct biannual therapeutic efficacy monitoring for the first and second-line therapeutic agents and plans to implement additional testing in 2018 and 2020. Based on the current overall needs and priorities, NMCP has sought support from other donors to cover this activity.

PMI funding will also target SBCC interventions focused on appropriate care seeking behavior and medication adherence for both uncomplicated and severe malaria at the community level (see SBCC section).

Proposed activities with FY 2018 funding: ***($4,549,000)***

- Procure 4 million RDTs (distribution costs covered in Pharmaceutical Management section) *($1,800,000*);
- Procure 650,000 AL treatment courses (distribution costs covered in Pharmaceutical Management section) *($656,500*);
- Procure ancillary diagnostic supplies (gloves and sharps containers) for RDT implementation *($150,000*); and
- Case management services support in ten focus districts, concentrating on RDT use and adherence to results, quality improvement for diagnostics, appropriate use of severe malaria treatments, and supervision and mentorship in facility and community settings, with approximately 80% effort to facility settings and 20% effort to the community level *($1,942,500*).

c. Pharmaceutical management

NMCP/PMI objectives

The 2017-2022 Malaria Strategic Plan calls for a reliable, secure, and accountable pharmaceutical and supply chain management system to ensure the consistent availability of essential commodities and supplies for malaria control and prevention activities. To achieve this objective, the NMCP plans to strengthen the logistics management information systems in collaboration with Health Technical Support Services (HTSS), conduct regular supportive supervision to ensure facilities adhere to supply chain standard operating procedures, conduct annual forecasting and quantification and quarterly pipeline reviews, develop annual procurement plans in collaboration with partners, validate reports from facilities to improve transparency and accountability, and support national and international efforts to strengthen the procurement and supply chain system.

Progress since PMI was launched

Supply chain issues have been a key concern in Malawi. Due to issues of leakage and general mismanagement, a PMI-Global Fund parallel supply chain was created in late 2010 to distribute all U.S. Government and Global Fund-supported malaria commodities. In August 2012, representatives from the GoM, CMST, and several partners, including WHO, the Global Fund, DFID, USAID and PMI, conducted a review of the supply chain management system and developed a *Joint Strategy for Supply Chain Integration in Malawi*. This roadmap to reintegration of the parallel supply chains into CMST included four distinct phases: CMST recapitalization and reform, management of essential drugs supply chain, warehousing and distribution, and procurement functions. Thirty-six specific performance benchmarks were to be measured through ad hoc external assessments and a mid-term review of CMST's capabilities as pre-conditions for reintegration. An independent evaluation of CMST's progress

toward the agreed-upon benchmarks was conducted in early 2016. The assessment found overall performance toward benchmarks to be limited, with only 39% of benchmarks achieved in the four years since the road map was developed. Given this slow progress, it is not clear when PMI will be able to transition the warehousing and distribution of malaria commodities to CMST.

After utilizing the PMI supply chain implementing partner for several years, the Global Fund began a new warehousing and distribution contract for Global Fund-procured malaria commodities late in 2014. While this resulted in a consolidated parallel supply chain for all Global Fund-procured commodities (i.e., HIV and malaria), there are now multiple parallel supply chains for malaria. These multiple supply chains for malaria drugs have exacerbated supply management problems due to difficulties coordinating between distribution agents and varying distribution calendars and timing. There is potential for reconsolidation of the PMI and Global Fund supply chains in the next Global Fund grant, expected to begin January 2018. This would help to alleviate coordination challenges and facilitate uninterrupted supply of medicines to facilities.

In addition to support for CMST reform, the U.S. Government has supported efforts to improve the overall supply chain through continued support to the MoH to strengthen planning and coordination centrally and improve commodity management and reporting at the district and facility levels. Support to the central level has included technical assistance to implement annual national quantification and forecasting of all essential medicines, conduct supply planning and commodity monitoring, maintain Supply Chain Manager and the National Stock Status Database, and provide financial support to employ two technical assistants seconded to HTSS, which has supervisory authority over the CMST and has responsibility for the overall supply system to public health facilities in Malawi. Support to the district, health center, and community levels have included quarterly supervision, mentoring, and EUV surveys; expanded access to and use of logistics management information system (LMIS); and improved access to malaria commodities through iCCM.

After dedicated efforts by PMI and MoH to improve LMIS reporting, rates have remained consistently high, at over 80%. Two data quality assessments (DQA) of LMIS data in 2014 and 2015 found high quality, though with some room to improve correct and consistent reporting of commodity data.

As LMIS and HMIS reporting improved, Malawi identified a major gap between the malaria commodities issued from a facility and the malaria cases treated. The GoM and stakeholders developed an action plan to improve commodity oversight and management – including improved supervision at the district, facility, and community levels; better use and review of data for decision making; and audits of facilities with discrepancies between consumption and reported cases. PMI has provided extensive support for the development and implementation of the action plan. PMI initiated malaria data reviews in each zone, with participation of the district health management team (DHMT) from each district, followed by data reviews in each district, with participation from each facility. DHMT and facility staff were trained in the correct recording of data, oriented on use of data, and created action plans to improve data and accountability for commodities. These data reviews are repeated semiannually in each zone and quarterly in each district. Additional supervision activities have been scaled up with support from PMI and Global Fund. The MoH created a Drug Theft Investigation Unit (DTIU), which audits facilities and initiates administrative actions and criminal proceedings against those suspected of fraud.

Progress during the last 12-18 months

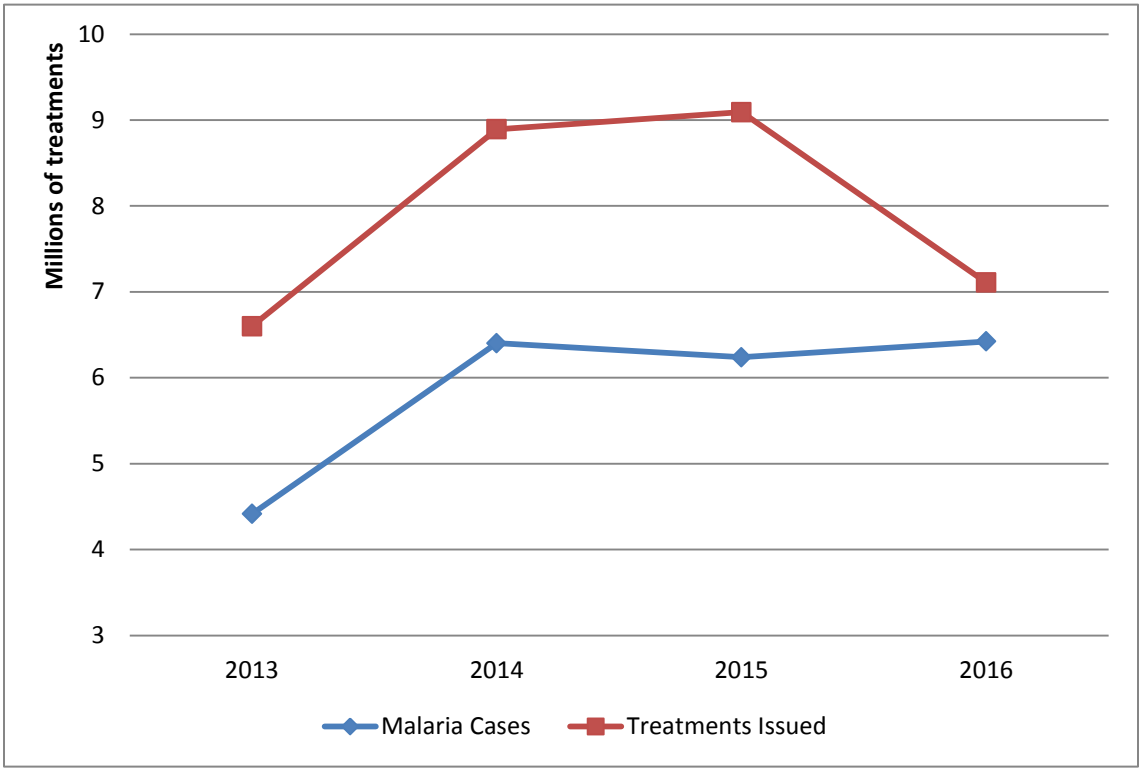
The NMCP and PMI continued to focus on improving accountability for malaria commodities at the facility level, minimizing stockouts of malaria commodities at service delivery points, and strengthening

supply planning and commodity management through planning, training, and supportive supervision. PMI-supported activities in the past year included monthly commodity distributions, integrated supportive supervision and peer mentoring, LMIS reporting, and capacity building at the central, district, and facility levels. PMI continued to support quarterly data reviews in each focus district, emphasizing the need for high quality data and accountability for medicines.

PMI continues to use a parallel supply chain that distributes USAID-procured health commodities, and has sought opportunities to improve coordination between the multiple other supply chains for malaria commodities. PMI, through the USAID Mission, has continued to advocate strongly for rapid and effective strengthening of the national supply chain system. Global Fund, PMI and USAID, and DFID are exploring strategies to improve CMST's long-term capacity for supply management.

After several years of large gaps between the malaria treatments issued and the malaria cases seen in facilities and communities, 2016 saw improvement, with unaccounted-for treatments dropping from over 30% to less than 10% (see Figure 4). As this improvement coincided with a period of short supplies, the priority going forward is to maintain this alignment.

Figure 4: ACT treatments issued compared with malaria cases reported (2013-2016)



Over the past year, the DTIU has continued auditing facilities and pursuing legal actions: at least 40 people have been convicted and many more cases are pending in the court system. The DTIU has ensured that health facility staff who are found guilty are removed from their positions. PMI and DFID have provided extensive technical support to the DTIU.

The current LMIS has proven to be a barrier to efficient and timely comparison of commodity and case data in part because it requires manual comparison of data. It is not easily configured, especially at

central level, to provide customized reports to allow for data analysis and does not offer possibility of inter-operability with other systems such as DHIS2. With support from PMI and USAID, the MoH has selected a new web-based system, OpenLMIS. Progress toward the launch of the system has been steady and it is expected to go live mid-2017 (see Health system strengthening and capacity building section). A third DQA of the LMIS was undertaken in 2017; results are forthcoming.

Plans and justification

PMI remains committed to supporting the operation of the PMI-USAID parallel supply chain. In support of this, PMI will strengthen MoH commodity management and planning at all levels of the system. At the zonal, district, facility, and community levels, PMI will continue to focus on improving provider behavior, accountability for medicines, and improved data management and use (see HSS and SBCC sections). PMI will continue to support a supply chain risk management advisor to the DTIU.

Proposed activities with FY 2018 funding: ***($2,800,000)***

- Provide technical assistance to GoM improve management, oversight, and accountability for supply chain management and the central, district, and facility level; continued support for the LMIS *($1,600,000*); and
- Provide support for receipt, warehousing, management and oversight, and physical distribution of PMI-procured case management commodities through the PMI supply chain management system directly to the health facility level *($1,200,000*).

4. Health system strengthening and capacity building

PMI supports a broad array of health system strengthening activities that cut across intervention areas, such as training of health workers, supply chain management and health information systems strengthening, drug quality monitoring, and NCMP capacity building.

NMCP/PMI objectives

The 2017-2022 MSP calls for strengthening capacity in program management at all levels of health service delivery by providing policy direction and leadership, building human resource capacity, mobilizing and utilizing resources more effectively, improving coordination and information sharing, and strengthening procurement and supply chain management. The NMCP plans to achieve these goals through strong leadership; creation of a supportive environment; improved infrastructure, equipment and supplies; and effective collaboration with partners. The MSP includes quarterly OTSS, in addition to the establishment of a core group of mentors and supervisors who will work with health workers to improve their knowledge and skills in malaria case management.

Progress since PMI was launched

The U.S. Government has taken an integrated approach to contribute to efficient systems strengthening across the Malawian health sector. To that end, the U.S. Government has helped to train and retain health care workers; incentivized health workers to deliver higher quality services; built the capacity of the MoH to effectively utilize the LMIS and improve coordination of donor drug procurement; expanded health information systems and linked these systems across health programs; and provided broad-based support to the national laboratory system. The U.S. Government also has supported the development of leadership and management systems at the MoH and district levels, including systems for human resources; surveillance, monitoring and evaluation; and financial management.

USAID has leveraged and created synergies with many other partners, including the private sector. The U.S. Government agencies have served as chairs on the Education, Agriculture, and Nutrition Donor

Groups in addition to the Health Donor Group. USAID and PMI staff serve on several committees and task forces on critical health systems issues.

The Malawi 2017-2022 HSSP2 builds upon the gains made under the 2004-2010 Program of Work and the 2011-2016 HSSP, and places an emphasis on primary health care including a basic health package, namely, the most critical interventions that must be in place to reduce morbidity and mortality. The considerable improvements in the delivery of an essential health package are demonstrated by reduced infant and child mortality rates, malaria case fatality, pneumonia case fatality, and maternal mortality, and in maintaining high immunization coverage, among other areas. However, while overall curative services are improving, services are not yet spread equitably across the country and health promotion and prevention activities lag behind. Utilization of ANC and postnatal care is not increasing as planned, and quality and availability of essential obstetric care is limited by shortages of skilled human resources, equipment, and transport. In the absence of donor funding, the resources for general health services are minimal and the technical capacities of personnel are limited. Health centers and hospitals continue to struggle with shortages of medicines and supplies.

In the area of surveillance, monitoring, and evaluation, while systems have been developed, data quality and analysis, especially at the district and lower levels, remain weak, prompting some disease control programs to implement parallel surveillance systems. In principle, the available systems are capable of producing reliable and timely data, but the limited capacity at the facility and district level hinder successful implementation. NMCP has been able to improve reporting and quality of malaria morbidity and mortality indicators such as malaria cases, confirmed cases, and malaria deaths in the HMIS through dedicated personnel and effort. The Central Monitoring and Evaluation Department (CMED) alone does not yet have the capacity to perform thorough analysis of progress in the health sector, though this has improved over recent years.

Progress during the last 12-18 months

Through its implementing partners, PMI provides technical support to the MoH to help improve policies, management and leadership, and fiscal responsibility. PMI promotes evidence-based policies, strengthens the management and technical capacity of the NMCP and other MoH divisions, supports development and strengthening of electronic data systems, strengthens the zonal supervision structures, bolsters decentralized management of health services at the district level, and strengthens the government's capacity for financial planning and management and budget execution.

PMI builds human resource capacity through the training of health facility workers on malaria case management and prevention of malaria in pregnancy, laboratory technicians on diagnosis of malaria, and pharmacists and other relevant health workers on pharmaceutical management. In addition, PMI strengthens supply chain management systems by providing technical assistance to HTSS in the MoH as well as to the zonal, district, and facility levels (see Case Management section). Through its support to zonal data reviews, PMI helps build capacity of district staff on DHIS2 and to use data for decision-making. District data reviews build capacity of facility level staff to collect and understand malaria case and commodity data. In order to strengthen community-based services, PMI supports supervisory visits to assess and improve the quality of services provided by HSAs and community scorecard activities to improve the communication between community members and health facility staff. Furthermore, PMI works with other U.S. Government health programs to improve health information systems through technical assistance and capacity building (see SM&E, Case Management sections).

Key PMI-supported activities during the past year include:

- *Human resources development*: PMI continued to support the two-year pre-service training program for pharmacy assistants. Facilities with pharmacy assistants have been shown to perform better, with higher quality and more timely data.
- *Supportive supervision*: Provision of integrated supportive supervision in 15 districts, reaching 98% of targeted health facilities and OTSS in all 29 districts, reaching 100% of facilities with microscopy and other high volume sites.
- *Electronic data systems*: PMI provided ongoing support to the DHIS2 platform, which captures health data including malaria morbidity and mortality data. In addition, an electronic data tool (using tablets and mobile phones) for integrated supportive supervision was finalized and is being used in 15 targeted districts as well as by zonal and national management teams. The GoM plans to scale up this tool to all districts. Additionally, the new web-based logistics management information system, OpenLMIS, moved toward a launch anticipated in mid-2017: system requirements were finalized, and a Requirements Verification Workshop and User Acceptance Testing were held.
- *Data collection and reporting:* Printing and distribution of malaria reporting books, Lab/RDT registers, and ACT registers.

PMI supports a Peace Corps Response Malaria Coordinator, who works with the NMCP and helps to engage Malawi Peace Corps volunteers to make measureable and meaningful efforts in malaria prevention efforts. In FY 2017, PMI also began supporting a Peace Corps Response volunteer who works with NMCP and PMI partners to support and build capacity on operational research and surveillance, monitoring, and evaluation. PMI also provides support to Peace Corps volunteers through Small Project Assistance grants. Key activities in the past year included: conducting malaria health education sessions at health facilities, supporting partners in operational research and LLIN durability monitoring, conducting Grassroots Soccer Malaria Skillz soccer tournaments with youth in communities, creating SBCC public service announcements for radio, conducting ITN care sessions with communities, and conducting awareness building activities during World Malaria Day such as mural painting, dramas, and songs.

Plans and justification

Working closely with other U.S. Government programs in Malawi, PMI will support the implementation of the HSSP2. As PMI continues to address malaria-specific challenges, nationwide progress still requires ongoing investment to strengthen the overall health system with in-country partners. Starting in FY 2017, PMI Malawi began focusing and concentrating its service delivery strengthening efforts in ten high malaria burden districts, building government capacity at the district level for facility-based case management; FANC and delivery of IPTp; community mobilization and iCCM; and surveillance, monitoring, and evaluation. These capacity building efforts will include expanded supportive supervision and mentoring to relevant cadres (e.g., facility and community health care workers, pharmacy technicians and assistants, etc.). Simultaneously, at the central level, PMI will strengthen pharmaceutical supply chain management (see Case Management section) and reinforce the HMIS and surveillance, monitoring and evaluation; in addition to continuing to provide technical support to the NMCP and other key parts of the MoH (such as CMED and IMCI).

Proposed activities with FY 2018 funding: ***($500,000)***

- Support to malaria district coordinators, district health officers, and zonal health officers: PMI will support key district health staff to conduct facility and community-level supportive

supervision, mentorship, coaching, and assistance with data collection and reporting, as well as support to the zonal offices for improved supervision and oversight *($300,000*);

- Pre-service training of pharmacy assistants: PMI plans to continue to provide scholarships for 48 pharmacy assistants (24 students per cohort in a 2-year pre-service pharmacy assistant training), so that this cadre will enter the workforce with the stock management skills necessary to help ensure commodity security at the facility level *($200,000*); and
- Provide support to Peace Corps: PMI will continue to support small project assistance grants and one or two malaria coordinators (*$0* – supported with previous years' funds).

Table 15: Health Systems Strengthening Activities

HSS Building Block	Technical Area	Description of Activity
Health Services	MIP	Strengthening FANC and improving IPTp uptake
	Diagnosis and treatment	Strengthening case management at facility and community levels
	Diagnosis and treatment	Supporting quality of diagnosis at facility and community levels
Health Workforce	HSS	Pre-service training of pharmacy assistants
	HSS	Support to district malaria coordinators, district health offices, and zonal health offices
	HSS	Building capacity of MoH Central Monitoring and Evaluation Division
	HSS	Through support to Peace Corps, build capacity to prevent malaria at the community level
	SM&E	Strengthen routine HMIS at the district and central levels
Essential Medical Products, Vaccines, and Technologies	ITNs	Procurement and distribution of ITNs
	IRS	Technical assistance to NMCP to support IRS, environmental compliance, and IVM implementation
	Diagnosis and treatment	Procurement and distribution of RDTs, ACTs, and ancillary supplies
	Malaria in Pregnancy	Procurement and distribution of SP and DOT materials
	Pharmaceutical Management	Supply chain strengthening, introduction and rollout of new web-based LMIS
Health Finance	N/A	N/A
Leadership and Governance	Pharmaceutical management	Technical assistance to GoM and districts to improve management, oversight, and accountability for service delivery and supply chain and logistics management

5. Social and behavior change communication

NMCP/PMI objectives

The HSSP2 2017–2022 emphasizes the need to recognize and scale up health promotion interventions in the implementation of the Essential Health Package. The HSSP 2017–2022 identified the limited capacity of existing communication efforts to reach all segments of the population as a threat to the successful delivery of essential health packages through public health interventions. In line with the HSSP2, the 2017-2022 MSP calls for strengthening advocacy, communication, and social mobilization capacities to move towards optimal coverage for all malaria interventions. This is aimed at achieving above 80% of the population practicing positive behavior to prevent and control malaria by 2022. The MSP aims to educate communities to practice appropriate preventive behaviors and to seek prompt diagnosis and treatment of malaria at the onset of signs and symptoms.

To achieve this, the NMCP developed the Malaria Communication Strategy (2015 - 2020) to improve community mobilization interventions through advocacy and social mobilization. Advocacy is targeted at the national level to mobilize political commitment and resources for malaria prevention and control efforts, stimulate increased responsibility on the part of community members to adopt malaria control behaviors, and encourage clinicians to adhere to case management and malaria in pregnancy guidelines. This strategy takes advantage of the *Moyo ndi Mpamba, Usamalireni* (Life is precious, take care of it) platform which is popular among Malawians and has been adopted as the central platform for health promotion activities related to the EHP (see Progress since PMI was launched, below). This central platform provides the harmony among all program areas to leverage each other and reach Malawians effectively with comprehensive health information. The Malaria Communication Strategy therefore, integrates the malaria slogan *Malungo Zii (*Malaria no More*)* into the central *Moyo ndi Mpamba* platform. This strategy utilizes the implementation structure of the National Health Communication Strategy as outlined from the national to the community levels through District Health Promotion Officers, Health Surveillance Assistants, Village Health Committees, and Village Development Committees.

The NMCP, in coordination with the Health Education Section (HES), established a technical committee to support and guide the implementation of the Malaria Communication Strategy. This committee is comprised of key malaria and SBCC stakeholders, including PMI. During major events and interventions such as ITN mass distribution campaigns, task forces under this committee spearhead SBCC efforts to support the intervention (e.g., logistics, resource mobilization, community engagement, technical direction).

Progress since PMI was launched

PMI identified key barriers/facilitators of key malaria-related behaviors through formative research conducted in 2012, as well as an end of project evaluation for the previous SBCC project in 2016. Recently, PMI identified other key barriers/facilitators of malaria related behaviors through a supplemental formative research process in an effort to develop an annual national communication campaign. This included three key processes: (a) review of existing literature – national surveys, such as the DHS, the national health communication strategy (which has a behavior analysis section), malaria indicator survey; (b) stakeholders' consultations, which involved finding out from key stakeholders working in malaria programming, including government arms (such as NMCP, healthcare providers, including community health workers/HSAs), civil society actors; and (c) audience research, which involved qualitative process of consulting audience members on key behaviors, enablers, and barriers to

change. The effect of the annual campaign will be evaluated as described below *(under Plans and Justification sub-section)* and modifications will be effected as appropriate.

PMI Malawi supports an integrated approach to SBCC focused on ITNs, MIP, and case management. SBCC activities have included: national campaigns and door-to-door visits to promote year-round ITN use; large-scale campaigns to emphasize ANC attendance to improve IPTp uptake; and community-based campaigns that emphasize ITN utilization, as well as improved case management through the promotion of early care-seeking behavior.

PMI funding supported strengthening SBCC planning and coordination at national and district level through the development of the following strategic documents:

i) The Health Promotion policy, to ensure a coherent approach that takes into account both intra-sector and inter-sector collaboration and coordination to address the determinants of health
ii) The National Malawi Health Communication Strategy (2015 – 2020) aimed at facilitating the coordination and harmonization of health promotion and communication strategies across the Health Sector
iii) The National Malaria Communication Strategy (2015 – 2020) whose main focus is to implement social and behavior change communication by examining and addressing barriers to individuals and communities adopting actions and behavior that contribute to the prevention and treatment of malaria. Through this approach, the NMCP intends to devise innovative communication approaches to encourage adoption of health promotion interventions

PMI Malawi, through its implementing partners, supported the designing of the central, integrated SBCC campaign platform, *Moyo ndi Mpamba.* The *Moyo ndi Mpamba* campaign is based on extensive research findings that explored how people defined health and wellbeing in Malawi and reflects their aspirations for a better future. The campaign provides a platform to tie together messages from the six key health topics that USAID Malawi supports (malaria; HIV/AIDS; maternal, neonatal and child health; family planning; water, sanitation, and hygiene; and nutrition). Following *Moyo ndi Mpamba's* adoption by the MoH as the brand identity for its integrated health communication efforts, the campaign has been further popularized and implemented across the country. PMI supported the design of Malawi's first Health Promotion Policy, which was developed to give overall direction for programming of health promotion interventions, including communications strategies.

Results from national surveys suggest that SBCC efforts have been effective in conveying information that led to adoption of positive behavior. Approximately 84% of Malawian women reported having knowledge that sleeping under a mosquito net can prevent malaria infections. In terms of behavioral practices, for instance, given access to a net, use has been consistently strong in Malawi since 2012 (see ITN section). Continued net distributions and SBCC campaigns nationwide will help to maintain high ITN access and use. Furthermore, the percentage of children under five years old with fever in the last two weeks for whom advice or treatment was sought increased from 50% in 2012 to 67% in 2015-16. Although the causal link and quantification of contribution is difficult to establish, it would be reasonable to assume that SBCC efforts contributed to improved ITN use and prompt care-seeking behavior in households in Malawi.

SBCC strategies have been employed from the national to the community level to target policy makers, health care providers, and community members. In promoting malaria interventions, PMI has utilized a variety of SBCC approaches, including educational meetings, mass media, print media, community

drama, and interpersonal communication activities. At the national level, PMI has been implementing SBCC activities through an integrated SBCC mechanism. The objectives of this project are in line with the NMCP's strategic plan to build capacity of key national institutional partners, strengthen national and community level planning and coordination, develop and produce evidence-based SBCC packages under a multi-level media campaign, and identify and implement best practices.

The small grants program for community mobilization has remained a central component of the SBCC strategy to ensure good coverage and reach of SBCC activities at household level in all districts where PMI's implementing partners work. Under the Community Action Cycle program, teams consisting of HSAs and community health extension workers collaborate with communities to identify key health issues. The teams then help the community identify solutions to these issues in an effort to bring about appropriate behavior for improved health outcomes. At the household and village level, communications teams have also concentrated on interpersonal communication activities to promote prevention behaviors including early and frequent ANC attendance, IPTp uptake, appropriate and prompt health-seeking behaviors, and ITN care and use. Community health workers who work within community action groups (CAGs) are responsible for providing HMIS data to CAGs for analysis to determine whether activities of CAGs are effective in reducing the burden of health issues being addressed. For instance, community health workers would produce data for a specific catchment area comparing cases of malaria before and after implementation of CAG activities.

Progress during the last 12-18 months

PMI-funded activities helped strengthen national-level and targeted district-level SBCC planning and coordination on EHP priorities. Specific activities included: support for inclusion of SBCC in health sector district implementation plans and health promotion and communication technical working group meetings.

PMI also supported the MOH's efforts to develop and produce evidence-based SBCC packages under a multi-level media campaign to ensure effective, integrated SBCC implementation through mass media and facility and community level interventions. The following key mass media activities were conducted:

i) ***Moyo ndi Mpamba* Campaign:** PMI continued support for the integrated SBCC campaign platform, *Moyo ndi Mpamba.* Six episodes of the *Moyo ndi Mpamba* radio program focusing on malaria were aired on 2 national and 14 community radio stations to promote ITN use, IPTp, and early care-seeking for fever.
ii) **Malaria-specific messaging:** PMI aired 1,214 radio spots supporting the registration exercise for the universal ITN distribution campaign and promoting the use of ITNs, prompt care-seeking, prompt diagnosis with RDTs, and appropriate treatment. These messages were broadcasted in the most widely spoken languages on the three national and most of the community radio stations; the radio spots reached approximately a quarter of the country's population.[13] In addition, 25,000 copies of the malaria comic book, *Chimwemwe Fights Malaria,* were revised, translated, and printed (20,000 in Chichewa and 5,000 in English). A total of 74,953 leaflets and fliers on malaria were distributed for community health workers and volunteers.
iii) **Social Accountability Campaigns:** Through collaboration between PMI and the USAID Office of Inspector General, the Make a Difference (MAD) campaign was jointly launched with the Global Fund "I Speak Out Now" campaign in order to address efforts to fight drug thefts in Malawi. The campaign included the design and placement of 48 advertisements in 2 national newspapers over a

[13] Based on SSDI baseline estimates through Zodiak, MBC 1 and MBC 2 radios only in the 15 SSDI districts

period of 3 months. A radio spot on reporting drug theft was integrated in the *Moyo ndi Mpamba* program. Two episodes tackled pilferage of malaria medicines and commodities, while one radio spot discouraged use of ITNs for fishing. The program received a total of 17,942 text messages as feedback and dialogue on the programs. Currently, PMI is supporting the design of newspaper advertisements to continue encouraging Malawians to report suspected cases of antimalarial drugs thefts. Furthermore, in collaboration with NMCP and the HES, PMI Malawi designed and produced guidelines targeting substandard, spurious, falsely-labelled, falsified and counterfeit medical products (SSFFC) guidelines which were developed as a guiding principle aimed at planning an SBCC campaign intended to protect the public from diverted and degraded malaria medicine and raising awareness and mobilizing communities to report theft and misuse of malaria medicines and commodities. PMI intends to support implementation of social accountability activities through an integrated platform using SSFFC guidelines targeting all medicines in Malawi.

iv) **Community Mobilization Support:** With PMI support, partners conducted a three-day technical review meeting with all community mobilization zonal coordinators to review the implementation of the Community Action Cycle. Partners provided technical support on community mobilization to non-governmental organization sub-grantees, District Health Promotion sub-committees, community mobilization district level trainers, community mobilization team members and Community Action Groups in SSDI focus districts where community mobilization is implemented. Partners conducted joint supervision visits with Health Education Services officials in four districts to showcase the community mobilization activities.

v) **Radio listeners' club:** PMI supports implementing partners to work with community members in radio listeners' clubs (RLCs) to link them up with radio programs. Equipped with voice recorders, RLCs receive basic training in recording voices during normal community activities such as meetings and celebrations. The SBCC subcontractor collects the recorded footage and post-produces it into a radio program that is broadcasted on national and/or community radios to the same community that produced it, as well as to a national audience. The RLCs are also trained using a guide to discuss issues covered in radio programs. For example, RLC members have been trained to encourage women to attend ANC early in pregnancy in order to access preventive interventions like ITNs and IPTp. The RLC listens to the radio programs together, discuss issues covered in the program, and develop action points on what they can do as community members to address the issues contained in the program. The RLCs also act as community outreach teams, working closely with and supporting HSAs in conducting outreach.

vi) **Community theatre performances:** PMI supports theatre and drama activities to engage with and discuss controversial issues and simplify and disseminate otherwise complex messages, such as social accountability for tackling drug pilferage. PMI utilized a trained theatre troupe to train local and community-based theatre groups in four PMI focus districts (Nkhata Bay, Nkhotakota, Salima, and Chikwawa), to embed messaging on pertinent health issues in participatory theatre performances and at the community level into interactive radio programs.

Although the country has made significant strides, more progress is needed. The MIS 2014 shows that some malaria prevention behaviors, like IPTp2 uptake, are stagnant at around 60%, despite Malawi being the first country in sub-Saharan Africa to attain high levels of IPTp2 coverage. Similarly, prompt care-seeking among children under five years of age still remains sub-optimal. These challenges represent opportunities to intensify community and health provider messaging to improve uptake of these interventions.

Plans and justification

PMI will continue to support NMCP efforts in sustaining gains on malaria knowledge and focus on increasing uptake and utilization of malaria interventions and promoting communities' sense of ownership and accountability of malaria commodities.

PMI plans to support an integrated SBCC approach at the national level and at the community level in ten focus districts with ITN, IPTp, and case management messaging. National level efforts will focus on advocacy, mass media communication, and materials development, while community level efforts will focus on interpersonal, small group interventions and strategies to engage traditional authorities to support and promote importance of malaria prevention activities.

PMI targets pregnant women with messaging primarily intended to increase uptake of ANC services, which is a key entry point for access to IPTp. Related messages target men/males as partners of pregnant women; "uncles and aunties" as key influencers of healthcare seeking decision making; and traditional and community leaders as drivers of an enabling community environment. The contractor will influence these influencers to support pregnant women by, among other things, encouraging them to go for ANC early and according to schedule to access IPTp services and to sleep under bed nets; providing transportation to health facilities (in light of long distances to health centers); and mobilizing support in terms of food (during delivery). These interventions are designed to improve women's self-efficacy to attend ANC and social norms around ANC attendance.

For prompt care-seeking among under five children, PMI targets parents of under five children with messages on key behaviors for both the parents and the under five children. For example, the importance of taking children to a facility or HSA within 24 hours of a fever and the need to complete referrals. Key interventions for parents and caretakers of under five children include a mix of instructional and dialogue-based mass media products that provide information on key child health interventions and services, and build skills among parents/caretakers in healthy upbringing of children. Print information materials, as well as interactive community and national radio programming, will complement interpersonal and community mobilization approaches. These interventions are designed to improve parents' understanding of the importance of early care seeking, and encourage communities to facilitate care seeking. The impact and outcome of the proposed SBCC activities will be monitored and evaluated through national health surveys (MIS and DHS). Furthermore, adherence by health workers to diagnostic tests and provision of treatment according to approved treatment guidelines will continue to be monitored on quarterly basis through on-going outreach training and supportive supervision.

PMI Malawi has also put in place monitoring strategies in order to track the reach and outcomes of malaria-related SBCC activities especially *Moyo ndi Mpamba* radio programs and community theatre as follows:

Monitoring reach of PMI supported activities: (a) The SBCC contractor uses the estimated listenership for each radio station as per Malawi Communication Regulatory Authority (MACRA) determined listenership figures. As such, the number of people listening to each radio station in each geographical region is estimated based on MACRA national listenership estimates. (b) The contractor also utilizes feedback mechanisms to determine reach of particular radio programs. For instance, for the *Moyo ndi Mpamba* reality radio programs the contractor monitors reach and feedback from listeners through whatsapp, facebook and short messaging services.

Monitoring outcomes: PMI, in collaboration with the integrated SBCC project, will monitor outcomes through mechanisms such as: (a) pre- and post-performance test (with community theatre activities) to

estimate the audience's messages uptake and retention based on the performances. (b) Planned audience feedback loop through interactive voice response (IVR) to check on understanding, retention and intention to implement certain behaviors among audiences of mass media activities. The contractor is scheduled to have one IVR survey in 2017, and will have two surveys in each of the subsequent years. (c) Household surveys have proxy indicators that would improve as a result of SBCC messaging e.g. IPTp2, 3 and care seeking within 24 hours for under five children with fever.

Proposed activities with FY 2018 funding: ***($1,600,000))***

- Support for national-level SBCC activities to improve uptake of malaria services and adoption of preventive and care-seeking behaviors and technical assistance to community-based SBCC activities. SBCC is designed to promote prompt treatment of malaria, adherence to treatment, and early care-seeking behavior; to improve demand for ITN and increase use; and to improve IPTp uptake (*$800,000*); and
- Community-based SBCC activities to improve demand for services and uptake of core malaria prevention and control interventions. Small grants to community-based organizations to improve uptake of malaria services, adoption of preventive and care-seeking behaviors, and improvement of oversight and accountability for health services through engagement with traditional authorities, health facility advisory committees and the community *($800,000*).

6. Surveillance, monitoring, and evaluation

NMCP/PMI objectives

In May 2017, the NMCP finalized the 2017-2020 Malaria Strategic Plan. The new plan calls for improved malaria monitoring and evaluation systems towards achieving enhanced data and program accountability by 2022. This plan follows RBM M&E guidance to provide a comprehensive framework for obtaining reliable and consistent data in order to assess progress toward achieving universal coverage of malaria interventions and reducing disease burden. PMI provides targeted programmatic and technical support to the NMCP, HTSS, and CMED to support improvements to surveillance, monitoring, and evaluation systems; implement population-based surveys to measure progress on key malaria indicators; and enhance the coordination of GoM efforts.

Progress since PMI was launched

National household surveys

The UNICEF-funded 2006 MICS provides the baseline data for PMI's program. Although it collected information on net ownership and usage, as well as IPTp uptake, it did not include biomarker data. The NMCP, with assistance from the Malaria Control and Evaluation Partnership in Africa, completed Malawi's first MIS in April 2010. This survey documented increases in household net ownership, net usage in vulnerable groups, and uptake of IPTp. Nevertheless, high parasitemia (~43%) was noted. PMI provided support to the 2010 DHS, which provided district-level estimates of under five mortality and malaria indicators. With FY 2012 funding, PMI supported the second MIS in Malawi and, with FY 2013 funding, PMI provided partial support and technical assistance to a third MIS (2014), which showed parasitemia declining to 37% from the 43% seen in 2010. The most recent survey was the 2015-16 DHS, which was completed in February 2016. At the time of writing, the 2017 MIS is underway. Please see the strategy section *Progress on indicators to date* for more details.

Health facility and other surveys

Health facility surveys: With FY 2010 and FY 2011 funding, PMI supported nationally representative

health facility surveys to assess the quality of case management for uncomplicated malaria in outpatient facilities and severe malaria in tertiary care facilities. Results from the outpatient facility evaluation showed poor provider adherence to microscopy results. (This survey was conducted prior to the rollout of RDTs in Malawi.) Only two-thirds of patients with uncomplicated malaria confirmed by microscopy received an ACT and 31% of patients without malaria were inappropriately treated with an ACT. Results from the tertiary care facility evaluation identified limited availability of medications and diagnostic supplies, as well as knowledge gaps among health workers, as key obstacles to providing quality care for patients with severe malaria. The case fatality ratio among patients admitted with suspected or confirmed malaria was 2.15% (95% CI 0.79-3.52) in patients of all ages. The 2013-14 SPA was a census of all formal sector health facilities in Malawi. The assessment indicated that among the facilities that offer malaria diagnostic and/or treatment services, only 63% had guidelines for the diagnosis and treatment of malaria available, and fewer facilities (33%) had IPTp guidelines available. Results on the capacity to confirm a malaria infection revealed that 83% of the facilities had malaria diagnostic capacity (i.e. the facility had a functional microscope, or else an unexpired malaria RDT available).

End-use verification surveys: PMI began supporting end-use verification surveys with FY 2011 funds. The most recent EUV survey was competed in March 2017. During the period Malawi has been implementing EUV, the country has observed tremendous improvements in the quality of data being reported from the Logistics Management Information Systems (LMIS). The LMIS report shows the stock status of malaria commodities at all levels on a monthly basis. Two DQAs of the LMIS in 2014 and 2015 showed relatively good consistency between stock data at the facility level and the LMIS reported data; a third DQA was conducted early in 2017 and data is forthcoming. Given that the LMIS now is able to provide routine information about commodity availability, and the need for a tool to hone in on theft and diversion, PMI is working with the supply chain implementing partner to adapt the EUV methodology to focus on commodity accountability.

Malaria surveillance and routine systems

PMI supported health facility surveillance via sentinel sites in Malawi from FY 2007 through FY 2010. However, PMI discontinued this support in FY 2011, and shifted focus to HMIS strengthening and capacity building for malaria surveillance. The HMIS has been the primary system for monitoring the implementation of services and collecting disease surveillance data for the MoH. The MoH began to transition the HMIS platform from DHIS to DHIS2 in 2009. The DHIS2 is a web-based system for capturing routine health data at district level; health facilities and village clinics submit paper-based forms, which are entered into the electronic system by the districts.

While the MoH was overhauling the HMIS, the NMCP was granted authority to develop a parallel reporting system for malaria surveillance in 2011. PMI supported this activity through training of district health management teams in the parallel system surveillance forms and mentoring visits from the NMCP monitoring and evaluation officers. With support from PMI and other partners, the NMCP worked with the CMED to ensure that appropriate malaria indicators (including commodity indicators) were included in the DHIS2 malaria-specific platform, enabling subsequent reintegration of the malaria parallel surveillance system with the national HMIS in 2013.

With FY 2013 funding, PMI supported a pilot activity to incorporate malaria-specific data fields into an electronic medical records (EMR) system, designed to provide patient-level malaria data at selected facilities and link clinical, laboratory, and pharmacy data. The pilot was implemented at three facilities:

Queen Elizabeth Central Hospital and Mchinji and Mulanje District Hospitals. The pilot was initiated in August 2014; the intervention uses the EMR system for the Outpatient Department (OPD) to capture malaria RDT results, prescriptions, and dispensations. The EMR system is able to generate routine reports for the facility and is linked to a central dashboard at NMCP to provide access to the aggregated data. At the time of writing, an external evaluation is being planned to assess the pilot intervention and possibilities of scale up.

Impact evaluation

With funding and support from PMI and the RBM partnership, Malawi completed the *Progress and Impact Series* report, which was disseminated in April 2013. Key findings include a 41% reduction in under five mortality from 188 to 112 deaths per 1,000 live births over the period 1996-2000 and 2006-2010. Modeling estimated that approximately 21,600 deaths among children under five years of age were prevented by malaria control interventions.

Progress during the last 12-18 months

National household surveys

With FY 2015 funding, PMI provided support and technical assistance to the DHS. The 2015-16 DHS survey was conducted between October 2015 and January 2016 and results were disseminated in March 2017. Survey results showed that the proportion of households that own at least one ITN has remained unchanged at 57% since 2010, though the survey did not capture the ITNs distributed in the 2016 mass campaign. Improvements were seen in some case management indicators: treatment was sought for 67% of children under five with fever and 52% had blood taken for testing. The 2015-16 Malawi Micronutrient Survey (2015-16 MNS) was conducted jointly as part of the 2015-16 DHS and collected data on parasitemia biomarker. Key results from the MNS continue to show high prevalence of malaria in children: 27% in pre-school aged children, 42% in school-aged children, and 16% in women of reproductive age. PMI is implementing a fourth MIS in May-June 2017. Data collection will be completed in June 2017 and results will be disseminated in February 2018.

Malaria surveillance and routine systems

PMI continued to support improvements to the HMIS system, including improved quality of data collection at the health facility level and timely and complete data entry into HMIS using DHIS2 at the district level. To strengthen routine data collection of malaria morbidity and mortality indicators, PMI supported malaria-specific data review meetings at zonal and district level in all districts; supported data collection and routine data quality assessments and supervision in data management and use at the district and health facility level in PMI focus districts. At the national level, PMI has provided technical support to the NMCP and CMED to strengthen central HMIS data management and use. PMI facilitates coordination between M&E stakeholders, including support for M&E Technical Working Groups (TWGs). Substantial progress has been made toward streamlining the core and program-specific indicators collected and reported by health facilities. The NMCP, with technical support from PMI, revised outpatient department registries and malaria reporting forms used by health facilities to collect and report data to HMIS. The revised forms will be rolled out to facilities in 2017. Overall, reporting rates for both the integrated HMIS reporting form and malaria-specific reporting form have improved over the last several years. In 2016, the reporting rates based on DHIS2 data were 92% for the malaria specific reporting form, 92% for the integrated HMIS form, and 89% for the village clinic form. However, improvements in timeliness, completeness, and data quality still are needed.

The CMED has developed a longer-term strategy for the overall health information system and plans to use DHIS2 as the central repository for information on all key health indicators. Under this strategy, CMED completed a major reconfiguration of DHIS2 in March 2017. Furthermore, there are plans to make the electronic LMIS and DHIS2 interoperable in efforts to improve Malawi's ability to compare morbidity and commodity consumption data. In addition to these structural changes to the system, CMED has completed a review of HMIS indicators with technical support from PMI. CMED has worked closely with NMCP, HTSS, and other partners to select appropriate malaria morbidity and mortality indicators and ensure that the appropriate tools are available to collect the needed data; rollout of the indicators and tools will occur in 2017.

Table 16 Monitoring and Evaluation Activity Summary Table

Data source	Survey activities	Year													
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Household Surveys	Multiple indicator cluster survey	X*,§								X*,§					X
	Demographic and Health Survey					X					X				
	Micronutrient Survey										X				
	Malaria Indicator Survey					X¶		X¶		X¶			X∞		
	Subnational anemia and parasitemia survey	X	X	X											
Health facility and other surveys	Health facility and related surveys				X**		X†	X†							
	Service provision assessment								X§§						
	End-use verification survey						X	X	X	X	X	X	X		
Malaria surveillance and routine system support	Sentinel surveillance		X	X	X	X									
	Support to malaria surveillance system						X	X	X	X¶¶					
	Support to HMIS		X	X	X	X	X	X	X	X	X	X	X	X	X
Other data sources	*In vivo* efficacy testing					X		X*		X		X*,¥		X*,¥	
	ITN durability											X	X	X	X

	Malaria impact evaluation								X						

* Not PMI funded
§MICS conducted by UNICEF. Report for 2006 available at http://www.childinfo.org/files/MICS3_Malawi_FinalReport_2006_eng.pdf. Report for 2014 pending.
¶ 2010 MIS conducted with technical assistance from the Malaria Control and Evaluation Partnership in Africa (MACEPA), report available at http://www.givewell.org/files/DWDA%202009/AMF/Malawi_MIS_2010_Final.pdf. 2012 MIS conducted by ICF-MACRO, data and report available at http://www.measuredhs.com/what-we-do/survey/survey-display-432.cfm. 2014 MIS supported by the Global Fund with technical assistance provided by PMI and ICF-MACRO.
∞ MIS was originally planned for 2016 but shifted to 2017.
**Evaluation of IMCI program
†The health facility survey in 2011 focused on the management of uncomplicated malaria. The subsequent health facility survey in 2012 focused on the management of severe malaria.
§§SPA was conducted during the second half of 2013 and first half of 2014
¶¶ Additional funding provided for one-time support to develop and incorporate malaria-specific indicators into an electronic medical records data management system.
¥ 2016 TES support in approved Global Fund New Funding Model grant, 2018 TES included in pending Global Fund Funding Request for 2018-2020.

Plans and justification

National household surveys

PMI plans to contribute to a MICS, which is expected to be conducted in 2019 by UNICEF. PMI and the NMCP will work with UNICEF to include the key malaria indicators and biomarkers.

Health facility and other surveys

There are no plans for an additional health facility survey or SPA at this time. PMI plans to continue support for quarterly assessments of PMI-funded commodities at the health facility and community level using a new approach (i.e. the current methodology is under review).

Malaria surveillance and routine systems

PMI has been providing support to oversee data collection at the health facility level and data entry into DHIS2. However, capacity is still not sufficient and further support is required to ensure timely and accurate data collection and reporting, and to improve analysis and use of malaria data for programmatic decision-making at all levels of the health system. In particular, PMI will continue to support district and zonal data review meetings to promote data use, as well as technical assistance for health information strengthening at the central level (CMED and NMCP) and district levels. PMI will provide training, supervision and mentorship on data reporting and use at the district and facility level using the revised data reporting forms and registers in the ten PMI focus districts. To promote data use centrally, PMI will provide technical assistance and support to the NMCP in producing a quarterly malaria bulletin. To improve coordination and strategic planning, PMI will continue to facilitate M&E TWGs.

Proposed activities with FY 2018 funding: ***($1,460,000)***

PMI plans to continue to support strengthening of routine health management information systems, with an emphasis on improving the quality, timeliness and use of malaria-specific surveillance data, as well as assessments of availability of commodities at health facilities. For district-level activities conducted in the ten PMI focus districts, PMI will work closely with CMED, HTSS, NMC, and other malaria partners to ensure that these activities are in line with the priorities of the GoM, support national level initiatives, and are coordinated with the activities of other partners working in the non-focus districts. Additionally, PMI will continue support for the ongoing 2016-2021 impact evaluation of the integrated district-level service delivery and systems strengthening activities, which will produce rigorous evidence of the impact of the project on the availability and quality of health services and the performance of health systems in the ten PMI focus districts.

Specifically, with FY 2018 funding, PMI will:

- Support quarterly supply chain monitoring of PMI-funded commodities at strategically selected health facilities and the community level *($200,000*);
- Continue efforts to strengthen the HMIS system by improving quality of data collection through routine data quality assessments, mentorship in data management and use; strengthening capacity for data use through malaria-specific data review meetings at district level *($500,000*);
- Strengthen routine HMIS at the central level, including support to MoH Central Monitoring and Evaluation Division (CMED) *($350,000*);
- Contribute to 2019 Multiple Indicator Cluster Survey (MICS), to include the key malaria indicators and biomarkers *($400,000*); and

- Provide CDC technical assistance for M&E *($10,000*).

7. **Operational research**

NMCP/PMI objectives

The 2017-2022 Malaria Strategic Plan calls for strengthening operational research through the support for local capacity building and the creation of stronger coordination between NMCP and researchers to harmonize and prioritize operational research efforts, including interoperability between HMIS and complementary systems. PMI-funded operational research has provided important data for decision-making, including studies measuring the durability of long-lasting ITNs, the impact of IRS, the effectiveness of the IPTp strategy, the quality of health facility case management practices for uncomplicated and severe malaria, the ability of patients to complete recommended first-line treatment for malaria, the distribution of potentially drug-resistant parasites and mosquitoes, and the effectiveness of ITNs in an area with significant pyrethroid resistance.

Progress since PMI was launched

Since PMI began, operational research investments in Malawi have produced important findings that have shaped NMCP and PMI policy and programs. A total of 27 peer-reviewed publications have been published from PMI-supported OR in partnership with the NMCP. The publications from 2016-2017 are listed below:

- Namuyinga RJ, Mwandama D, Moyo D, Gumbo A, Troell P, Kobayashi M, Shah M, Bauleni A, Eng JV, Rowe AK, Mathanga DP, Steinhardt LC. Health worker adherence to malaria treatment guidelines at outpatient health facilities in southern Malawi following implementation of universal access to diagnostic testing. Malar J. 2017;16(1):40.
- Mzilahowa T, Chiumia M, Mbewe RB, Uzalili VT, Luka-Banda M, Kutengule A, Mathanga DP, Ali D, Chiphwanya J, Zoya J, Mulenga S, Dodoli W, Bergeson-Lockwood J, Troell P, Oyugi J, Lindblade K, Gimnig JE. Increasing insecticide resistance in Anopheles funestus and Anopheles arabiensis in Malawi, 2011-2015. Malar J. 2016;15(1):563.
- Shah MP, Briggs-Hagen M, Chinkhumba J, Bauleni A, Chalira A, Moyo D, Dodoli W, Luhanga M, Sande J, Ali D, Gutman J, Mathanga DP, Lindblade KA. Adherence to national guidelines for the diagnosis and management of severe malaria: a nationwide, cross-sectional survey in Malawi, 2012. Malar J. 2016;15(1):369.
- Mzilahowa T, Luka-Banda M, Uzalili V, Mathanga DP, Campbell CH Jr, Mukaka M, Gimnig JE. Risk factors for Anopheles mosquitoes in rural and urban areas of Blantyre District, southern Malawi. Malawi Med J. 2016; 28(4):154-158.
- Mathanga DP, Mwandama DA, Bauleni A, Chisaka J, Shah MP, Landman KZ, Lindblade KA, Steinhardt LC. The effectiveness of long-lasting, insecticide-treated nets in a setting of pyrethroid resistance: a case-control study among febrile children 6 -to 59 months of age in Machinga District, Malawi. Malar J. 2015;14:457.
- Desai M, Gutman J, Taylor SM, Wiegand RE, Khairallah C, Kayentao K, Ouma P, Coulibaly SO, Kalilani L, Mace KE, Arinaitwe E, Mathanga DP, Doumbo O, Otieno K, Edgar D, Chaluluka E, Kamuliwo M, Ades V, Skarbinski J, Shi YP, Magnussen P, Meshnick S, Ter Kuile FO. Impact of Sulfadoxine-Pyrimethamine Resistance on Effectiveness of Intermittent Preventive Therapy for Malaria in Pregnancy at Clearing Infections and Preventing Low Birth Weight. Clin Infect Dis. 2016;62(3):323-33.

- Paczkowski M, Mwandama D, Marthey D, Luka M, Makuta G, Sande J, Ali D, Troell P, Mathanga DP, Gutman J. (2016)
- *In vivo* efficacy of artemether-lumefantrine and artesunate-amodiaquine for uncomplicated *Plasmodium falciparum* malaria in Malawi, 2014. Malar J. 2016;15(1):236.

In 2015, PMI-funded a three-arm randomized controlled trial to assess mobile-telephone text messaging on malaria (arm one) or pneumonia and diarrhea (arm two) versus no messages as a way to improve health worker performance. A baseline survey of health worker case management practices was conducted in early 2015, followed by a stakeholder workshop to design the content of the messages. Messages were delivered to health care workers for a period of six months, followed by a survey to assess the impact of the intervention conducted in November 2015, immediately after the delivery of messages concluded. Analysis of this end-line data revealed no significant improvement in health care worker performance in the intervention group. In light of these results, the second end-line survey planned for May 2016 was not conducted. The results were presented at the American Society for Tropical Medicine and Hygiene Meeting in 2016, and the publication is being prepared.

In 2015, PMI supported a repeat evaluation of the effectiveness of IPTp focusing on the effect of the sextuple (*dhps*581) mutation, which is associated with extremely high levels of SP resistance. The preliminary data suggests that SP remains effective at preventing patent, but not subpatent, parasitemia, and was associated with increased birth weight in women who received at least three doses compared to women who received fewer than three doses. As compared to a prior survey from 2012 which found that approximately 8% of woman with *P. falciparum* detected by PCR at delivery carried the *dhps*A581G mutation, in this sample only 2% (2/82) of samples were positive for mutation at *dhps*581. This indicates that there has not been a significant expansion of this highly mutant genotype.

Progress during the last 12-18 months

PMI Malawi is supporting two studies with previous years' funding. The first study, using FY 2015 and FY 2016 funds, is assessing the efficacy of IPTp-DP compared to SP, to help determine whether this might be an alternative to IPTp-SP, in light of the relatively high rates of SP resistance among parasites in Malawi. This study started recruitment in January 2017. Recruitment will continue for about 12-15 months with an additional 6 months of follow-up, and another 6 months of laboratory and data analysis. The second study, supported by FY 2016 funds, focuses on increasing IPTp uptake through community delivery of IPTp-SP. As highlighted in the *Malaria in Pregnancy* section, IPTp coverage goals have yet to be met despite two decades of IPTp implementation in Malawi. Although a high proportion of women attend ANC at least once in pregnancy, according to the 2015-16 DHS, only about 24% of women attended ANC in the first trimester and 51% attend four visits, limiting the number of women who could receive three or more doses of IPTp during pregnancy. To address this, PMI Malawi has developed a protocol to conduct a pilot assessment of the effect of community delivery of IPTp-SP on IPTp uptake and ANC attendance; the implementation is expected to begin in fall 2017.

Table 17. PMI-funded Operational Research Studies

Completed OR Studies			
Title	**Start Date**	**End Date**	**Budget (US$)**
IPTp effectiveness monitoring and SP drug resistance markers in pregnant women	2008	2012	40,000
Health facility surveys: management of uncomplicated and severe malaria	2008	2012	330,000
Pilot study of intermittent preventative treatments for infants	2008	completed	150,000
Patient adherence to first-line treatment of malaria	2009	2011	140,000
Pilot study of community ACT use through HSAs	2010	completed	200,000
Ongoing and planned OR Studies (prior to FY 2017)			
Title	**Start Date**	**End Date**	**Budget (US$)**
Evaluation of mobile-telephone text messaging intervention to improve health worker performance	2014	Data collection completed, analysis and writing ongoing	520,000
IPTp effectiveness monitoring in areas with high levels of resistance and SP drug resistance markers in pregnant women (delivery cross sectional study)	2015	Data collection completed, analysis and writing ongoing	325,000
Study assessing the efficacy of IPTp-DP versus IPTp-SP	2016	2019	400,000
Pilot study of community delivery of IPTp-SP	2017	2019	400,000

Plans and justification
The two studies described above, supported with prior year's funding, will continue.

Proposed activities with FY 2018 funding:
No proposed OR activities with FY 2018 funding.

8. Staffing and administration

Two health professionals serve as Resident Advisors (RAs) to oversee PMI in Malawi, one representing CDC and one representing USAID. In addition, three Foreign Service Nationals (FSNs) work as part of the PMI team. All PMI staff members are part of a single interagency team led by the USAID Mission Director or his/her designee in country. The PMI team shares responsibility for developing and implementing PMI strategies and work plans, coordinating with national authorities, managing collaborating agencies and supervising day-to-day activities. Candidates for RA positions (whether

initial hires or replacements) will be evaluated and/or interviewed jointly by USAID and CDC, and both agencies will be involved in hiring decisions, with the final decision made by the individual agency.

The PMI interagency professional staff work together to oversee all technical and administrative aspects of PMI, including finalizing details of the project design, implementing malaria prevention and treatment activities, monitoring and evaluation of outcomes and impact, reporting of results, and providing guidance and direction to PMI implementing partners.

The PMI lead in country is the USAID Mission Director. The day-to-day lead for PMI is delegated to the USAID Health Office Director and thus, the two PMI RAs, one from USAID and one from CDC, report to the USAID Health Office Director for day-to-day leadership, and work together as a part of a single interagency team. Technical expertise housed in Atlanta and Washington complements PMI programmatic efforts.

The two PMI RAs are physically based within the USAID health office but are expected to spend approximately half of their time with and providing TA to the NMCPs and implementing partners, including time in the field monitoring program implementation and impact.

The number of locally-hired staff and necessary qualifications to successfully support PMI activities either in Ministries or in USAID will be approved by the USAID Mission Director. Because of the need to adhere to specific country policies and USAID accounting regulations, any transfer of PMI funds directly to Ministries or host governments will need to be approved by the USAID Mission Director and Controller, in addition to the U.S. Global Malaria Coordinator.

Proposed activities with FY 2018 funding: ***($1,934,000)***

- Support to CDC for staffing *($550,000*); and
- Support to USAID for staffing *($984,000*) and administration *($400,000*). (*$1,384,000*).

Table 1: Budget Breakdown by Mechanism
President's Malaria Initiave – Malawi
Planned Malaria Obligations for FY 2018

Mechanism	Geographic Area	Budget ($)	%
ONSE	10 focus districts	$3,842,500	19.2%
GHSC-PSM	Nationwide	$10,864,500	54.3%
TBD - Vector Control IDIQ	Selected districts	$1,515,000	7.6%
TBD - Environmental Management	Selected district	$35,000	0.2%
HC4L	Nationwide	$800,000	4.0%
HP+	Central level	$350,000	1.8%
TBD - Pre-service training	Central level	$200,000	1.0%
TBD	Nationwide	$400,000	2.0%
CDC IAA		$609,000	3.0%
USAID		$1,384,000	6.9%
Total		**$20,000,000**	**100%**

Table 2: Budget Breakdown by Activity
President's Malaria Initiave – Malawi
Planned Malaria Obligations for FY 2018

Proposed Activity	Mechanism	Budget		Geographic Area	Description
		Total $	Commodity $		
PREVENTIVE ACTIVITIES					
VECTOR MONITORING AND CONTROL					
Entomologic monitoring and insecticide resistance management					
Entomological monitoring	TBD - Vector Control IDIQ	350,000		Chikwawa, Nkhotakota, Karonga, Balaka, and Ntcheu districts	Entomological monitoring and technical assistance to the NMCP's entomology program in five districts.
CDC TDY	CDC IAA	29,000			Two technical assistance visits for entomology activities.
Subtotal Ento monitoring		379,000	-		
Insecticide-treated Nets					
Procurement of ITNs for routine distribution	GHSC-PSM	3,720,000	3,720,000	Nationwide	Procure approximately 1.2 million ITNs for continuous distribution through routine channels.
Distribution of ITNs	GHSC-PSM	1,200,000		Nationwide	Support

					management, oversight, and distribution of PMI-procured ITNs to health facilities for routine distribution.
ITN Durability	TBD - Vector Control IDIQ	150,000		Mangochi and Kasungu districts	Continue to monitor ITN durability following the 2016 mass campaign.
Subtotal ITNs		**5,070,000**	**3,720,000**		
Indoor Residual Spraying					
Support implementation for IRS	TBD - Vector Control IDIQ	1,015,000		Select district	Spraying in one district, supported with pipeline funds
Environmental compliance support for IRS activities	TBD - Environmental Management	35,000		Select district	
Subtotal IRS		1,050,000	-		
SUBTOTAL VECTOR MONITORING AND CONTROL		6,499,000	3,720,000		
Malaria in Pregnancy					
Procurement of SP	GHSC-PSM	288,000	288,000	Nationwide	Procure approximately 2.4 million treatment courses (7.2 million tablets) of SP for IPTp.
Procurement of supplies for directly observed therapy for IPTp	GHSC-PSM	50,000	50,000	Nationwide	Procure ANC supplies (cups, water buckets) to help improve IPTp uptake.
Strengthening MIP services through support for FANC	ONSE	300,000		10 focus districts	Support proper implementation of IPTp and ITN

					distribution through ANC in selected districts, including supportive supervision and mentorship.
CDC TDYs	CDC IAA	20,000			Two technical assistance visits to support ongoing IPTp studies
Subtotal Malaria in Pregnancy		658,000	338,000		
SUBTOTAL PREVENTIVE		**7,157,000**	**4,058,000**		
CASE MANAGEMENT					
Diagnosis and Treatment					
Procurement of RDTs	GHSC-PSM	1,800,000	1,800,000	Nationwide	Procure approximately 4 million RDTs for use in facilities and village health clinics.
Procurement of ACTs	GHSC-PSM	656,500	656,500	Nationwide	Procure approximately 650,000 courses of first-line ACTs for use in health facilities and village health clinics.
Ancillary diagnostic supplies	GHSC-PSM	150,000	150,000	Nationwide	Procure gloves and sharps boxes for diagnostic services.
Strengthen community and facility-based case management services	ONSE	1,942,500		10 focus districts	Support to improve facility- and community-based case management services and

					systems in 10 districts, concentrating on quality improvement for diagnostics, appropriate use of uncomplicated and severe malaria treatments, and supervision and mentorship in facility and community settings.
Subtotal Diagnosis and Treatment		**4,549,000**	**2,606,500**		
Pharmaceutical Management					
Technical assistance to strengthen the national supply chain system	GHSC-PSM	1,600,000		Nationwide	Technical assistance to GoM to improve management, oversight, and accountability for supply chain and logistics management at the central, zonal, and district levels, as well as the DTIU. Support to quantification and LMIS.
Support for PMI parallel supply chain	GHSC-PSM	1,200,000		Nationwide	Support management, oversight, and distribution of PMI-procured

					commodities to the health facility level.
Subtotal Pharmaceutical Management		**2,800,000**			
SUBTOTAL CASE MANAGEMENT		**7,349,000**	**2,606,500**		
HEALTH SYSTEM STRENGTHENING / CAPACITY BUILDING					
Support to district malaria coordinators, district health offices, and zonal health offices	ONSE	300,000		10 focus districts	Support key district health staff to conduct facility and community-level supportive supervision, mentorship, coaching, and assistance with data collection and reporting, as well as support to the zonal offices for improved supervision and oversight.
Pre-service training for pharmacy assistants	TBD - Pre-service training	200,000		Central level	Support pre-service training for 48 pharmacy assistants (24 students/cohort in a 2-year program) to be placed in health facilities upon graduation.
Peace Corps	Peace Corps	-			Continue support to two Peace Corps malaria coordinators to work with NMCP and coordinate malaria activities with other

					volunteers, and support SPA grants; pipeline will be used to fund FY 2018 activities.
SUBTOTAL HSS & CAPACITY BUILDING		500,000			
SOCIAL AND BEHAVIOR CHANGE COMMUNICATION					
Support for nationwide SBCC activities	HC4L	800,000		Nationwide	Support for national-level SBCC activities (e.g., mass media) to improve uptake of malaria services and adoption of preventive and care-seeking behaviors; development of SBCC materials to be used at the community level.
Support for community-based SBCC activities	ONSE	800,000		10 focus districts	Support for community-based SBCC activities to improve demand for services and uptake of core malaria prevention and control interventions and adoption of preventive and care-seeking behaviors; improvement of oversight and

					accountability for health services through engagement with traditional authorities, health facility advisory committees, and the community.
SUBTOTAL SBCC		**1,600,000**			
SURVEILLANCE, MONITORING, AND EVALUATION					
Supply chain monitoring	GHSC-PSM	200,000		Nationwide	Spot checks of PMI-funded commodities at strategically selected health facilities and the community level; validation of LMIS data; support data quality audits.
Strengthen routine HMIS at the district level, including continued mentoring and supervision of HMIS officers	ONSE	500,000		10 focus districts	Strengthen routine data collection through training and supervision at the district and health facility level and data review meetings at zonal level.
Strengthen routine HMIS at the central level	HP+	350,000		Central level	Strengthen routine HMIS at the central level, including support to MoH Central Monitoring

					and Evaluation Division (CMED)
Support to 2019 Multiple Indicator Cluster Survey (MICS)	TBD	400,000		Nationwide	UNICEF plans to support a MICS in 2019. PMI will contribute funding to this survey to incorporate malaria prevalence and other malaria indicators.
SM&E Technical Assistance	CDC IAA	10,000			Technical assistance for SM&E activities.
SUBTOTAL SM&E		**1,460,000**			
OPERATIONAL RESEARCH					
SUBTOTAL OR		-	-		
IN-COUNTRY STAFFING AND ADMINISTRATION					
CDC	CDC IAA	550,000			
USAID	USAID	1,384,000			
SUBTOTAL IN-COUNTRY STAFFING		1,934,000	-		
GRAND TOTAL		**20,000,000**	**6,664,500**		