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

GHANA

Malaria Operational Plan FY 2018

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ABBREVIATIONS and ACRONYMS

ACT	Artemisinin-based combination therapy
AGA	AngloGold Ashanti Mining Company
AGAMal	AngloGold Ashanti Malaria Control Program
ANC	Antenatal care
CDC	Centers for Disease Control and Prevention
CHPS	Community-based health planning and services
CMS	Central Medical Stores
CWC	Child Welfare Clinics
DFID	U.K. Department for International Development
DHIMS2	District Health Information Management System
DHS	Demographic and Health Survey
EUV	End-Use Verification
FY	Fiscal year
GES	Ghana Education Service
GH-FDA	Ghana Food and Drug Authority
GHS	Ghana Health Service
Global Fund	Global Fund to Fight AIDS, Tuberculosis and Malaria
GOG	Government of Ghana
iCCM	Integrated community case management
IPTp	Intermittent preventive treatment of pregnant women
IRS	Indoor residual spraying
ITN	Insecticide-treated mosquito net
KAP	Knowledge, Attitudes and Practices
MaVCOC	National Malaria Vector Control Oversight Committee
M&E	Monitoring and evaluation
MICC	Malaria Inter-Agency Coordinating Committee
MICS	Multiple Indicator Cluster Survey
MIP	Malaria in pregnancy
MIS	Malaria Indicator Survey
MOH	Ministry of Health
MOP	Malaria Operational Plan
NHIA	National Health Insurance Agency
NHIS	National Health Insurance Scheme
NMCP	National Malaria Control Program
Noguchi	Noguchi Memorial Institute for Medical Research
OPD	Out Patient Department
OTCMS	Over the Counter Medicine Sellers
OTSS	Outreach training and supportive supervision
PMI	President’s Malaria Initiative
PHC	Primary health care
RDT	Rapid Diagnostic Test
RMS	Regional Medical Stores
SBCC	Social, behavior change communication
SHEP	School Health Education Program

SM&E	Surveillance, Monitoring & Evaluation
SP	Sulfadoxine-pyrimethamine
USG	United States Government
USAID	United States Agency for International Development
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. 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-supported countries, and all 15 original countries have documented substantial declines in all-cause mortality rates among children less than 5 years of age.

In 2015, PMI launched the next six-year strategy, setting forth 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 Partnership's second generation global malaria action plan, *Action and Investment to defeat Malaria (AIM) 2016-2030: for a Malaria-Free World* and the World Health Organization's updated *Global Technical Strategy: 2016-2030*. Under the PMI Strategy 2015-2020, the U.S. Government's goal is to work with PMI-supported countries and partners to further reduce malaria deaths and substantially decrease malaria morbidity, towards the long-term goal of elimination.

Ghana began implementation as a PMI focus country in FY 2008.

This FY 2018 Malaria Operational Plan presents a detailed implementation plan for Ghana, 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 Ghana, 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 Ghana is $26 million. PMI will support the following intervention areas with these funds:

Entomologic monitoring and insecticide resistance management:
Monitoring entomological and insecticide resistance are key components of vector control and management. Ghana's Integrated Vector Control Strategy views entomological monitoring and insecticide resistance management as central to the Integrated Vector Control strategy. PMI has supported entomological monitoring in its IRS districts over the years and will continue to support this activity in 17 sites in 7 districts with FY 2018 funding. Funding will support insecticide susceptibility testing (molecular and genetic), cone bioassays (for spray quality and durability of insecticide), and the determination of entomological inoculation rate and parity rates from indoor and outdoor human landing catches and pyrethroid spray catches. Additionally, PMI continues to support ten monitoring sites as part of national support to the NMCP in collaboration with Global Fund under the National Insecticide Resistance Monitoring Partnership set-up through the National Malaria Vector Control Oversight Committee platform.

Insecticide-treated nets (ITNs):
PMI continues to support Ghana's ITN strategy aimed at achieving universal coverage of ITNs through complementary distribution channels: mass campaign distribution, and continuous distribution via primary schools, antenatal care (ANC) clinics, child welfare clinics, and through private sector. With FY 2018 funding, PMI will continue working with the NMCP, Global Fund, and U.K. Department for International Development to sustain universal coverage through the continuous distribution strategy. PMI will procure and distribute 1.3 million ITNs through schools, support the NMCP to manage a successful national continuous distribution system, and promote ITN use through targeted, effective communication efforts. Following the 2018 mass distribution campaign, PMI will continue and complete year two of ITN durability monitoring to assess net survivorship, attrition, physical integrity, and bio-efficacy analysis.

Indoor residual spraying (IRS):
The NMCP's 2014-2020 National Strategic Plan aims to protect at least 80% of the population at risk by 2020 through several malaria interventions, including IRS in areas with high parasite prevalence (i.e., >40% parasite prevalence). PMI IRS has continued to maintain high coverage (93% in 2016), by using a multi-pronged approach to expanding community mobilization. During the 2017 spray season, PMI will cover 7 districts in the Northern Region, covering approximately 300,000 structures. With FY 2018 funding, PMI will continue to support IRS in the 7 Northern districts. Funding will cover IRS operations, community mobilizations and sensitization, and cost of insecticide, trainings, environmental compliance management, mosquito collections, and IRS promotion activities.

Malaria in pregnancy:
Since 2015, Ghana's National Guidelines for Malaria in Pregnancy was revised to adopt WHO's recommendation of a three-pronged approach for the prevention and treatment of malaria in pregnancy, which includes: providing sulfadoxine-pyrimethamine (SP) for the intermittent preventive treatment of malaria in pregnancy, which is recommended for all pregnant women at each scheduled ANC visit; distributing ITNs at the first ANC visit and promoting the use of ITNs during pregnancy; and effective case management of malaria during pregnancy. With FY 2018 funding, PMI will continue to support ANC clinics at health facilities and, where available, community-based health planning and services compounds to effectively deliver a package of malaria prevention services to pregnant women to include supportive supervision and on-site training of intermittent preventive treatment of pregnant women at every ANC visit and to ensure distribution of an ITN to every pregnant woman during their first ANC visit.

Case management:
The NMCP requires confirmation of all suspected malaria cases in all age groups, by either microscopy or rapid diagnostic test. For confirmed malaria cases, the NMCP strategy calls for widespread and prompt access to appropriate antimalarial treatment. The NMCP remains focused on improving the quality of microscopy at higher-level facilities and scaling up the use of rapid diagnostic tests at all levels, particularly in peripheral settings, including community-based health planning and services compounds. Currently, PMI's clinical outreach training and supportive supervision covers all public sector facilities at least twice a year since 2012. PMI works closely with NMCP and Ghana Health Service Clinical Laboratories Unit to improve the quality and scale up of malaria diagnosis in Ghana. PMI enrolled 405 health facilities with a laboratory out of a total of 580 (as enumerated in a 2017 assessment).
With FY 2018 funds, PMI will continue to support comprehensive case management training, supervision, and quality improvement through continuation of the clinical and laboratory outreach training and supportive supervision including enrolling all new facilities with laboratories into the lab outreach training and supportive supervision program, and ensure the procurement of an estimated 4 million rapid diagnostic tests and 1.2 million treatments.

Health systems strengthening and capacity building:
PMI supports a broad array of cross-cutting health system strengthening activities, such as training health workers, supply chain management, health information systems strengthening, drug quality monitoring, and NCMP capacity building. PMI supports building the operational and management capacity of other Government of Ghana agencies such as the National Health Insurance Authority with a vested interest in malaria treatment and control. Ghana's National Health Insurance Scheme has greatly increased access to health care services—particularly malaria care and treatment. As of 2017, approximately 45% of the population is covered under the National Health Insurance Scheme. PMI also prioritized support for strengthening procurement and supply chain, while also building capacity for quality assurance and supportive supervision, with a goal of sustainable and equitable health systems. Over the past year, PMI has continued to support two students in the Field Epidemiology Laboratory Training Program, fund small grants to Peace Corps Volunteers to facilitate malaria promotion activities in their communities, and strengthen the National Health Insurance Agency to build the capacity of private sector providers in under-served areas to access financing and information on standards of quality for malaria services. With FY 2018 funds, PMI will continue to support a diverse range of activities, including: strengthening the capacity of the NMCP, ensuring that the National Health Insurance Authority continues to improve access to malaria diagnosis and treatment, the National Health Insurance Authority capitation roll out, and building the capacity of local Ghanaian non-governmental organizations and civil society organizations to monitor the quality and ease of access to health services, with a focus on malaria diagnostics and treatment.

Social and behavior change communication: The *Social and Behaviour Change Communication (SBCC) Strategy for the National Malaria Control Programme (2015-2020)* provides strategic direction to guide the development, implementation, and monitoring and evaluation of the SBCC components of national malaria prevention and control efforts. With support from PMI and other partners, SBCC activities have contributed to the increased uptake and use of malaria control and prevention interventions in Ghana. PMI supports the development of SBCC campaign and communication activities, including integrated mass media campaigns and community- and facility-based interpersonal communication activities, and SBCC capacity strengthening. PMI supports the design, implementation, and evaluation of SBCC activities promoting adherence to national malaria case management guidelines (i.e. correct and consistent use of ACTs and adherence to rapid diagnostic test results), adherence to

intermittent preventive treatment of pregnant women guidelines, ANC attendance, prompt care seeking, acceptance of IRS, correct and consistent use of ITNs and ITN care practices.

Surveillance, monitoring and evaluation: The objectives of the *National Malaria Control Monitoring and Evaluation Plan (2014-2020)* are to reinforce the health information systems and processes to provide timely, accurate, reliable, and valid data for programmatic planning, management, and decision-making. PMI has contributed to strengthening Ghana's surveillance, monitoring and evaluation system, and the number of health facilities reporting timely and complete data to the district health management information system has increased since national rollout in 2012. Since 2008, PMI has supported four national-level household surveys to provide information on key malaria indicators (the 2008 and 2014 Demographic and Health Survey, the 2011 Multiple Indicator Cluster Survey, and the 2016 Malaria Indicator Survey). According to the 2014 Demographic and Health Survey, from the pre-PMI period 2003-2008, to the PMI scale-up period from 2008–2014, all-cause under-five mortality has decreased. The FY 2018 PMI plan supports the NMCP to strengthen routine health information systems for malaria M&E through continued training and supportive supervision of regional, district and health facility data management staff.

Operational research: The NMCP in Ghana has strong in-country technical capacity to conduct operational research. PMI supported operational research is guided by the 2014–2020 National Strategic Plan and falls in line with PMI operational research priorities. In 2015, Ghana Health Service, in collaboration with the NMCP held a research symposium to discuss operational research priorities in Ghana. Based on results from a 2013 formative study on outdoor sleeping and nighttime activities in the Upper and Northern Regions that suggest human outdoor exposure to malaria vectors may limit the impact of indoor-oriented vector control measures, PMI plans to further explore these patterns and conduct a study using FY 2015 and FY 2016 funds. The study is ongoing and aims to better understand malaria vector outdoor feeding and resting behavior, how these behaviors overlap with human outdoor behavior, and the relation of vector behavior to IRS and ITN insecticide pressures and insecticide resistance development.

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 4 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 Sub-region 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-supported 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 Ghana

Malaria is endemic and perennial in all parts of Ghana, with seasonal variations that are more pronounced in the northern part of the country. The length of the malaria transmission season varies by geographic region in Ghana, depending on the length of the dry season (December-February) during which there is

little transmission. In Ghana, there are two major transmission patterns. There is a six to seven month transmission season in a larger part of the north of the country and a shorter three to four month transmission in the upper part of the north, with the highest number of cases occurring between July and November. In the southern part of Ghana, the transmission season is nine months or more, with a small peak from May to June and a larger peak from October to November. Although, Ghana's entire population of 29 million[1] is at risk of malaria infection, children under five years of age and pregnant women are at higher risk of severe illness due to lowered immunity.

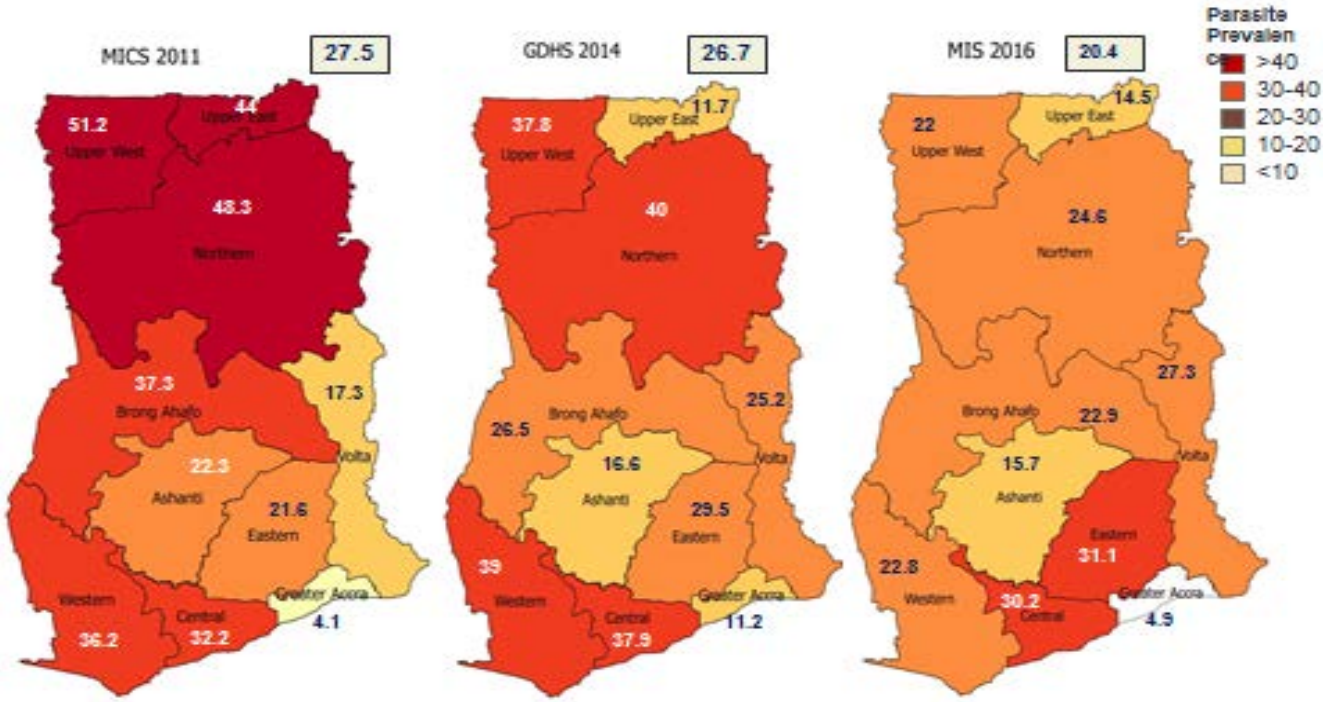
From 2012 to 2016, according to Ghana's District Health Information Management System (DHIMS2), malaria cases seen in health facility outpatient departments have increased from approximately 300 per 1,000 population in 2012, to about 316 per 1,000 population in 2016. From 2010 to 2012, there was an increase in total outpatient department (OPD) cases from 4.9 million to 11.3 million, resulting from increased access to health due to the expanding coverage of the National Health Insurance Scheme (NHIS), expanded geographical access to health care through increasing the number of community-based health planning and services (CHPS) compounds, improved data reporting, and continued presumptive diagnosis of malaria. Yet, since 2013, OPD attendance has remained steady with slight fluctuations. From 2013 to 2016, Ghana has also significantly increased malaria testing of suspect cases from 39% to 78% so with increased laboratory testing, confirmed malaria cases have increased from 143 per 1,000 population to 166 per 1,000 population. Importantly, malaria-attributable mortality has declined significantly from 19% in 2010 to 4.2% in 2016. Geographically, regions that had the highest parasitemia prevalence in 2014 have seen large decreases, while a few regions have seen small increases (Figure 1). As a result, the national parasitemia prevalence among children under 5, according to national household surveys, has decreased from 27% in 2014 to 20% in 2016.

Ghana is urbanizing rapidly, with the 2010 census demonstrating that over 50% of the population now live in urban areas. According to published research, the 2011 Multiple Indicator Cluster Survey (MICS), the PMI-supported Ghana Urban Malaria Study in April 2013, the 2014 Demographic Health Survey (DHS) and 2016 Malaria Indicator Survey (MIS), malaria prevalence tends to be lower in urban areas than in rural areas. From the 2016 MIS, malaria prevalence was higher in rural areas (28%) than in urban areas (11%).

Plasmodium falciparum accounts for 85-90% of all infections. *Plasmodium malariae (*<10%) is also found and more rarely *P. ovale* (0.15%). No cases of *P. vivax* infection have been detected in Ghana. Mixed infections of *P. falciparum* and *P. malariae* are not uncommon. The major vectors are *Anopheles gambiae* species complex and *An. funestus*. These species generally bite late in the night, rest both indoors and outdoors, and are most abundant in the rural and peri-urban areas. Outdoor biting is common in the northern savannah (>50% outdoor biting pre-IRS was documented at several monitoring sites in the northern region). *Anopheles melas* is found in the mangrove swamps of the southwest and *An. arabiensis* has been observed in the savannah areas of northern Ghana.

[1] Projected Population based on 2010 Population and housing census, Ghana Statistical services

Figure 1: Malaria Prevalence (by microscopy) in children 6-59 months, by Region, 2011 – 2016.



*All three surveys were implemented during the peak transmission season: mid-September – mid-December

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

The Ministry of Health (MOH) exercises oversight and control over policy formulation and monitoring progress towards achieving established targets. The Ghana Health Service (GHS) is responsible for delivery of public health and clinical services, in parallel with the three teaching hospitals in Accra, Kumasi, and Tamale. The National Health Insurance Scheme (NHIS) represents a major development in health system financing and has increased attendance at health facilities.

National Health Insurance Scheme

Ghana's NHIS, created in 2003 and implemented by the National Health Insurance Authority (NHIA), provides registered Ghanaians with a comprehensive benefit package. These services are provided through two different NHIA mechanisms, fee for services and capitation. Under both mechanisms, NHIA patients receive services that are part of a pre-determined comprehensive package of health services. These services are free with no upfront or co-payment. Most people enrolled in NHIA are covered under the fee for services plan in which the health care facility submits a reimbursement claim to the NHIA for the services provided to the patient. Under capitation, health care providers are contracted by NHIA to provide a predetermined comprehensive package of health services to the NHIA-enrolled patient in their practice, for which the provider receives a fixed monthly amount. Capitation encourages preventive and rationalization of care resources, but also limits the frequency with which patients can change providers, thus allowing for competition among providers. Capitation is being scaled-up in four regions (Ashanti, Upper West, Upper East, and Volta Regions), with roll out for another five regions (Brong Ahafo, Central, Eastern, Northern, and Western Regions) starting at the end of 2017. The funding streams for the NHIS are the same for both capitation and fee for services, with approximately 70% of total funding coming from a health insurance

levy added to VAT, 23% coming from contributions made by formal sector workers to the Social Security and National Trust (SSNIT), and the remainder coming from premium payments. Members do not pay deductibles or co-payments when accessing health care, and protected groups (children under five, pregnant women, elderly and the poor) are exempt from NHIS premiums.

NHIA has expanded access and utilization of services with outpatient visits increasing 35-fold and in-patient service increasing 29-fold, since 2005. NHIS is now estimated to cover 60% of the total nation's health expenditures. Currently, NHIS covers 45% of the population (roughly 13 million people). Because individuals are required to register for NHIS each year, the list of enrollees has varied, but the trend of enrollees continues to increase annually. Efforts are ongoing to increase the number of enrolled participants and retention.

In 2016, a yearlong technical review of the NHIS was conducted. A major recommendation of this review is the streamlining of the package of services to focus on free primary health care (PHC) including malaria diagnosis and treatment and maternal and child health services at all public and faith based facilities for the entire Ghanaian population. It is expected that the recommendation will soon be adopted and PHC will be implemented in 2017, ensuring PHC coverage for all Ghanaians.

Those without NHIS coverage rely mainly on informal care for malaria treatment, even though diagnosis and treatment of malaria are free of charge for all ages at public health clinics. However, the uncovered population still has access to public and private health facilities, but is required to pay for the curative services.

The NHIS provides a comprehensive benefits package, covering about 95% of health conditions affecting the population, including curative services (encompassing all necessary malaria services and medicines), as well as inpatient services, emergency care, maternity care, and oral health. The current program emphasizes curative services, but reform efforts are underway to strengthen quality of care and emphasize preventative services. While malaria remains the fourth largest cost center of the NHIS, it is the most frequently diagnosed illness in the system. The presence of NHIS in Ghana provides PMI a unique opportunity to work with Government of Ghana (GOG) to leverage the impact that insurance reimbursement has on improving malaria diagnosis and treatment. Recent studies confirm the importance of NHIS in increasing the access to, and quality of malaria treatment services. Ghanaians participating in the NHIS were overall more likely to seek treatment for malaria in the formal system (NHIS accredited public or private hospital, health center, or clinic) compared to those who were uninsured.[2]

NHIS is strengthening its regulatory oversight of accredited health providers (public and private sector) through clinical audits (which began in 2010). Independent teams conduct these audits to validate individual facility reimbursement claims and confirm that established standard operating procedures are being followed. For malaria, facilities are only reimbursed for treatment, although confirmatory testing is part of the approved standard operating procedures for receiving NHIA reimbursement for malaria treatment. If an audit finds a claim for malaria treatment, with no evidence of a confirmatory test, the facility can be required to refund the full reimbursement amount to NHIA. Failure to test due to RDT stockout is made on a case-by-case basis. The audits have generated over $1.2 million in refunds from facilities to the NHIS, and more importantly are showing improved provider compliance over time.

[2] Fenny AP, Asante FA, Enemark U, Hansen KS. "Malaria care seeking behavior of individuals in Ghana under the NHIS: Are we back to the use of informal care?" *BMC Public Health* 2015: 15: 370. DOI: 10.1186/s12889-015-1696-3

Attempts to link or compare NHIS claims data with DHIMS2 data is not feasible at this time, given the structures and types of data they each capture. However, standard claims summary forms have been implemented in the four scaled-up regions with analyzable claims data available for the first time. In conducting clinical audits, the NHIA has increasingly been using NMCP protocols as an assessment tool; and is working with district assemblies to include malaria indicators in their annual programs of work as a means of improving adherence and reducing both mortality and costs of treatment. There are also discussions on using facility adherence to NCMP protocols for malaria case management as an indicator in the Ghana district league tables, a social accountability tool which ranks districts by progress towards development. PMI is encouraging NHIA's efforts to improve the NHIS by supporting clinical audits and capitation.

Ghana Health Service

The GHS operates at 3 levels: national, regional (10 regions), and district (216 districts). Policies and major aspects of program design are developed at the national level by the central leadership and programs, such as the NMCP, while implementation and management of health services is primarily the responsibility of the decentralized health management teams at the regional and district levels. The Ministry of Health Holistic Assessment of Health Sector Program of Work 2015, published April 10, 2016, notes that the national nurse to population ratio improved from 1 nurse to 959 people in 2014 compared to 1 nurse to 739 people in 2015. This is above the ratios recommended by the World Health Organization (WHO). The number of community health nurses increased from 6,300 in 2010 to 15,900 in 2015. Additionally, as part of its strategy for equity in health care, the GHS plans to reallocate human resources from urban to rural communities in the coming year. There are 378 hospitals, 814 health centers, 1,322 clinics, and 379 private maternity homes in the country. Of these, 83% are in the public sector and 9% are faith-based institutions, most of which are closely integrated with the GHS. The remaining 8% of facilities are in the private sector and located primarily in the larger cities.

The GHS rolled out an updated electronic routine health information system (DHIMS2) in early 2012, with PMI supporting improvements in malaria data quality. By mid-2012, the DHIMS2 system was providing monthly reports that met the NMCP's benchmarks that at least 90% of districts report malaria morbidity and mortality data through DHIMS2, resulting in the phase out of NMCP's parallel reporting system.

The penetration of the GHS services at the community level is variable. The CHPS program was launched to address the challenge that, at the time of the launch, more than 70% of all Ghanaians lived over eight kilometers from the nearest health care provider,[3] a problem exacerbated by poor road and transportation infrastructure. There are currently 5,981 CHPS zones. Of these, there are 4,034 functioning CHPS zones meaning the CHPS zone has either a CHPS compound or a community health nurse affiliated with a health clinic that provides community-based health services. A CHPS compound refers to the base of operation for a community health nurse and consists of, at a minimum, a two-room facility with equipment for basic curative and preventive care. CHPS compounds provide access to community health nurses and midwives in communities of at least 6,000 people. By end of 2016, the GOG completed construction of CHPS compounds in 1,809 of the 4,034 functioning CHPS zones. Related to this objective the GOG has instructed all districts to build two CHPS compounds a year. Over the past three years, the Japan International Cooperation Agency has built over 60 new CHPS compounds, with a target of 80 by the end of 2017. In many rural areas, networks of government-trained community health volunteers promote public health services. A typical district with a population of 100,000 people has one district hospital, approximately 5 health centers and 10-15 CHPS compounds.

[3] Ministry of Health of the Republic of Ghana. 1998. A profile of health inequities in Ghana. Accra: Ministry of Health.

The NMCP is a program unit within GHS responsible for management and oversight of clinical and community-based interventions related to malaria. The NMCP is the principal recipient of malaria grants from the Global Fund. With government decentralization of services in Ghana, regional and district level malaria control activities are managed and implemented by the Malaria Focal Persons and/or the Disease Control Officers who report to the Regional and District Health Management Teams.

4. National malaria control strategy

In the past two decades, Ghana has consistently improved malaria control methods, increased resources for malaria prevention and control, and promptly adopted revised international technical standards. Between 2002 and 2004, Ghana adopted ACT as the first-line antimalarial therapy for uncomplicated malaria. IPTp with sulfadoxine-pyrimethamine (SP) was adopted as the national policy between 2003 and 2004 and is implemented by the Reproductive Health Division in collaboration with the NMCP. In 2003, international support for malaria control increased sharply; Ghana benefited from a succession of Global Fund grants, the launch of PMI in 2007, and significant additional support from the U.K. Department for International Development (DFID), the United Nations Children's Fund (UNICEF), the World Bank, and the governments of Japan, China, and Cuba. Beginning in 2005, IRS was implemented on a district-wide scale by the AngloGold Ashanti Mining Company (AGA) in Obuasi, Ashanti Region with additional districts in the north of the country receiving IRS supported first by PMI and then including the Global Fund. The availability of unprecedented external resources encouraged the NMCP to pursue an aggressive scale up of proven malaria control methods from 2008 to present.

In light of the marked inter-regional and urban/rural difference in malaria burden, the NMCP, in collaboration with major malaria partners, namely the Global Fund and PMI, are moving away from the de facto one-size-fits-all approach to programming malaria control interventions which has characterized the past decade. Moving forward, efforts are being made to tailor malaria control and case management interventions based on specific regional circumstances.

In 2013, the national malaria strategy was reviewed with support from the Roll Back Malaria Partnership and partners, which resulted in the report of the Malaria Program Review and an *Aide Memoire* that was signed by the Minister of Health and development partners in January 2014. Based on the recommendations from the Malaria Program Review and new and emerging interventions at the global level, the NMCP developed the *National Malaria Control Strategic Plan for 2014-2020,* which was finalized in August 2014. PMI provided support in the development of the strategic plan.

The scope of the strategic plan is to consolidate the recent gains and accelerate malaria control in the high transmission areas to further reduce malaria burden, and move towards establishing lower-transmission areas in Ghana by the end of 2020. The plan calls for reducing the malaria morbidity and mortality burden by 75% (using 2012 as baseline) by the year 2020 with the specific objectives outlined below:

- *To protect at least 80% of the population at risk with effective malaria prevention interventions by 2020*
    - To maintain the universal coverage already achieved, distribute ITNs through mass campaigns (one ITN per two persons) and continuous distribution through antenatal care (ANC) clinics, child welfare clinics (CWC) and primary schools, targeting pregnant women, children under five years, and school-aged children, respectively
    - IRS for areas with high parasite prevalence

- Larval control that involves larviciding and environmental management in the context of integrated vector management
- Seasonal Malaria Chemoprevention (SMC) implemented in phases in the northern part of the country where malaria transmission is highly seasonal
- Prevention of malaria in pregnancy offered as a package of interventions including the use of ITNs and IPTp3 with SP

- *To provide correct diagnosis to all suspected malaria cases and prompt and effective treatment to 100% of confirmed malaria cases in accordance with treatment guidelines by 2020*
  - Routine laboratory testing by microscopy or rapid diagnostic tests (RDTs) to address the issue of rational use of ACTs. Ghana's policy recommends that all suspected malaria cases are confirmed in accordance with the "Test, Treat, and Track" Initiative. Strengthening health worker capacity for malaria case management via supportive supervision
  - Increasing access to underserved communities where there is no CHPS compound through the integrated community case management (iCCM)
  - Improving access to diagnosis and treatment in the private sector and enforcing adherence to guidelines in the private sector

- *To strengthen and maintain the capacity for program management, partnership, and coordination to achieve malaria programmatic objectives at all levels of the health care system by 2020*
  - Holding regional and national malaria reviews
  - Facilitating relevant committee and working group meetings
  - Advocating at corporate and parliamentary levels for increased resource allocation for malaria control activities
  - Ensuring efficient and effective procurement and logistics management
  - Developing and implementing a financing sustainability plan for accelerated malaria control

- *To strengthen the systems for surveillance and M&E in order to ensure timely availability of quality, consistent and relevant malaria data at all levels by 2020*
  - Enhancing routine surveillance and coordinated monitoring of program progress
  - Supporting population based surveys: Demographic and Health Survey (DHS), Multiple Indicator Cluster Survey (MICS), Malaria Indicator Survey (MIS), and Knowledge, Attitudes and Practices (KAP) survey
  - Improving data quality and dissemination of survey and surveillance reports

- *To increase awareness and knowledge of the entire population on malaria prevention and control so as to improve uptake and correct use of all interventions by 2020*
  - Advocating to political leaders, policy makers, opinion leaders and corporate bodies for support for malaria control
  - Advocating to health worker for conforming to the Test, Treat, and Track strategy for correct case management of malaria
  - Sustaining communication, education, and community mobilization to increase knowledge among the general population to enhance uptake of malaria prevention interventions (ITN ownership and use, IRS, IPTp, etc.)

In 2009, a revised Integrated Vector Control Strategy was released and a National Malaria Vector Control Oversight Committee (MaVCOC) was established with PMI support. This committee's mandate is to ensure safe and effective implementation and management of malaria vector control operations, in

accordance with WHO guidelines and local Environmental Protection Agency pesticides regulation requirements. This committee also serves as the technical advisory body on vector control to the NMCP and the Malaria Inter-Agency Coordinating Committee (MICC). In 2014, MaVCOC released a revised standard operating procedure for IRS.

From 2008 to 2015, the MOH has sponsored the Cuban Labiofam company to conduct larviciding, beginning with a pilot in central Accra and expanding to central urban districts of Kumasi, and Sunyani. Larviciding was not considered a stand-alone intervention, but instead, part of NMCP's integrated vector management and was conducted in areas where breeding sites were few, fixed, and findable. As the number of unbiased studies on its efficacy or effectiveness in Africa is limited, larviciding in Ghana was also conducted within the context of generating data on its impact.[4] By the beginning of 2016, however, these activities had been suspended due to financial constraints and before a formal evaluation of impact.

5. Updates in the strategy section

PMI updated the strategy section in the FY 2018 MOP to provide results from the 2016 MIS compared to previous surveys, which showed an increase in coverage and use of malaria interventions (i.e. ITN ownership, access, and use, uptake of IPTp-2, etc.) and a national decrease in malaria parasitemia.

6. Integration, collaboration, and coordination

Funding

In Ghana, PMI has traditionally provided technical assistance and filled funding and commodity gaps in support of the country's malaria control program. PMI supports key, evidence-based malaria control interventions, taking into consideration the contributions from the GOG, Global Fund, DFID, and other stakeholders to ensure priority interventions are scaled up, gaps are filled, and regional variations in malaria epidemiology and progress to-date are addressed.

Given the pivotal role played by the Global Fund grants in Ghana, PMI is working with the NMCP and the Global Fund to plan for the most effective use of resources available. Global Fund supports two active malaria grants—one to the AngloGold Ashanti Malaria Control Program (AGAMal), the primary recipient of the Round 8 Grant, and the other to the NMCP/MOH (Round 4), which have been consolidated under the Global Fund's New Funding Mechanism for the period 2015-2017.

Under Global Fund's New Funding Model, implemented in 2015, Ghana has approximately $118 million available through year end 2017. With the grant, the NMCP and AGAMal implement a full suite of malaria control interventions including vector control, case management, MIP, SBCC, and SM&E. While AGAMal had planned to scale up IRS implementation to 40 districts, the current funding will not support the expansion, and NMCP has thus re-programmed funds away from IRS to support other malaria control activities. Therefore, AGAMal reduced its coverage from 25 districts in 2014 to 10 districts in 2016 and 2017. At the time of writing this MOP, the request for funding to Global Fund for $111 million for malaria control activities for a three-year period (2018-2020) is being developed. Similarly, with the new funds, the NMCP and AGAMal are proposing to support a full suite of malaria control interventions. Related to vector control, the NMCP proposes to continue supporting IRS in nine districts of the Upper West Region

[4]WHO, Global Malaria Program 2012
http://www.who.int/malaria/publications/atoz/interim_position_statement_larviciding_sub_saharan_africa.pdf

and Obuasi District in Ashanti Region, with aspiration to expand to three districts in the Upper East Region if additional funding becomes available.

Since 2013, DFID has provided approximately £10 million (approximately $16 million) to support malaria control in Ghana. DFID has supported the Private Sector Malaria Program and the procurement of SMC commodities for the SMC pilot in Upper West and Upper East Regions in coordination with the Global Fund. DFID will continue to support the Private Sector Malaria Program, a five year, £5 million program until the end of 2019.

The U.S. Government is well-represented and engaged in oversight bodies in Ghana such as the Health Sector Working Group organized by the MOH, the Country Coordination Mechanism for the Global Fund, and the tri-annual health business meetings that draw participants from all over the country to review and plan national health interventions. In addition, the U.S. Government coordinates with malaria control stakeholders through multiple committees and subcommittees organized under the NMCP, including the MaVCOC, the ITN Coordinating Subcommittee, Case Management Subcommittee, Communication Subcommittee, Resource Mobilization and Sustainability Subcommittee, and the Surveillance, Evaluation and Monitoring Committee. Ghana's Malaria Interagency Coordinating Committee (MICC), created in 2013, is designed to be the convening body of malaria expertise in Ghana across all sectors and intended to help coordinate disease control efforts across all sectors and partners.

Private Sector

Ghana has a large and rapidly growing private sector whose engagement in malaria control has increased substantially during the past decade. This has encompassed corporate social responsibility programs (e.g. AGAMal/Global Fund, oil companies), work place health care promotion efforts (e.g. mines and plantations), and marketing of malaria medications and preventive services (e.g. pharmaceutical manufacturers, sanitation companies, and larviciding). As expected, not all private sector engagement has been aligned with NMCP policy or international public health interests (e.g., the distribution of substandard medications, the confusion of environmental management and garbage control with *Anopheles* mosquito control, and the aggressive marketing of new health and diagnostic technology).

Recognizing the fact that Ghana's categorization as a lower middle income country would lead to gradual decrease of international donor support, the NMCP recently formed the Resource Mobilization and Sustainability Subcommittee with PMI support. This subcommittee aims to promote greater buy-in and involvement from private sector and the GOG, including raising awareness about the impact of malaria on productivity and GDP. In late 2015, the Malaria Foundation was formed, with guidance from NMCP, as a private foundation to support malaria. A retired Chief Executive of an investment bank was appointed as official Malaria Ambassador at the ceremonial launch, with finalization of its charter and legal structure still pending. It is envisaged that business and industry leaders will serve on its board. PMI continues to work to improve malaria diagnostics, treatment, and referrals in the private sector, specifically community businesses, such as pharmacies and over the counter medicine sellers (OTCMS). PMI coordinates with the NMCP, GHS, National Drugs Program, Pharmacy Council, GOG researchers, pharmacy associations, and other stakeholders to promote RDT diagnosis and scale up appropriate case management or referral of clients at OTCMS shops and pharmacies.

Within U.S. Government

PMI collaborates with other U.S. Government agencies supporting malaria control in Ghana such as Peace Corps, Centers for Disease Control and Prevention (CDC), Naval Medical Research Unit No. 3, Department of Defense, National Institutes of Health, and the State Department. Peace Corps volunteers

have been integrated into PMI supported projects for community mobilization and the promotion of malaria control interventions. Peace Corps volunteers have been engaged in ITN distribution, SBCC and community mobilization activities, and selected PMI operational research. The Department of Defense, National Institutes of Health, and Naval Medical Research Unit No. 3 support malaria vaccine research, surveillance of incidence and causes of fevers, laboratory system strengthening for infectious disease, and drug resistance monitoring.

The U.S. Government supports integrated health programs in Ghana to strengthen health systems while addressing specific goals in maternal and child health, nutrition, reproductive health, water and sanitation, malaria, and HIV/AIDS. USAID/Ghana focuses its health program investments in five regions (Central, Greater Accra, Northern, Volta and Western), at the community, district, and regional levels to encourage positive behavior change, improve the quality of service delivery, and improve health management systems, thereby achieving results across the full spectrum of health elements. PMI programs have been integrated into these efforts to ensure that malaria-specific content is strengthened (e.g. in training and quality assurance) and that health system strengthening will lead to improvement in malaria control indicators (e.g. improved availability of ITNs, RDTs and ACTs). In addition, PMI supports ITN distribution, expanded case management interventions (e.g. lab and clinical supportive supervision, etc.), and procurement and distribution of essential malaria commodities (ITNs, SP, ACTs, and RDTs) to ensure the entire country is covered.

PMI support to strengthen commodity supply chain management is combined with USG funding under the President's Emergency Plan for AIDS Relief and other USAID health funding, in a concerted effort to improve supply chain management for all pharmaceuticals and health commodities. PMI's contributions and technical assistance to strengthening IPTp are integrated with the ANC program and include support to strengthen training institutions for midwives throughout the country. Support for case management provided in concert with capacity building for management of other childhood illnesses, such as diarrhea and respiratory infections, brings added value to both PMI and maternal and child health programs.

In 2015, the CDC Division of Global Health Protection began supporting Ghana's Global Health Security Agenda goals to strengthen health service delivery, laboratory capacity, and prevent outbreaks. In 2016, Ghana was identified as a U.S. Government Phase 2 country. Specific Global Health Security Agenda/Ghana programs include: the immunization flagship project to scale-up routine childhood vaccinations and detect gaps in coverage; workforce development through Field Epidemiology Training Program Frontline; strengthening surveillance of reportable diseases through integrated disease surveillance and response and piloting a community event-based surveillance system in 2 districts to detect/report unusual health events for the critical early detection of emerging and re-emerging pathogens in the community; and strengthening laboratory capacity for the detection of 15 priority diseases. PMI continues to collaborate with CDC and GOG to ensure complementarity of programs to strengthen the health systems to enhance malaria control efforts.

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-supported 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-supported 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-supported countries, achieving a greater than 80% reduction from PMI's original 2000 baseline levels.
2. Reduce malaria morbidity in PMI-supported countries by 40% from 2015 levels.
3. Assist at least five PMI-supported countries to meet the World Health Organization's criteria for national or sub-national pre-elimination.[5]

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 old 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

8. Progress on coverage/impact indicators to date

PMI and the NMCP rely on nationally representative household health surveys to track progress in coverage of malaria control interventions in Ghana. There have been six such surveys implemented by the Ghana Statistical Service and partners since 2003, each conducted during the late rainy season, albeit during different months and in some cases employing slightly different methods. The 2008 DHS, conducted in September-November 2008, provides the baseline for key PMI indicators. The 2011 MICS and 2014 DHS both incorporated a full malaria module, and were conducted in September-December. The 2016 MIS is the most recent population-based health survey.

The 2016 MIS reported significant progress in malaria indicators, most notably, IPTp2 uptake reported at 78%. In comparison to the 2014 DHS, IPTp3 has increased from 39 % to 60%. Net ownership increased from 68% to 73%. Net use among pregnant women increased from 43% to 50% and among children under 5 year old increased from 47% to 52%. Yet, the 2016 MIS highlights a gap between net use and access that

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

requires more exploration. The 2016 MIS also showed a decrease in percentage of children under five with diagnosis of malaria by microscopy from 27% to 20% (Table 1).

Ghana has achieved steady gains in many of the key malaria intervention indicators, as indicated in Table 1. Between 2006 and 2014, ITN ownership and use, uptake of IPTp, and treatment with ACTs have all increased.

Table 1: Evolution of Key Malaria Indicators in Ghana from 2006 to 2016

Indicator	2006 MICS	2008 DHS	2011 MICS	2014 DHS	2016 MIS
% Households with at least one ITN	19%	42%	49%	68%	73%
% Households with at least one ITN for every two people	NA	NA	25%	45%	50%
% Children under five who slept under an ITN the previous night	22%	39%	39%	46%	52%
% Pregnant women who slept under an ITN the previous night	NA	20%	33%	43%	50%
% Rooms in PMI targeted districts protected by IRS*	NA	>85%	93%	84%	93%
% Children under five years old with fever in the last two weeks for whom advice or treatment was sought	NA	NA	50%	56%	72%
% Children under five with fever in the last two weeks who had a finger or heel stick	NA	NA	16%	34%	30%
% Children receiving an ACT among children under five years old with fever in the last two weeks who received any antimalarial drugs**	3%	12%	18%***	37%	61%
% Women who received two or more doses of IPTp during their last pregnancy in the last two years**	28%	44%	64%	67%	78%
% Women who received three or more doses of IPTp during their last pregnancy in the last two years	NA	NA	NA	38%	60%
Malaria prevalence in children under five years old (RDT; microscopy)	NA	NA	48%; 28%	36%; 26%	28% 20%
% Children under five with hemoglobin <8.0 g/dL	NA	NA	7 %	8%	NA
All-cause under five mortality	111	80	82	60	NA

* Source: Abt/AIRS annual report for 2008, 2011 2014, and 2016; ** SP was adopted for IPTp in 2003; ACTs were adopted in 2004; *** The 2011 MICS did not distinguish adequately between responses for "amodiaquine" (23.6%) and "artesunate-amodiaquine," which was counted along with arthemeter-lumefantrin, dihydroartemisinin – piperaquine as "any ACT" (18%). Thus, the true figure may lie somewhere between 18% and an estimated 36%. Supporting this conclusion, government health centers and CHPS compounds were found to prescribe an implausible 55.6% "amodiaquine." Moreover, it has emerged that in popular speech, artesunate-amodiaquine is often called "amodiaquine."

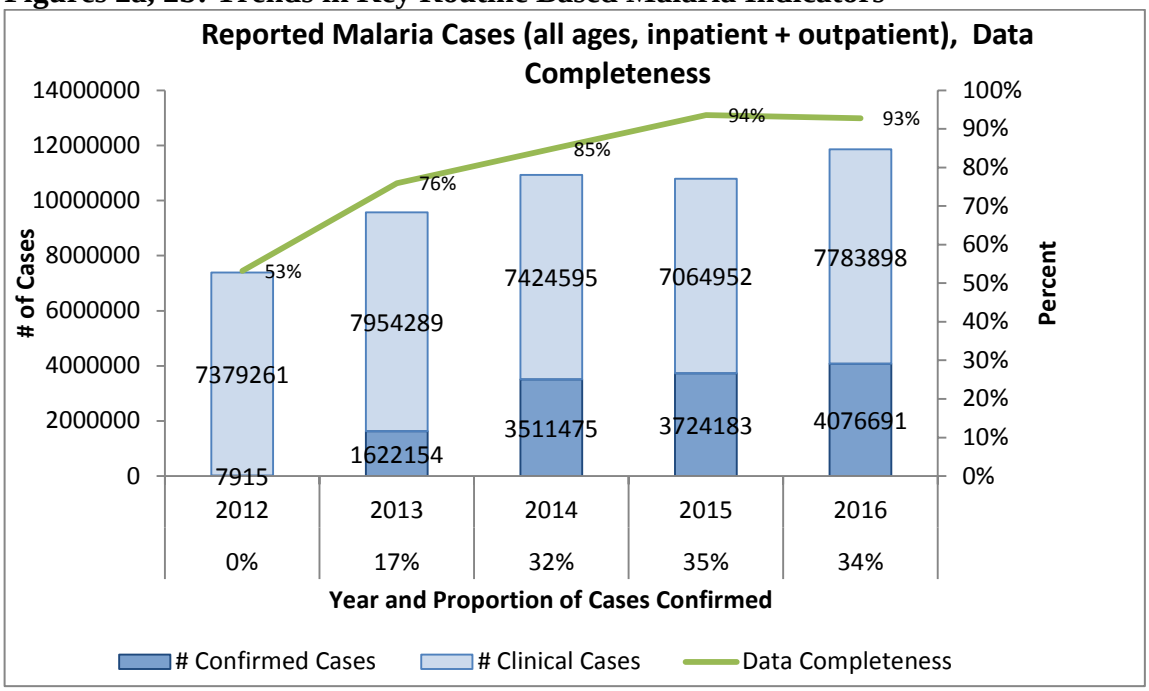
From 2012 to 2016, according to the HMIS, reported malaria cases seen in health facility outpatient departments have increased by 5%, from 7,379,261 to 7,783,898. Importantly, Ghana has significantly increased malaria testing of suspect cases from 39% in 2012 to 78% in 2016. Therefore, with increased laboratory testing, confirmed malaria cases have increased 16% from 3,511,475 in 2014 to 4,076,691 in 2016. Test positivity rate (TPR) has increased with expanded testing and has remained steady. (Table 2, Figure 2a). Data completeness has also improved from 53% in 2012 to 93% in 2016. Malaria cases in children under five have fluctuated slightly from 12% to 13% in 2016 (Figure 2b).

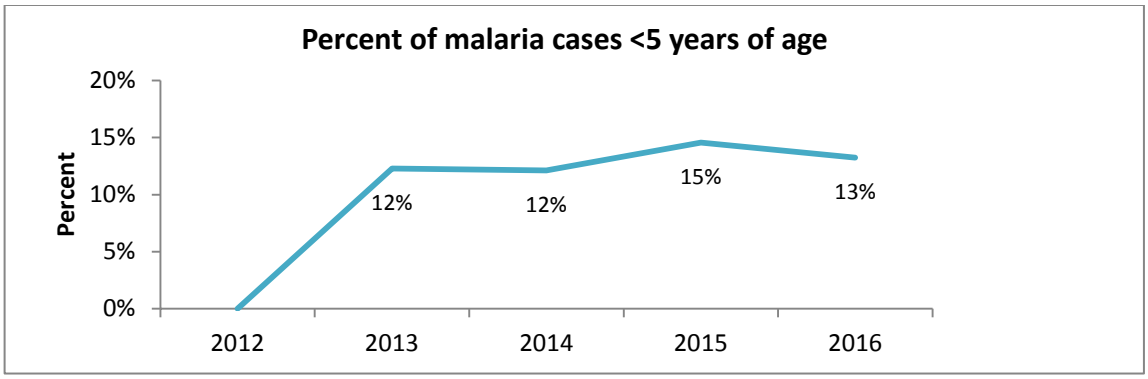
Table 2: Evolution of Key Malaria Indicators reported through routine surveillance systems in Ghana from 2012 to 2016

Indicator	2012	2013	2014	2015	2016
Total # reported malaria cases*	7,379,261	7,954,289	7,424,595	7,064,952	7,783,898
Total # of diagnostically confirmed cases	7,915	1,622,154	3,511,475	3,724,183	40,766,91
Total # <5 Cases (confirmed)	NA	1,177,075	1,326,170	1,569,903	1,571,745
Total # inpatient malaria deaths	2,799	2,985	2,200	2,137	1,297
Data Completeness** (%)	53%	76%	85%	94%	93%
Test Positivity Rate (TPR)	27%	61%	63%	56%	54%

*The same as the total number of suspected (i.e. fever) cases. **Percentage of health facilities reporting each month

Figures 2a, 2b: Trends in Key Routine Based Malaria Indicators





9. Other relevant evidence on progress

A health systems baseline survey was conducted from March – May 2015 to determine the current levels of key health systems indicators relevant to USAID's health portfolio in Ghana, which includes malaria. The two main objectives of the baseline study were to (1) guide program implementation and set early targets and (2) enable an evaluation of USAID's investments using a pre-post design that will compare indicator levels in the future of those levels at baseline. The final list of research questions was determined to be most relevant to USAID investments and could not be answered using existing data sources. Organized into four thematic areas, both quantitative and qualitative questions covered: (1) quality of care and services; (2) culture of quality assurance and quality improvement; (3) community and governmental support for CHPS; and (4) health insurance.

A total of 597 facilities (451 CHPS compounds and 146 health centers) were randomly sampled from all 10 regions for the quantitative component of the survey. One hundred and seventy qualitative interviews (152 key informant interviews and 18 focus groups) were completed across the five USAID focal regions. Key results showed that 80% of CHPS zones and all health centers had at least one staff member providing treatment for malaria; about one-third of CHPS compounds and health centers did not standardly test for malaria, as prescribed by national guidelines. The most common reasons for not testing were insufficient RDT supply, lack of availability of RDT/lab at certain times of the day or night, and assumption that fever was due to another reason. At the time of the survey 42% of CHPS compounds had not received malaria outreach training and supportive supervision (OTSS) because some regions were not implementing the supportive supervision. However, currently, all ten regions are implementing OTSS and 97% of all health workers are covered by the intervention. Stockouts of malaria RDTs remain problematic – 51% of CHPS that did not test all clients with fever had insufficient RDT supplies. Using the same framework as the baseline survey, the midline survey will be conducted in March – May 2017 with results available in December 2017. The endline survey will be implemented in 2019.

III. OPERATIONAL PLAN

1. Vector monitoring and control

NMCP/PMI objectives

The *National Malaria Control Strategic Plan for 2014-2020* supports an integrated vector management program. PMI aligns its interventions in Ghana with the strategic plan, and in collaboration with partners supports universal coverage of ITNs. ITNs are provided through mass campaigns and continuous distribution at ANC clinics (targeting pregnant women), CWC targeting children under five years, and primary schools (targeting children in classes two to six). PMI supports social and behavior change communication (SBCC) and community mobilization activities to promote correct and consistent ITN use, with an 85% target of use among pregnant women and children under five years of age. Currently, with PMI and Global Fund support, the NMCP plans to conduct IRS in 20 districts. The Global Fund will cover a sub-set of the districts in Upper West (9 districts), Upper East (3 districts) and Ashanti (1 district) regions. PMI will cover a sub-set of districts in Northern Region (7 districts). The PMI IRS campaign aims to spray 85% of eligible structures in each of the 7 districts in the Northern Region and support related entomological monitoring. PMI also supports a national insecticide resistance monitoring program. Program activities include collecting *Anopheles* mosquitoes and testing them for susceptibility to insecticides, genotyping for resistant genes, and assessing biochemical resistance. PMI also supports the establishment and maintenance of a national database for entomological and insecticide resistance data, with the objectives of measuring the impact of malaria control interventions, tracking insecticide resistance trends, and developing an effective insecticide resistance management plan for current and future malaria control activities.

a. Entomologic monitoring and insecticide resistance management

Routine Entomological and Insecticide Resistance Monitoring of PMI IRS Districts

Progress since PMI was launched

Entomological and resistance monitoring in PMI IRS districts has matured since the introduction of IRS. During the ninth IRS round in 2016, the number of sentinel sites increased from 14 to 17 (13 PMI entomological monitoring sites in 2014, 14 in 2015, and 17 in 2016) (Figure 3), with continued emphasis placed on quality control and monitoring of important entomological parameters. Three entomological monitoring sites in Savelugu Nanton district were maintained when IRS was withdrawn after the 2014 spray season. A new site in West Gonja district was added in 2015 and three sites were added in 2017 when IRS was expanded to Gushiegu and Karaga districts. Morphological and molecular analysis of mosquitoes collected at PMI entomological monitoring sites has demonstrated that IRS has a positive impact on several entomological parameters, including entomological inoculation rates, parity, and indoor resting densities in communities covered by the program in Northern Region.

Progress during the last 12-18 months

PMI IRS entomological monitoring activities demonstrate a decline in malaria transmission in areas covered by IRS in Northern region. In contrast, when IRS is withdrawn, entomological indicators ceased to indicate improvement, as was observed in Savelugu-Nanton in 2015-2016 and Tolon-Kumbungu in 2014-2016. The impact of IRS on entomological variables within these periods could be attributed to the effectiveness of pirimiphos-methyl due to the high susceptibility of local vector species (98-100%) and the excellent quality of insecticide applications. The 2016 IRS campaign demonstrated that pirimiphos-methyl was effective at killing the older (infected) female *An. gambiae* and *An. coluzzii* mosquitoes, reducing their

life spans, lowering mosquito infection prevalence rates, lowering mosquito biting densities and ultimately lowering malaria transmissions as measured by entomological inoculation rates (EIRs) within IRS areas.

Figure 3: 2016 PMI-supported IRS districts, and entomological monitoring sentinel sites

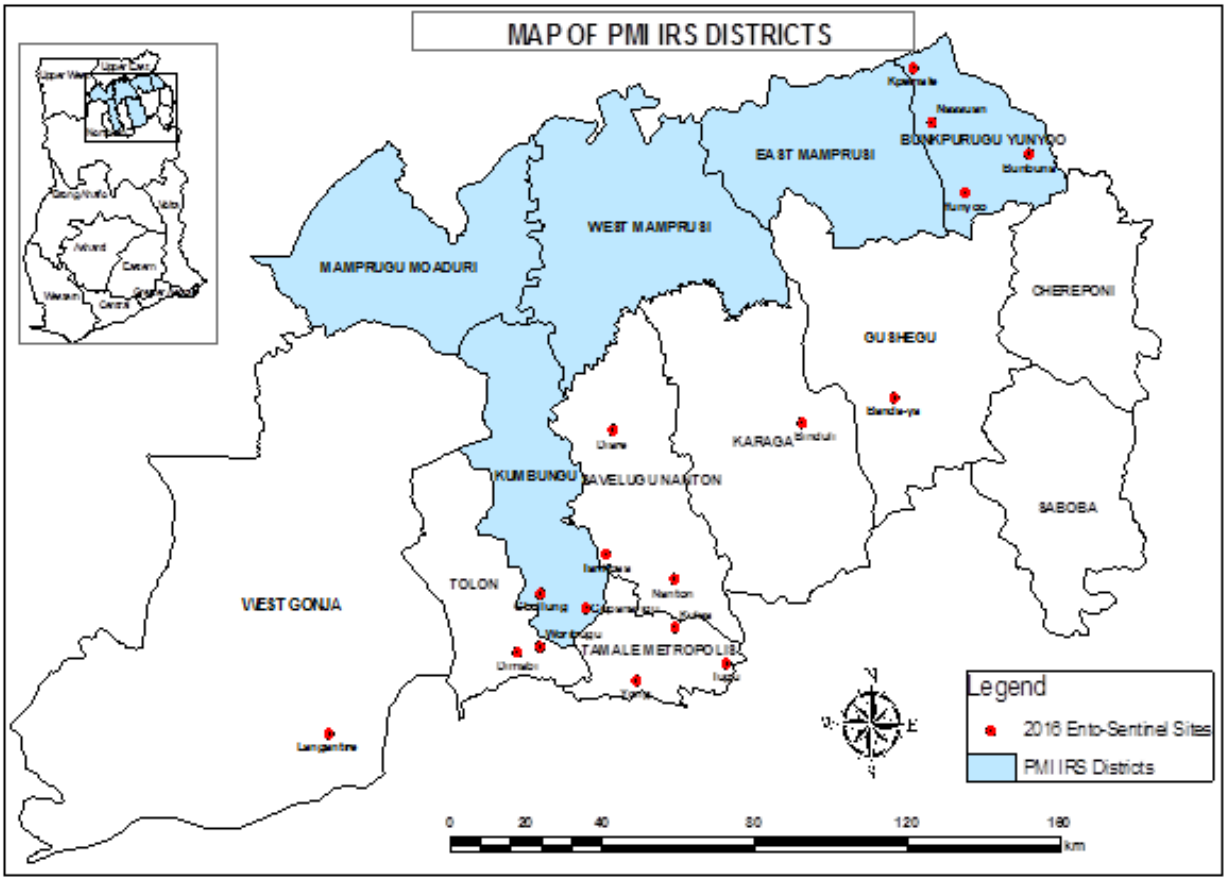


Table 3: Selected entomological variables, IRS and non-IRS Districts, 2010-2016

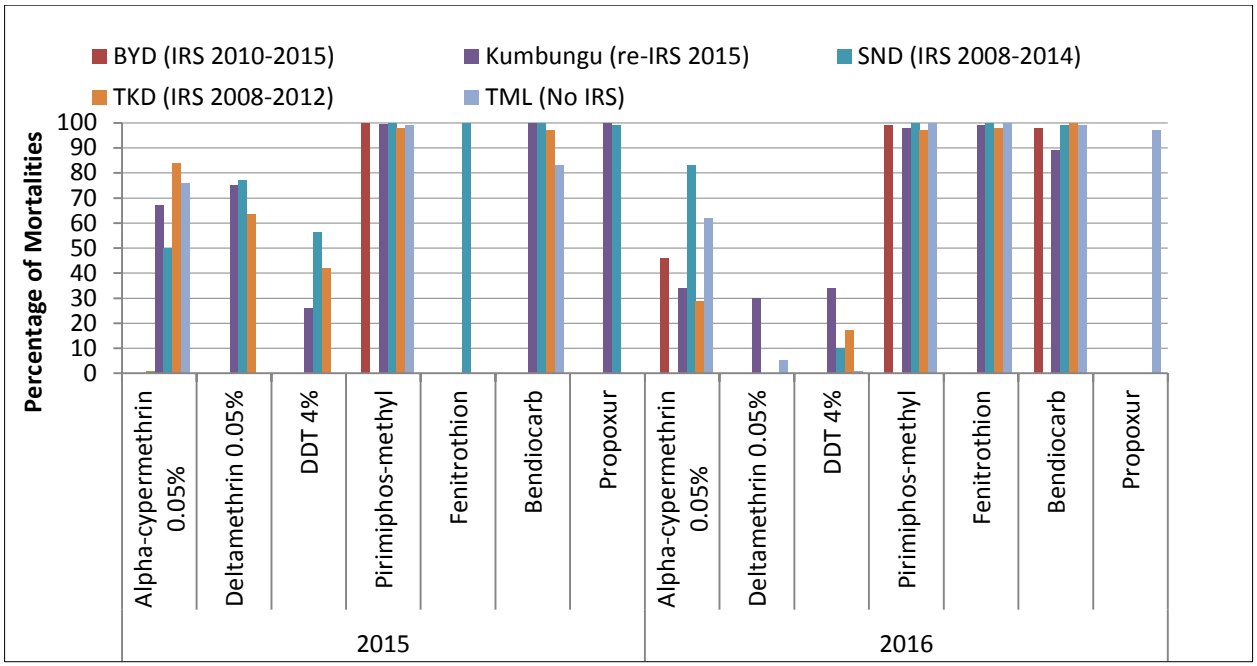
Bunkpurugu-Yunyoo (IRS)	**2010 (Pre-IRS)**	**2011 (PYR)**	**2012 (PYR)**	**2013 (OP)**	**2014 (OP)**	**2015 (OP)**		**2016 (OP)**	
[1]**Annual Entomological Inoculation Rate (EIR)**	127.0	87.1	6.0	6.8	3.3	3.8		8.2	
[2]**Mosquito Parity (%)**	74.5	64.7	43.1	28.2	24.3	30.6		39.3	
[3]**Mosquito indoor resting density**	N/A	3.0	1.5	0.2	0.1	0.2		0.4	
Savelugu-Nanton (IRS stopped after 2014)	**2010 (PYR)**	**2011 (PYR)**	**2012 (OP)**	**2013 (OP)**	**2014 (OP)**	**2015 (No IRS)**		**2016 (No IRS)**	
Annual EIR	7.0	9.2	10.3	0.0	0.0	14.2		16.8	
Mosquito Parity (%)	N/A	44.8	37.4	27.5	28.1	51.2		57.2	
Mosquito indoor resting density	N/A	1.2	1.6	0.4	0.7	0.8		0.3	
Tolon-Kumbungu (Partial IRS)	**2010 (PYR)**	**2011 (PYR)**	**2012 (PYR)**	**2013 (No IRS)**	**2014 (No IRS)**	**2015**		**2016**	
						Tolon (No-IRS)	**Kumbungu (OP)**	**Tolon (No-IRS)**	**Kumbungu (OP)**
Annual EIR	21.0	24.0	102.8	93.3	166.9	13.0	26.2	14.4	11.3
Mosquito Parity (%)	N/A	53.3	46.6	50.4	68.5	67.4	53.1	69.4	54.6
Mosquito indoor resting density	0.9	0.8	0.9	0.7	0.9	0.7	1.1	0.4	0.5
Tamale (Non-IRS)	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**		**2016**	
Annual EIR	110.0	135.0	104.8	160.9	113.9	48.9		55.1	
Mosquito Parity	N/A	68.6	65.8	64.3	72.3	68.3		66.8	
Mosquito indoor resting density	3.1	2.6	1.6	1.7	2.3	1.0		1.9	

[1]Annual Entomological Inoculation Rate (EIR): number of infective bites/person/year;
[2]Mosquito Parity: % of mosquitoes that had laid eggs;
[3]Mosquito indoor resting density: number of mosquitoes/person/room/night;
PYR – Pyrethroid; OP- Organophosphate; Kumbungu (re-IRS 2015) - IRS was re-introduced in only Kumbungu in 2015; TKD (IRS 2008-2012) - IRS was in both Tolon and Kumbungu when the district was not split into two

Resistance testing of local malaria vectors (*An. gambiae* s.l.) in PMI IRS districts in Northern Region showed continued high susceptibilities to the organophosphate pirimiphos-methyl (0.025%, WHO assay) selected for IRS (Figure 4). Monthly wall bioassays in 2015 and 2016 demonstrated that pirimiphos-methyl remained effective (>80% mortality) on sprayed surfaces for at least seven months, which was comparable in longevity to previously used pyrethroid insecticides. Standard WHO cone assays were conducted in

communities in Savelugu-Nanton District (SND), Bunkpurugu-Yunyoo District (BYD), Tolon-Kumbungu District (TKD), Kumbungu District, and Tamale Metropolitan (TML) within three days after spraying to test the quality of work by spray teams and to evaluate the potency of the insecticide on three main types of sprayed surfaces: mud, cement, and wood. Results showed 100% mosquito mortality on the tested surfaces, indicating excellent insecticide efficacy and spray coverage.

Figure 4: **Percentage mortalities of *Anopheles gambiae* s.l. exposed to diagnostic doses of different insecticides, PMI entomological sites, 2015-2016.**

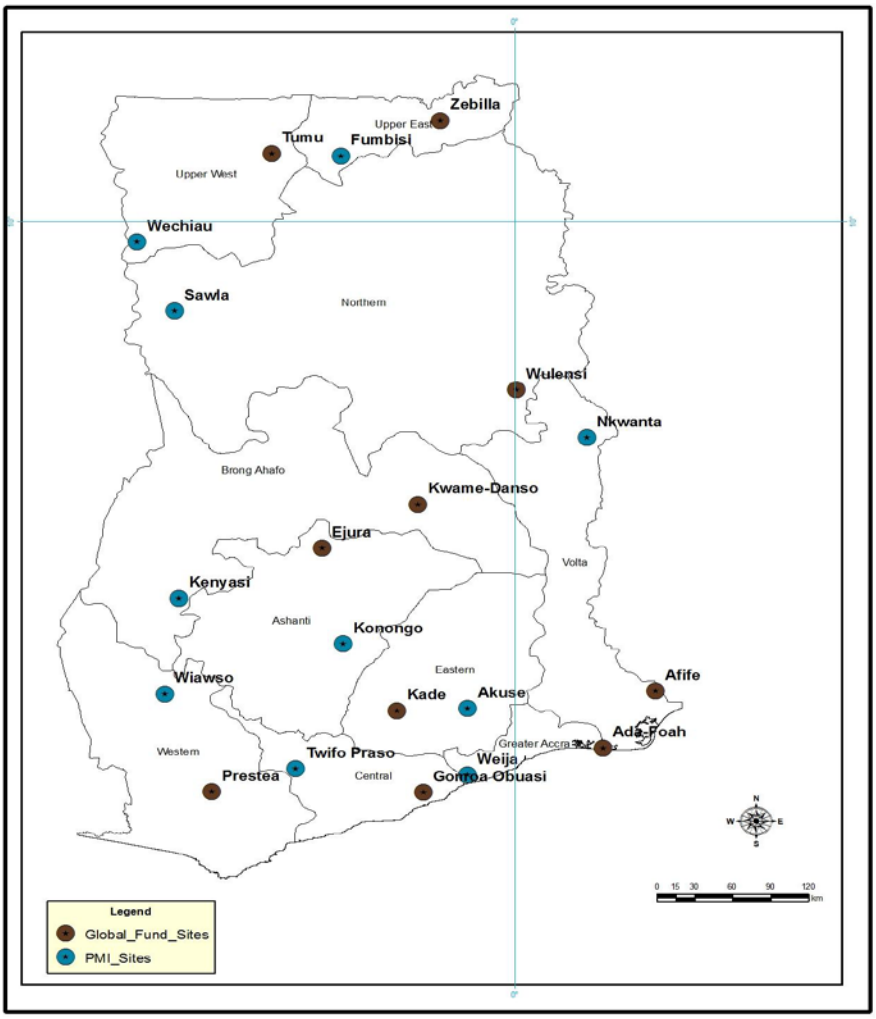


National Insecticide Resistance Monitoring Partnership (NIRMOP)

Progress since PMI was launched

With PMI support, the National Insecticide Resistance Monitoring Partnership (NIRMOP) regularly (quarterly) brings together researchers and partners in malaria vector control to plan, conduct, and evaluate results of insecticide resistance testing at sentinel sites throughout the country. There are 20 entomological sentinel sites, 2 in each region, and PMI began supporting 10 of these 20 sites in 2013 (Figure 5). Initially there was some mixed success completing assays due to incomplete oversight and accountability issues, but after rapid improvements the program is now fully functional and yields valuable data to inform all partners and programs.

Figure 5: **Map of NIRMOP twenty entomological sentinel sites in Ghana**.



Progress during the last 12-18 months

With support from the NMCP, Noguchi Memorial Institute for Medical Research (Noguchi) takes the lead in NIRMOP implementation activities. As in previous years, PMI and the Global Fund each provided half the funding for NIRMOP in 2016. Bioassay testing was completed at the 20 sites, with more than 90% of sites completing the minimum testing required. All surveys (bioassays) were done according to NIRMOP's standard operating procedures.

An. gambiae s.l. was susceptible to organophosphates, and to a lesser extent carbamates, in many of the sites (Tables 4a and 4b). *An. gambiae* s.l. was susceptible to pirimiphos-methyl, an organophosphate, in six of the ten sites, with possible resistance developing at two sites (Kenyase and Konongo). Pirimiphos-methyl is the IRS insecticide currently used in Northern and Upper West Regions, and results show that the local vectors are still susceptible to this insecticide in these regions.

Table 4a: Percentage mortalities of *Anopheles gambiae* s.l. exposed to diagnostic doses of different insecticides in the five northern regions of Ghana, 2016.

Region / Insecticides	Northern	Upper East	Upper West	Brong Ahafo	Ashanti
	Sawla	Fumbisi	Wechiau	Kenyase	Konongo
Deltamethrin	7.3 (96)	49.4 (81)	34.5 (84)	70.3 (91)	1.1 (89)
PBO+Deltamethrin	84.2 (95)	96.5 (85)	96.3 (98)	95.0 (80)	75.0 (84)
Permethrin	5.3 (94)	17.8 (90)	10.3 (87)	63.2 (87)	13.3 (83)
PBO+Permethrin	14.7 (95)	42.1 (95)	80.5 (87)	88.2 (85)	68.7 (83)
Alphacypermethrin	47.9 (94)	93.8 (80)	88.2 (85)	82.9 (82)	75.3 (81)
DDT	4.1 (98)	16.3 (80)	19.8 (81)	16.0 (81)	1.3 (80)
Bendiocarb	76.7 (90)	67.1 (79)	70.7 (82)	75.3 (81)	53.8 (80)
Malathion	100.0 (96)	97.7 (88)	98.8 (82)	100.0 (85)	88.0 (83)
Pirimiphos methyl	99.0 (98)	100.0 (82)	100.0 (79)	90.1 (81)	84.0 (81)
Fenitrothion	74.1 (85)	52.6 (78)	NA	NA	30.0 (80)
Propoxur	50.6 (89)	70.3 (91)	NA	91.4 (81)	30.4 (79)
Cyfluthrin	NA	NA	NA	NA	NA

NB: Numbers in brackets ( ) are numbers of mosquitoes exposed
NA: Test not done due insufficient mosquitoes to expose to insecticide

Table 4b: Percentage mortalities of *Anopheles gambiae* s.l. exposed to diagnostic doses of different insecticides in five southern regions of Ghana, 2016.

Region / Insecticides	Greater Accra	Volta	Central	Western	Eastern
	Weija	Nkwanta	Twifo	Sefwi	Akuse
Deltamethrin	8.3 (96)	47.1 (87)	13.7 (73)	30.6 (72)	8.6 (93)
PBO+Deltamethrin	32.3 (99)	90.4 (83)	52.1 (71)	75.0 (80)	91.3 (92)
Permethrin	5.1 (99)	17.1 (82)	5.6 (90)	11.8 (76)	31.1 (90)
PBO+Permethrin	7.5 (93)	46.5 (71)	25.9 (81)	37.3 (83)	72.0 (93)
Alphacypermethrin	43.3 (97)	71.3 (87)	10.3 (97)	43.2 (88)	49.5 (95)
DDT	2.1 (96)	1.1 (91)	4.2 (95)	9.6 (83)	14.4 (90)
Bendiocarb	51.5 (97)	90.5 (84)	100.0 (91)	92.5 (80)	8.6 (93)
Malathion	93.9 (98)	98.9 (90)	100.0 (98)	98.8 (81)	100.0 (94)
Pirimiphos methyl	46.2 (93)	98.8 (85)	93.7 (95)	100.0 (82)	100.0 (95)
Fenitrothion	85.9 (99)	NA	100.0 (84)	NA	69.2 (91)
Propoxur	70.1 (97)	93.9 (82)	96.9 (98)	NA	20.7 (92)
Cyfluthrin	5.1 (99)	41.7(84)	14.6 (82)	NA	NA

NB: Numbers in brackets ( ) are number of mosquitoes exposed
NA: Test not done due insufficient mosquitoes to expose to insecticide

National Insecticide and Entomological Database

Progress since PMI was launched

In 2014, PMI supported the development of a database to track insecticide resistance and entomological data associated with PMI IRS entomological monitoring activities in Northern Region. In late 2015, Ghana's Malaria Vector Control Oversight Committee (MaVCOC), with PMI support, authorized the PMI

database to be expanded and re-designed to incorporate the data currently gathered by all entities conducting entomological and insecticide resistance monitoring. The database will provide the NMCP/MaVCOC with a more comprehensive view of insecticide resistance and other entomological parameters associated with vector control activities. Management of the database will be transferred to the NMCP, but individual contributors will maintain control over use of their data for publication.

Plans and justification
Entomological monitoring is a key component of the PMI vector control program, and given its importance in the NMCP strategy, PMI will continue to support routine entomological monitoring in PMI IRS districts in Northern Region (See IRS section). Given the success of NIRMOP's insecticide resistance collections from 2015 to 2016 and the importance of insecticide resistance monitoring in the NMCP strategy, PMI will continue to support 10 of the 20 existing NIRMOP sites in FY 2018, while the Global Fund will support the remaining 10 sites.

Proposed activities with FY 2018 funding: ***($235,500)***

- *Nationwide insecticide resistance monitoring:* In collaboration with another partner and national research institutions, PMI will continue to support insecticide resistance monitoring at 10 of the 20 existing NIRMOP entomological sentinel sites. Insecticide resistance monitoring will be conducted using standard WHO susceptibility testing with at least six insecticides from the four insecticide classes. The funding supports technical assistance, equipment, training, oversight, data collection, and reporting. This activity will leverage other vector control partner resources for entomological and insecticide resistance monitoring activities and will help fill gaps to ensure national coverage. *($50,000)*

- *Routine entomological monitoring:* IRS routine entomological monitoring will continue at 17 entomological monitoring sites in Northern Region. The activities include: WHO bottle assay insecticide susceptibility testing, cone bioassays (for spray quality and durability of insecticide), molecular analysis for species identification and resistance genes, and the determination of entomological inoculation rates, and parity rates from indoor and outdoor human landing catches and pyrethroid spray catches. *($185,500)*

b. Insecticide-treated nets

Progress since PMI was launched
Mass Distribution
In 2012, Ghana completed its first Universal Coverage Campaign (UCC) with a hang-up component. This UCC distributed more than 12.4 million long-lasting ITNs in all ten regions. The replacement campaign was scheduled to take place in 2014-2015 in nine of the ten regions (Upper West Region, which is covered by IRS, was initially excluded from the UCC). The UCC began in late 2014; however, the January 2015 Central Medical Stores (CMS) fire (which destroyed over 1.4 million ITNs) forced the NMCP to adjust the distribution schedule and extend the rolling campaign into 2016. By October 2016, a total of 14.9 million ITNs were distributed through a mass distribution campaign in each of the 10 regions, including the Upper West Region. About 3 million ITNs were distributed in 2014 covering Eastern and Volta Regions; 7 million ITNs were distributed in 2015 covering Ashanti, Brong Ahafo, Central, and Western Regions; and 4.9 million ITNs were distributed in 2016 covering Greater Accra, Upper East, Upper West, and Northern Regions. The next planned UCC is scheduled to take place nationwide in 2018 in two phases (phase one

will include Brong Ahafo, Western, Central, Volta, and Eastern Regions and is slated to start in the first quarter of 2018) over six months. The NMCP is currently working with malaria control partners to secure over 15 million ITNs needed for distribution in 2018. Going forward, Ghana will strive to implement a consolidated mass ITN distribution campaign over a six month period rather than the previously implemented "rolling" mass ITN distribution campaign.

Continuous Distribution
Following the 2012 UCC, the NMCP, with PMI support, pioneered a mixed model of continuous distribution channels in 2013 with a pilot to test the viability of ITN distribution through different channels, including: ANC clinics, CWCs (through the Expanded Program on Immunization), primary schools, and the private sector. Based on the coverage rates achieved and the exceptionally good level of cooperation from school authorities, the NMCP decided to scale up the distribution of ITNs nationwide using three channels – schools, ANC clinics, and CWCs – in 2014 and beyond.

- *School-Based Distribution*

This channel targets school-aged children in primary classes two and six nationwide and is led by the Ghana Education Service (GES) School Health Education Program (SHEP) in collaboration with the NMCP. The school-based distribution was organized in all ten regions during the second term of the 2013/2014 academic year and repeated in the 2015/2016 academic year. Class enrollment registers are used to identify the students eligible for distribution. The supply chain for the ITNs is a successful collaboration between the NMCP and GES SHEP. ITNs are positioned at the district stores and circuit supervisors coordinate the movement of the ITNs to schools in their catchment area. Once the ITNs arrive at the schools, the head teacher supervises distribution to students. Students receive instruction on malaria and ITN use and care. Parent-teacher association meetings provide the platform for information dissemination on ITNs with the aim of encouraging household acceptance and use of ITNs. In 2014, a total of 1,373,800 pupils attending classes two and six in more than 14,000 primary schools received ITNs and information on ITN use. Similarly, in 2016, a total of 936,359 pupils from 16,026 private and public schools in classes two and six received ITNs and information on ITN use. The 2016 distribution targeted schools in six regions which did not receive ITNs through the mass distribution campaign in 2016. Continuous school-based distribution is not conducted in regions or years when the mass campaign is implemented.

- *Facility-Based Distribution (ANC and CWC)*

The facility-based distribution aims to distribute ITNs to pregnant women at their first ANC visit and to children 18-24 months receiving their second measles booster vaccination at CWCs. ***In theory***, ITNs are distributed to regional medical stores (RMS) and districts are expected to compile health facilities' ITN needs, track requests, and pick up ITNs from the RMS on a quarterly basis. Facilities then are expected to pick up their supplies from the district to ensure adequate stocks remain within their ANC clinics and CWCs for ongoing distribution. Periodically, there are also scheduled deliveries from the RMS to facilities, at which time ITNs may also be distributed to facilities. ***In practice***, districts are not able to routinely resupply their ITN stocks from the RMS due to limited capacity to transport the bulky commodities and limited funds for transportation. And, likewise, facilities may also have limited ability to collect regular supplies of ITNs from the district level. Additionally, inadequate training and supervision, health worker attrition, storage constraints, inaccurate quantification accounting, and poor inventory management of ITNs continue to be challenges associated with the health facility-based distribution channel.

Despite these challenges, a total of 1,130,689 ITNs were distributed in 2016 through ANC clinics and CWCs. Careful monitoring of activities and supportive supervision must remain a priority to ensure continuous improvements in ITN distribution through clinics. Key to ensuring the effectiveness of facility-

based channels is maintaining supportive supervision for the health workers to help improve ITN distribution management, especially at lower level health facilities. Special messaging has also been developed to promote accessing ITNs through ANC clinic visits, as well as to encourage and increase correct and consistent use of an ITN once it is in the household.

- *Private Sector*

The evaluation of an e-voucher scheme with private sector retailer in Eastern Region confirmed that it was successful in sustaining the ownership gains made by UCC by replacing older ITNs and filling ownership gaps in households that the UCC did not completely reach.[6] And, more recently, in 2016, the NMCP started a new pilot in collaboration with DFID to stimulate and sustain the commercial market of ITNs through selected local distributors, by increasing the number of private sector retail outlets stocking ITNs, and increasing the number of employers distributing ITNs through their workplace malaria prevention programs. The results from this pilot activity will inform the NMCP's future private sector continuous distribution strategy.

Progress during the last 12-18 months

Over the course of the three-year (2014-2016) UCC, PMI provided technical assistance to support the implementation of the campaign in six regions (Ashanti, Central, Brong Ahafo, Northern, Upper East and Greater Accra Regions) including: facilitating regional micro-planning meetings, training 293 district and sub-district officers to validate registration data, and monitoring distribution activities to ensure high quality.

In 2015, the continuous distribution of ITNs through schools was suspended in the aftermath of the CMS fire, due to a shortage of ITNs in country. All available ITNs were reallocated to support the UCC already planned and underway. Continuous distribution of ITNs through schools resumed in May 2016 (2015/2016 academic year), and PMI supported the distribution of 936,359 ITNs through 16,026 private and public primary schools in 6 regions (those that did not receive ITNs through the UCC in 2016). A total of 1,939 stakeholders from GES and GHS were trained to support the implementation of ITNs distribution through schools, including the monitoring of SBCC activities in the schools before, during, and after the actual distribution of ITNs. In addition, a total of 7,641 school teachers were trained to master relevant SBCC content in promoting ITN use and care among school pupils, select the messages for each audience, and agree on the activities and materials recommended for the school-based continuous distribution.

In 2016, PMI supported monitoring visits to 2,413 ANC clinics and CWCs, reaching 8,305 health workers. These efforts are improving the number of health facilities that estimated their needs and ordered ITNs from the RMS directly or via districts, and also submitted correct monthly reports on facility-based continuous distribution. However, ITNs still stock out at the facilities, therefore limiting the ability of these channels to reach their full distribution potential. Efforts continue to identify and address the constraints to increase the efficacy and capacity of the channels. In 2017, PMI anticipates training about 1,000 persons from nine regional and district health management teams as well as conducting 3,725 monitoring visits which will result in onsite coaching of over 9,300 providers from health facilities on facility-based continuous distribution.

[6] For additional details, please see the "Results from Networks Ghana Eastern Region Continuous Distribution" presentation made at the 2014 VCWG Annual Meeting. The presentation can be downloaded at: http://www.rbm.who.int/partnership/wg/wg_itn/ppt/ws3/m9AKilian.pdf

In 2016, PMI procured a total of 1.6 million long-lasting ITNs expected to be delivered in March 2017. These ITNs will support school-based continuous distribution through 21,000 primary schools in 9 out of 10 regions (Upper West region is completely covered by IRS) and, in combination with ITNs procured by the Global Fund, support facility-based continuous distribution through ANC clinics and CWCs.

Social and behavior change communication

Ghana continues to face a concerning net use gap – even among those with access to an ITN. The 2016 MIS indicated regional ITN use among those with access to an ITN ranged from a low of 27% in Greater Accra Region to a high of 65% in Upper East Region.[7] While ITN use rates do vary throughout the country, as a whole, Ghana has a use gap of roughly 30-40%. Considerable effort needs to be made to understand the barriers to ITN use and to develop appropriate measures to address them.

In 2016, USAID/Ghana launched a revitalized national mass media campaign called *"Good Life. Live it Well,"* (details in the SBCC section, below), which include key messages to promote correct and consistent use of ITNs. These messages are being aired nationally on key television and radio stations to ensure wide coverage. Additionally, by the end of 2016, PMI had supported SBCC activities targeting pupils and caregivers on use and care of ITNs through 7,641 school teachers in 16,026 primary schools and to pregnant women and mothers at over 2,400 health facilities. At the community level, 13 community radio stations in Northern Region and Volta Region are airing key MIP messages, which include promotion of ITN use and care. PMI recognizes that additional effort and focus to increase ITN use is needed and will continue to be a primary focus.

Commodity gap analysis

The NMCP guidelines for continuous distribution channels recommend procuring long-lasting ITNs in bulk to benefit from economies of scale, with shipments scheduled twice a year to cover the next six-month supply need. The ITN shipments are then divided and transported to Regional Medical Stores. PMI will continue to support the procurement of ITNs for facility-based and school-based continuous distribution channels and, when gaps exist and resources are available, mass distribution campaigns.

[7] Koenker, H. and Ricotta, E. "PMI ITN Access and Use Report – 2016". VectorWorks Project. Download at: http://www.vector-works.org/resources/llin-use-and-access-for-pmi-countries/

Table 5: ITN Gap Analysis

Calendar Year	2017	2018	2019
Total Targeted Population[1]	24,497,037	25,128,241	25,756,447
Continuous Distribution Needs			
Channel #1: ANC Clinics [2]	1,133,064	1,162,117	1,191,169
Channel #2: EPI [3]	636,048	652,000	668,351
Channel #3: Schools[4]	1,014,300	0	1,517,378
Estimated Total Need for Continuous Channels	**2,783,411**	**1,814,117**	**3,376,899**
Mass Campaign Distribution Needs			
2017/2018/2019 mass distribution campaign(s)[5]	0	13,960,134	0
Estimated Total Need for Campaigns	0	13,960,134	0
Total ITN Need: Routine and Campaign	**2,783,411**	**15,774,251**	**3,376,889**
Partner Contributions			
ITNs carried over from previous year	0	4,886,589	0
ITNs from MOH	0		0
ITNs from Global Fund[6]	3,070,000	0	0
ITNs from other donors (AMF)	0	3,600,000	0
ITNs planned with PMI funding[7]	4,600,000	4,360,000	1,300,000
Total ITNs Available	**7,670,000**	**12,846,589**	**1,300,000**
Total ITN Surplus *(Gap)[8]	**4,886,589**	**(2,927,661)**	**(2,076,889)**

1. Target population excludes people living in districts covered by IRS, as well as 90% of population of Greater Accra, Kumasi, and Takoradi Metros
2. Assuming 4% of the population becomes pregnant and ANC clinic attendance is 96.7%
3. Assuming the population of children under one year is 3% and 77% EPI coverage
4. Coverage estimates based on extrapolated data from historical project coverage levels. No distribution is planned in 2018 because the mass distribution is scheduled.
5. The NMCP is planning to start a nationwide mass distribution campaign in 2018 to be completed in a window of 6 to 12 months, with coverage of one net per two individuals in the household.
6. The next request to Global Fund, which will fund activities in 2018, will be submitted by May 23, 2017, the number of ITNs is likely to increase following the NMCP and Global Fund negotiations.
7. PMI 2017 procurement is funded from FY2016 MOP (1.6 million ITNs); approved FY2017 MOP will procure 1,360,000 ITNs; also, for the mass distribution campaign scheduled to start in Quarter One of calendar year 2018, PMI will procure an additional 3 million ITNs to fill the gap of needed ITNs, using cumulative pipeline.
8. *****The gap for 2018 mass distribution campaign is now at 2.9 million ITNS after including 3 million ITNs procured with PMI cumulative pipeline to reduce this gap. Similarly, Global Fund is looking into the possibility of using any savings from current agreement to procure ITNs to close the gap.

Plans and justification

PMI will continue to strengthen multi-sectorial and stakeholder coordination for ITNs by supporting the NMCP to achieve and maintain high levels of ITN coverage. Activities will include improved planning, implementation, and monitoring of school-based and facility-based continuous distribution (e.g. strengthen validation procedures for continuous distribution of ITNs and on-the-job training of sub-district supervisors). PMI will continue to build capacity within the GHS and GES to design, implement, and evaluate programs and activities to promote the correct and consistent use of ITNs through community mobilization and SBCC activities. PMI will continue to promote social and behavior change through community mobilization, interpersonal communication, and mass media campaigns to create awareness about continuous distribution channels and establish an overall net use culture by promoting correct and consistent ITN use and proper care of ITNs. Following the planned 2018 mass distribution campaign, PMI

will support ITN durability monitoring including survivorship, attrition, physical integrity, and insecticidal activity.

Further detail on the ITN SBCC strategy, background, and rationale for promotion of ITN use and care is covered in the SBCC section of the MOP. In FY 2018, PMI will procure long-lasting ITNs for distribution through continuous distribution channels and provide technical and financial support to the NMCP and GES SHEP to train staff for implementation.

Proposed activities with FY 2018 funding: ***($6,857,000)***

- *Procurement and transportation of ITNs:* Procure approximately 1.3 million long-lasting ITNs to support continuous distribution channels (schools, ANC clinics and CWCs) to ensure Ghana maintains universal coverage of ITNs following the completion of the planned mass distribution in 2018. The budget includes transportation of ITNs to regional distribution points. *($5,107,000)*

- *Technical assistance for ITN distribution and supply chain:* Support the GHS/NMCP and GES in distributing ITNs from regional warehouses to schools and health facilities. Funds will support the costs of training, planning, supervision, operations, and M&E. *($1,600,000)*

- *ITN durability monitoring:* Support year two of the ITN durability monitoring which will include the 24 month survey to assess net survivorship, attrition, physical integrity and bio-efficacy analysis from a sample of ITNs from the 2018 mass distribution campaign. *($150,000)*

- *Support school- and community-based activities to address barriers to correct and consistent use of ITNs and promote ITN care:* design, implement, monitor, and evaluate school- and community-based activities to address identified barriers to correct and consistent ITN use and promote ITN care. Targeted ITN-specific technical assistance will be provided to the NMCP and GES SHEPs to ensure that overall ITN-related SBCC activities throughout Ghana remain state of the art. Support will also include efforts to increase effectiveness of school-based continuous distribution of ITNs through activities to increase awareness of and community participation in school-based distribution. (*This activity is budgeted in the SBCC section.*)

c. Indoor residual spraying

Progress since PMI was launched
PMI began supporting IRS in Ghana in 2008, focusing on building local capacity, adhering to strict environmental compliance, and conducting routine entomological monitoring. The selection of districts in Northern Region for spraying was done in consultation with the NMCP. Districts were selected based on high malaria burden (>40% parasitemia in children under five), poor healthcare and economic infrastructure, and a relatively short, intense malaria transmission season in the region.

The PMI IRS program initially demonstrated that IRS could be scaled up quickly and safely in remote rural areas. By 2011, in collaboration with NMCP and local communities, the program expanded to cover a population of over 920,000 in nine districts and employed approximately 1,300 people, with an increasing percentage of women being hired (approximately 30% in 2016). In 2012, the emergence of pyrethroid resistance prompted the program to switch to more expensive organophosphates and, consequently, to decrease the number of districts sprayed from nine in 2012 to four in 2013.

The IRS program exceeded the 90% national target for coverage of eligible structures sprayed until 2014. However, improved enumeration of structures and monitoring in 2014 revealed that the true coverage was less than reported; in particular, Savelugu Nanton had IRS coverage of 68%. This brought down overall coverage to 83%, slightly below the PMI coverage target of 85%, in 2014. The low coverage in Savelugu Nanton was likely due to its urban nature and spray fatigue, since the district had been sprayed since 2008. Entomological monitoring data in Savelugu Nanton indicated that the entomological inoculation rate was zero in 2012 and 2013, and organophosphate/carbamate resistance was detected in the vector population using the genetic resistance marker *Ace-1*, which is associated with acetylcholine esterase target site insensitivity. Fortunately, the bioassays conducted still produced 100% mortality, indicating continued operational effectiveness of the tested insecticides. As a result of low IRS coverage and the entomological indicators, the NMCP recommended that IRS be discontinued in Savelugu Nanton and re-started in Kumbungu District in the 2015 spray season. Kumbungu was chosen to replace Savelugu Nanton because of the high coverage of IRS before it was withdrawn in 2013 due to high cost of organophosphate insecticide when the IRS project had to switch completely from pyrethroids to organophosphates. It was also chosen based on deterioration in its entomological indicators since withdrawal. In preparation for the withdrawal from Savelugu Nanton, meetings were held with district health and administrative officials to confirm that community mobilization and SBCC activities would continue to encourage ITN use and the district would be included in ITN distributions. Table 6 below illustrates the scale-up of PMI-supported IRS from 2008 to 2017 and planned coverage in 2018 and 2019.

Table 6: PMI-supported IRS activities, 2008-2019

CY	Number of Districts Sprayed	Insecticide Used	Number of Structures Sprayed	Coverage Rate	Population Protected
2008	5	Pyrethroids	254,305	> 85%	601,973
2009	6	Pyrethroids	284,856	94%	708,103
2010	8	Pyrethroids	342,876	97%	849,620
2011	9	Pyrethroids	354,207	92%	926,699
2012	9	5 Pyrethroids 3 Organophosphates 1 Both insecticides	355,278	93%	941,240
2013	4	Organophosphates	197,655	91%	534,060
2014	4	Organophosphates	205,230	84%	570,572
2015	5*	Organophosphates	205,935	92%	553,954
2016	5	Organophosphates	211,283	93%	570,871
2017**	7	Organophosphates	316,587	90%	851,419
2018**	7	Long-lasting, non-pyrethroid insecticide	316,587	90%	851,419
2019**	7	Long-lasting, non-pyrethroid insecticide	316,587	90%	851,419

* One district was split into 2 districts: West Mamprusi became West Mamprusi and Mamprugu Moagduri.
** Projected targets based on national strategic plan and/or discussions with the NMCP.

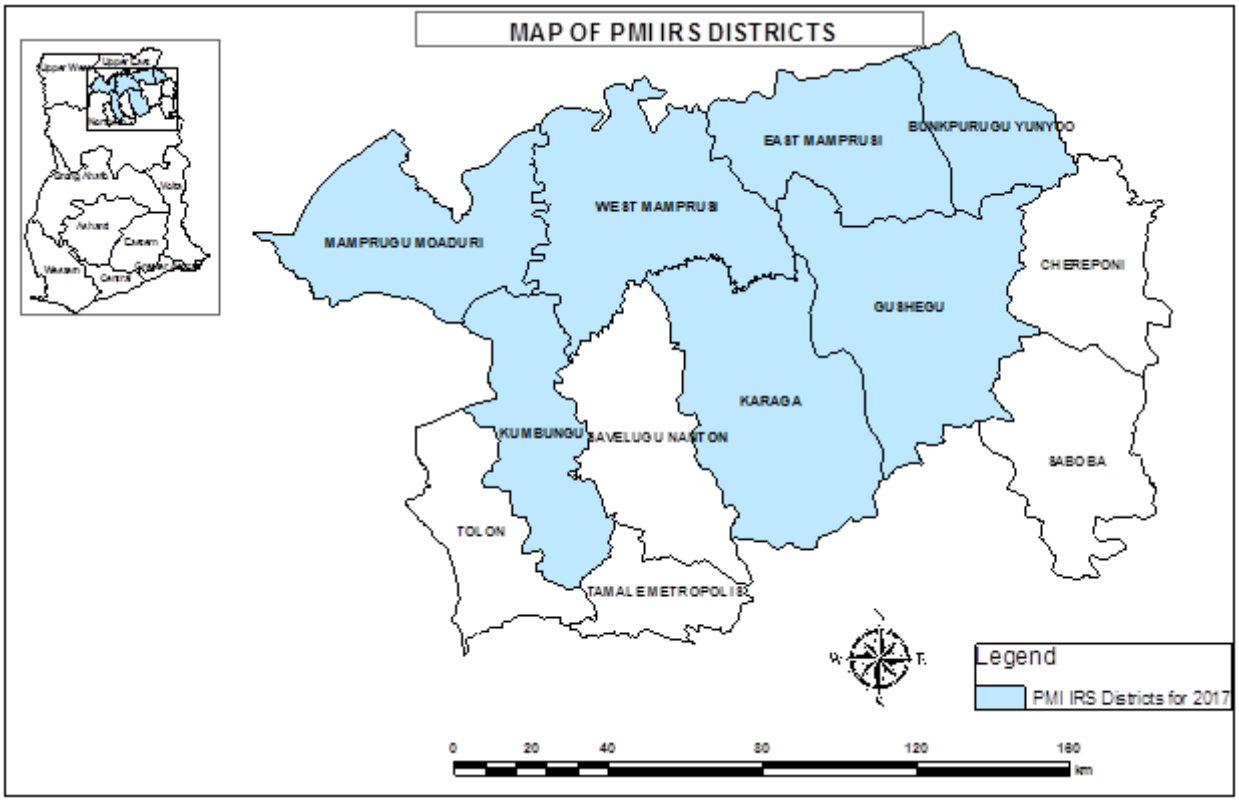
Progress during the last 12- 18 months

In 2016, PMI completed its ninth spray round, spraying five districts (Bunkpurugu-Yunyoo, East Mamprusi, Mamprugu Moagduri, West Mamprusi, and Kumbungu) in Northern Region. The coverage

exceeded the PMI target of 85%. The overall coverage (93%) protected a population of 570,871 people, including 10,881 pregnant women and 96,150 children under five. There were 16 operational sites across the 5 districts, and the program provided seasonal employment to almost 700 workers from local communities, of which one-third were women. An additional 796 people were hired for IRS operations, including 747 GHS community mobilizers. GHS and district assembly staff were embedded in PMI IRS operations and Regional Environmental Protection Agency staff participated in poison management trainings and environmental inspections.

Ghana is benefiting from the UNITAID-funded NGenIRS project in 2017. This market intervention project includes a short-term co-payment to accelerate the price reduction of long-lasting insecticides. Beginning with the tenth spray round in 2017, the price reduction will enable PMI to expand coverage of IRS to 7 districts in Northern region (Figure 6) covering approximately covering 88,730 additional structures projected from the 2 new districts in 2017 (Gushegu - 48,936 structures and Karaga - 39,794 structures). The other increase of 17,000 structures is extrapolated from annual population increase in the former 5 districts.

Figure 6: PMI-supported IRS districts in 2017 in Northern Region of Ghana



Plans and justification

Participation in the NGenIRS project will allow PMI to maintain IRS coverage with a long-lasting, non-pyethroid insecticide in seven districts in 2017 and beyond in the Northern Region. The selection of districts in Northern Region for IRS was made in consultation with the NMCP and MaVCOC. PMI will also continue to play a critical role in building national capacity for IRS and entomological monitoring through its support of entomological monitoring sites in PMI-supported IRS areas and nationwide through NIRMOP.

Proposed activities with FY 2018 funding: ***($5,669,000)***

- *IRS program implementation and management:* Support IRS implementation and programmatic monitoring and evaluation in seven districts in Northern Region. Funding will support spray operations, data collection, environmental assessment and compliance monitoring, logistics, and SBCC activities including community mobilization. Proposed activities include support for procurement of insecticide and equipment; support for supervision by GHS, Environmental Protection Agency, and Noguchi personnel; and collaboration with the NMCP, MaVCOC, the AGAMal IRS program, and other partners. Programmatic monitoring and evaluation includes the activities that measure the performance of IRS, particularly those relating to monitoring coverage levels. *($5,600,000)*

- *Environmental compliance for IRS implementation:* Support environmental compliance monitoring for IRS implementation in seven districts in Northern Region. Funding will support environmental assessment and compliance monitoring. *($40,000[8])*

- *Technical assistance to support entomological monitoring for IRS:* Provide technical assistance and quality assurance, through two visits by a CDC entomologist, for ongoing entomological monitoring of the PMI IRS program. *($29,000)*

2. Malaria in pregnancy

NMCP/PMI objectives
In 2015, Ghana's National Guidelines for Malaria in Pregnancy were revised to adopt WHO's recommendation of a three-pronged approach for the prevention and treatment of MIP, which includes: the administration of intermittent preventive treatment with sulfadoxine-pyrimethamine (IPTp-SP); distribution of ITNs at first ANC visit and promoting ITN use throughout pregnancy; and appropriate case management through prompt and effective treatment of malaria in pregnant women.

The GHS MIP guidelines recommend that SP should be given from 16 weeks of gestation or at quickening, and subsequent doses should be given until delivery at 4 week intervals for a minimum of 5 doses and a maximum of 7 doses. The guidelines also recommend daily provision of 0.4 mg of folic acid. The first line drug for the treatment of uncomplicated malaria in pregnant women is oral quinine. ACTs are not recommended for use in the first trimester except when they are considered to be lifesaving or when other antimalarials are considered to be unsuitable. The recommended treatment for malaria during the second and third trimester is artesunate-amodiaquine or artemeter-lumefantrine.

Progress since PMI was launched
Ghana's MIP program is coordinated by an MIP technical working group comprised of the NMCP, GHS Family Health Division, development partners, NGOs and other stakeholders. Collaboratively, the Family Health Division and NMCP make decisions on policy guidelines and content of training.

High ANC clinic attendance rates provide great opportunities to improve uptake of three or more doses of IPTp. The 2014 DHS reported that 87% of pregnant women attended ANC 4 or more times. Nationally, the proportion of women reporting that they received at least 2 doses of IPTp during their most recent

[8] Includes payback of core funds advanced for 2017 environmental compliance monitoring.

pregnancy increased from 68% (2014 DHS) to 78% (2016 MIS) and women reporting that they received 3 doses of IPTp increased from 39% (2014 DHS) to 60% (2016 MIS). However, the percentage of pregnant women who slept under an ITN remained constant at 50% from the 2014 DHS to the 2016 MIS. Despite high ANC rates, there remains a net-use gap among pregnant women. Efforts to improve use are underway and include SBCC activities at ANC visits to encourage and increase correct and consistent use of ITNs.

Progress during the last 12-18 months

During the past 18 months, PMI supported pre-service education for midwives, community and public health nurses through revision of the curriculum and training in the updated IPTp policy. With continuous supervision, coaching and post-training follow-up, the goal of this stand-alone eLearning module was to improve knowledge, skills and practices of the updated IPTp policy. In addition, 8,500 copies of the GHS MIP guidelines were distributed to all the health training facilities. By the end of calendar year 2016, PMI reached approximately 10,000 students in pre-service education, distributed MIP manuals in 88 training institutions, and trained 100% of targeted health workers. One challenge that PMI will continue to support the NMCP to address through training and OTSS is ensuring that providers' adherence to the MIP policy that during ANC visits, only symptomatic pregnant women are tested with an RDT.

To expand the reach of in-service training, an estimated 1,773 students are currently using the Malaria Digital Learning app, "Hello Nurse". This app is meant to look at the decision-making ability for nurses to diagnose and perform RDT to enable them treat correctly. Previously this app was accessible to just a few a students in the schools on desktop and on few laptops, it was realized that most of the students had android mobile phones and were able to download games and other app on their phones without purchasing data hence the introduction of the "Hello Nurse" app on android phones.

PMI procured approximately 3 million treatments of SP, which arrived in country June 2016 and met approximately one year's worth of SP needs at ANC clinics in Ghana. An additional 2 million treatments will be procured with PMI funding in 2017. The GOG has committed to cover any remaining gaps through their own procurements system. At the time of writing the MOP the commodities had been cleared by the Ghana Food and Drug Authority (GH-FDA) for distribution to health facilities. NMCP and PMI implementing partners will continue to monitor the commodities using tools such as the quarterly EUV, PPQRm, and forthcoming eLMIS. PMI and the Global Fund are working with the NMCP and GOG to ensure an adequate national stock of SP.

Table 7. Status of IPTp policy in Ghana

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	October 2015 to December 2016	11,094*	Yes	Yes	Yes

*Met or exceeded target.

Table 8. SP Gap Analysis for Malaria in Pregnancy

Calendar Year	2017	2018	2019
Total Population	29,311,592	30,044,381	30,795,491
SP Needs			
Total number of pregnant woman visits to ANC [1]	2,983,920	3,052,870	3,278,981
Total SP Need (in treatments)	**2,983,920**	**3,052,870**	**3,278,981**
Partner Contributions			
SP carried over from previous year	849,150	0	0
SP from Government	0	0	0
SP from Global Fund	0	0	0
SP from Other Donors	0	0	0
SP planned with PMI funding	2,035,244	0	0
Total SP Available	**2,884,394**	**0**	**0**
Total SP Surplus (Gap)	**(99,526)**	**(3,052,870)**	**(3,278,981)**

1. It is estimated that 4% of the population will be pregnant for each year, based on 2010 census data. Total number of pregnant woman visits to ANC clinic calculated based on expected attendance. For 2018 targets are: ANC1: 80%; ANC2: 79%; ANC3: 66%; ANC420%; ANC5: 10%

Plans and justification

PMI will continue to support the full suite of MIP services recommended in the GHS MIP guidelines, including IPTp at ANC clinics and health centers and, where available, at CHPS compounds in all ten regions. To effectively deliver a package of malaria prevention services to pregnant women, PMI will support outreach, training, and supportive supervision; on-site training; provision of IPTp at every ANC visit; distribution of an ITN to every pregnant woman at first ANC visit.

Proposed activities with FY 2018 funding: ***($550,000)***

- *Strengthen IPTp implementation in 5 USAID focus regions:* Support health care workers at health facilities and CHPS compounds to effectively deliver malaria prevention services to pregnant women, including supportive supervision and on-site training of IPTp at every ANC visit and ensuring the distribution of an ITN at first ANC visit. ($275,000)

- *Strengthen IPTp implementation in 5 non-USAID focus regions:* Support health care workers at health facilities and CHPS compounds to effectively deliver malaria prevention services to pregnant women, including supportive supervision and on-site training of IPTp at every ANC visit and ensuring the distribution of an ITN at first ANC visit. ($275,000)

3. Case management

a. Diagnosis and treatment

NMCP/PMI objectives

Since 2009, the NMCP has required confirmation of all suspected malaria cases in all age groups, by either microscopy or rapid diagnostic test (RDT), in accordance with WHO guidelines. The NMCP remains focused on improving the quality of microscopy at higher-level facilities and scaling up the use of RDTs at all levels, especially in peripheral settings, including CHPS compounds.

The NMCP strategy calls for widespread and prompt access to appropriate antimalarial treatment. Adopted in 2004, Ghana's first-line therapy for uncomplicated malaria includes artesunate-amodiaquine. In 2009, artemether-lumefantrine and dihydroartemisinin-piperaquine were added as additional first-line treatment options. Artemether-lumefantrine is currently the most commonly used first-line treatment. Quinine and intramuscular artesunate are therapies for severe malaria. In Ghana only a medical doctor or anesthetist is permitted to administer drugs intravenously. When a medical doctor is available to supervise the administration, IV is the preferred method. However, due to the low doctor patient ratio, this is often not the case at lower level facilities. In 2012, the Anti Malaria Drug Policy was revised based on WHO recommendations that injectable artesunate is superior to quinine in the management of severe malaria. Ghana has been and will continue to push artesunate as the preferred treatment. IM Artemether and IV/IM quinine are the other approved drugs, in order of preference, for the management of severe malaria. However, quinine remains the first line treatment for malaria in pregnancy in the first trimester. Rectal artesunate is endorsed for pre-referral use at lower level facilities including CHPS compounds for severe malaria. The recommended therapy for pregnant women is described in the MIP section.

The NMCP recently changed their case management policy from community-based management of fever through integrated community case management (iCCM) by community-based volunteers to integrated management of childhood illness (IMCI) by community health nurses at CHPS compounds. Community-based treatment of fever through community-based agents suffered from a chronic lack of commodities, such as zinc and oral rehydration salts, and from a lack of reporting. Conversely, community health nurses are well-trained regular staff of the GHS at CHPS compounds integrated into the GHS and usually the NHIS, so patients who visit CHPS compounds for fever treatment receive a full package of services.

Seasonal malaria chemoprevention (SMC) has been implemented by the NMCP with support from DFID and Global Fund in the Upper West Region and has recently been expanded to cover the Upper East region with support from Global Fund. These regions qualify for SMC with a sahelian transmission season less than four months. There are also discussions about the possibility of expanding SMC to eligible parts of Northern Region. Although not directly supporting SMC, PMI remains engaged in national level technical discussions on the future of SMC in Ghana.

Table 9. Status of Case Management Policy in Ghana

Status of Case Management Policy in Ghana according to the National Malaria Control Strategic Plan, 2014-2020	
What is the first-line treatment for uncomplicated *P. falciparum* malaria?	Artesunate-amodiaquine Artemether-lumefantrine Dihydroartemisinin-piperaquine
What is the second-line treatment for uncomplicated *P.falciparum* malaria?	NA
What is the first-line treatment for severe malaria?	Quinine and intramuscular artesunate
In pregnancy, what is the first-line treatment for uncomplicated *P. falciparum* malaria in the first trimester?	Oral quinine
In pregnancy, what is the first-line treatment for uncomplicated *P. falciparum* malaria in the second and third trimesters?	Artesunate-amodiaquine Artemether-lumefantrine
In pregnancy, what is the first-line treatment for severe malaria?	Quinine – 1st trimester IV/IM Artesunate – 2nd and 3rd trimester
Is pre-referral treatment of severe disease recommended at peripheral health facilities? If so, with what drug(s)?	Rectal artesunate
Is pre-referral treatment of severe disease recommended for community health workers? If so, with what drug(s)?	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)	Not mentioned

Progress since PMI was launched

PMI's primary strategy for improving malaria case management (diagnosis and treatment) is clinical and laboratory OTSS. OTSS is designed to provide long-term, ongoing support for strengthening malaria case management in health facilities by identifying weaknesses that require improvement and providing support to clinicians and laboratory staff. OTSS consists of regularly scheduled supervisory visits to health facilities and, if applicable, their laboratories where a standardized checklist is used to assess key issues such as: relevant infrastructure and personnel factors such as staffing, level of training, and performance in malaria case management. Clinical OTSS focuses on malaria case management provided through the facility's OPD, including an assessment of RDT use. Laboratory OTSS is only conducted in health facility laboratories and, though generally focused on microscopy, it also assesses correct and consistent use of RDTs in the laboratory setting. Clinical and laboratory OTSS teams are comprised of different cadres of health professionals and, currently, their visits do not necessarily coincide. PMI planned to integrate the laboratory and clinical OTSS activity in 2016. However, the mechanism to facilitate the process was not awarded until the end of 2016. With the mechanism in place, PMI will refocus attention on a coordinated approach to an integrated clinical and laboratory OTSS.

GHS has made significant progress in improving malaria case management capacity at health facilities throughout the country. Since 2012, PMI has supported quarterly clinical OTSS covering all public sector facilities. To date, 9 rounds of clinical OTSS have successfully trained and provided supportive supervision for more than 97% of public sector health workers in malaria case management. For severe malaria, all

prescribers at referral facilities were trained under the revised case management protocol in the use of injectable artesunate and prescribers at lower level facilities were trained in the use of rectal artesunate. PMI procures antimalarials for both uncomplicated and complicated malaria. PMI has also facilitated extensive training in data management for health information officers and includes data monitoring and quality control in the standard package of clinical OTSS activities.

PMI has worked closely with NMCP and GHS Clinical Laboratories Unit (CLU) to improve the quality and scale up of malaria diagnosis in Ghana. In 2008, a national malaria laboratory assessment indicated that only 55% of laboratories had received a supervisory visit in the last six months and more than half of the laboratories had only one or no staff trained in malaria diagnosis. Since then, the laboratory OTSS program has been rolled out systematically across Ghana's ten regions. Eleven rounds of Lab OTSS have been conducted. All 408 health facilities with a laboratory (as enumerated in a 2008 assessment) have been enrolled into laboratory OTSS, including 302 (74%) public, 45 (11%) private, and 61 (15%) quasi-public (semi-autonomous public institutions) facilities. Most staff at the enrolled facilities has been trained in malaria diagnosis. In April 2016, the WHO accredited the Ghana National Malaria Slides (slide bank). Over the past year, the slide bank has been used for the Malaria Diagnostic Refresher Training and also a proficiency testing scheme during regular Lab OTSS visits. PMI has also supported annual malaria diagnostic refresher training for senior health facility laboratory staff who have supervisory roles but do not necessarily spend most of their time on the bench. PMI is supporting increased use of RDTs in the private sector, particularly in private clinics, pharmacies, and over-the-counter medicine shops (OTCMS). Since 2009, availability of microscopes in public sector and quasi-public sector (semi-autonomous public institutions) facilities has significantly improved. The laboratory and clinical OTSS program provides PMI with feedback on the condition of microscopes and PMI has supplied microscopes to the NMCP/GHS on an as needed basis. The GHS regularly procures microscopes for its laboratories and public health facilities generate funds to procure reagents and lab supplies. The Global Fund has procured microscopes for other disease programs such as TB and HIV, which are also used for malaria diagnosis.

PMI has supported malaria case management pre-service education, with support for midwife and nursing training by updating curriculums for all public Registered General Nursing, Registered Midwifery, Registered Community Nursing, and Registered Nurse assistant schools in existence before 2013. As a result, 35 schools have had their curriculum updated and 142 tutors who teach courses that cover malaria have been trained in malaria case management and MIP. PMI has also supported the updating of curriculum of all public tertiary medical institutions to reflect current NMCP protocols on case management and diagnosis.

The GHS continues to strategically expand CHPS compounds and improve the efficiency and quality of health services offered by CHPS compounds to bring basic public health and clinical services closer to communities in rural and hard to reach areas. CHPS compounds provide community outreach services through community health nurses who are able to provide a range of public health services. The CHPS program has broad support within the GHS and is a strong platform for expanding access and availability of appropriate malaria case management services. PMI's work with CHPS aligns with and supports the GHS and NMCP strategies. PMI supports the training of CHPS health workers in case management diagnosis and IPTp. PMI has also supported internship trainings for community health nurses.

The impact of PMI's contributions to improve case management at all sectors of the health system was noted in the 2016 MIS. Preliminary results showed significant improvements in malaria case management indicators, including an increase in the number of children under 5 years old with fever who took an ACT from 26% (2014 DHS) to 61% (2016 MIS), and a decrease, nationally, in parasitemia among children under five years old from 27% (2014 DHS) to 20% (2016 MIS). Unfortunately, however, the diagnostic

test rate decreased from the 2014 DHS to the 2016 MIS. A number of reasons may explain why testing, as reported in the 2016 MIS, is low. In the 2016 MIS, 48% sought care from the public sector, 51% from the private sector, and 1.5% from other sources. Data reported from DHIMS is primarily from public facilities, where diagnostic tools are readily available. Looking at trends in care seeking from the 2014 DHS and 2016 MIS may be a better comparison based on methodology. Between the 2 surveys, there was a decrease in the percent who sought care from 77% to 72%, with a comparative decrease in testing rates from 34% to 30%. This is consistent with the decrease in those who sought care in the public sector between 2014 DHS and 2016 MIS (60% to 48%, respectively), and the increase in those who sought care in the private sector between 2014 DHS and 2016 MIS (38% to 51%, respectively). Since diagnostic tools are found more frequently in the public over private facilities, the above possibly explains the decrease in testing rate between household surveys.

The use of non-ACTs has decreased significantly since the 2014 DHS (from 63% to roughly 40%), despite the continuous importation of unlicensed monotherapies. Weak enforcement of regulations of licensed drugs, including ACTs, has been a long-standing problem even though it has declined over the years. PMI continues to work with the NMCP and other stakeholders to monitor the situation in an attempt to help curb this practice.

There are currently ten Global Fund-supported therapeutic efficacy study sites, operated by Noguchi for *in vivo* drug efficacy monitoring throughout the ten regions of Ghana. PMI, WHO, and Naval Medical Research Unit No. 3/Department of Defense have provided support for monitoring efficacy of the two first-line ACTs used for the treatment of uncomplicated malaria since the launch of PMI. The NMCP did not recommend the testing of the second-line ACT, DHAP, in the past because the drug is not widely used. However, the NMCP plans to test DHAP at three sites in 2018. Efficacy studies are typically conducted and supported by the Global Fund, biennially. Table 10 provides an outline of the years and sites of completed, ongoing and planned TESs.

Table 10. PMI-funded TESs

Completed TESs			
Year	**Site name**	**Treatment arm(s)**	***% PCR-uncorrected efficacy (95% CI)**
2015/2016	LEKMA Hospital	AS-AQ	100
	Sunyani Municipal Hospital	AS-AQ	100
	Wa Regional Hospital	AS-AQ	100
	Hohoe Municipal Hospital	AS-AQ	100
	Old Tarkwa Government Hospital	AS-AQ	100
	War Memorial Hospital, Navrongo	AL	100
	Begoro Government Hospital	AL & AS-AQ	96.8 (87.8-99.4) & 100
	Bekwai Municipal Hospital	AL	100
	Ewim Polyclinic, Cape-Coast	AL & AS-AQ	87.5 (76.3-94.7) & 95.2 (85.8-98.8)
Ongoing TESs			
Year	**Site name**	**Treatment arm(s)**	
2017	Wa Regional Hospital	AL	
	Old Tarkwa Government Hospital	AL	
	Hohoe Government Hospital	AL	
	Sunyani Municipal Hospital	AL	
	Bekwai Municipal Hospital	AS-AQ	
	War Memorial Hospital, Navrongo	AS-AQ	
	LEKMA Hospital	AL	
	Yendi Municipal Hospital	AL	
Planned TESs FY 2018			
Year	**Site name**	**Treatment arm(s)**	
2018/2019	LEKMA Hospital	AS-AQ & AL	
	Sunyani Municipal Hospital	AS-AQ & AL	
	Wa Regional Hospital	AS-AQ & AL	
	Hohoe Municipal Hospital	AS-AQ & AL	
	Old Tarkwa Government Hospital	AS-AQ & AL	
	War Memorial Hospital, Navrongo	AS-AQ, AL, & DHAP	
	Begoro Government Hospital	AS-AQ, AL, & DHAP	
	Bekwai Municipal Hospital	AS-AQ & AL	
	Ewim Polyclinic, Cape-Coast	AS-AQ, AL & DHAP	
	Yendi Municipal Hospital	AS-AQ & AL	

*PCR analysis of treatment failures is currently ongoing

Progress during the last 12-18 months

Clinical and laboratory OTSS

Although Ghana has a long history of presumptive treatment of malaria and historically low diagnostic testing rates, the investment in training and OTSS is beginning to show results. In collaboration with GHS CLU, PMI supported national Malaria Diagnostic Refresher Training and Proficiency Testing (MDRT) to improve regional capacity to conduct laboratory OTSS and improve the quality of microscopy. The GHS CLU regional laboratory technicians conducted laboratory OTSS in 199 facilities covering 1,767 laboratory health workers in August 2016. Adherence to negative test results, as reported from the last round of Lab OTSS, improved with prescribers currently adhering to negative test results 84% of the time, compared to 72% for the first quarter of 2015 and only 50% in 2010.

During the past 12 months, PMI supported the GHS to roll out a national proficiency testing scheme, an assessment using the slides from the national slide bank. Because these slides are validated, their use is able to give GHS CLU a true and quick assessment of the competency of laboratory staff on the bench. The process assesses key parameters of malaria diagnosis such as specie identification and parasite count. This testing scheme has now been incorporated into the regular lab OTSS activity. Preselected slides are sent to identified laboratory technologists/technicians ahead of the visit of OTSS supervisor. The trainee uses a specified amount of time to read the slides and on the visit of the supervisor they discuss the results and develop a plan to improve as appropriate. PMI worked with the GHS CLU to pilot the proficiency testing program in Ashanti region in 27 facilities as part of the OTSS program in 2016. Based on the Ashanti pilot, proficiency testing is being scaled up in the round 13 Lab OTSS. PMI also continued supporting pre-service training and increased the number of public health schools (community health nursing, public health nursing, and midwifery schools) being supported from 38 to 47 schools.

To further strengthen malaria case management, PMI's recent technical assistance to the NMCP has focused primarily on supervision of health care workers. PMI planned to train 6710 health workers on the updated malaria case management guidelines in 2016 but trained a total of 11,094. In the last year, PMI also provided technical and financial support to regional and district directorates to conduct clinical OTSS for treatment and diagnostics targeting 80% of all facilities. A total of 3,957 facilities in all 10 regions covering over 90% of all public health facilities were covered and an estimated 15,400 health workers in hospitals and prescribers at CHPS compounds were reached.

Results from the September 2016 end-use verification (EUV) survey which sampled 35 service delivery points out of an estimated combined total of 650 facilities and 2 regional medical stores in the Brong Ahafo and Volta Regions, showed that 69% of health facilities had at least one WHO pre-qualified ACT in stock on the day of the visit. However, stock-outs of individual artemether-lumefantrine (AL) presentations were high and ranged from 47-100% and 61-89% for artesunate-amodiaquine (AA). Rapid diagnostic tests and SP were stocked out in 12.5% and 10% of health facilities, respectively. A large proportion of health workers (85%) working in malaria case management were trained but only 38% of staff working in stock management were trained. Additionally, among 700 patient records examined, 66% were diagnosed with malaria and 41% were under 5 years of age. Of the suspect malaria cases, 70% were diagnosed by RDTs, 3% by microscopy, and 27% clinically.

Private Sector

As reported in the 2014 DHS, more than 20% of febrile children are not taken to health facilities for examination, with caregivers choosing to treat them at home or seek advice from sources outside of health

facilities. PMI, in collaboration with the Pharmacy Council, a regulatory body for pharmacists, provided refresher training for 1,697 OTCMS in appropriate case management and use of RDTs. Supportive supervision visits are being conducted to encourage and ensure that OTCMS are adhering to malaria protocols. To improve the regular supply of RDTs to the private sector, PMI collaborated with the NMCP, the professional association of OTCMS, and other development partners, primarily DFID, to improve the private sector's access to RDTs and capacity to test clients with febrile illnesses prior to treating. Based on the reporting developed by the NMCP and completed and submitted by OTCMS, over 10,000 tests have been conducted and reported, and approximately 66% of these tests were negative. An analysis of the reporting template data indicated that only 4% of those who tested negative were given ACT.

National Health Insurance Scheme (NHIS)
Unique among PMI focus countries, the NHIS administered by National Health Insurance Authority (NHIA) plays a significant role in providing access to quality malaria case management for its enrolled participants. As described in more detail in other sections of this document (see the Strategy Section and the HSS section), PMI is working to capitalize on the opportunities that NHIS offers to strengthen malaria diagnosis and treatment services provided through registered facilities. These efforts include developing strategies on how to improve malaria case management, such as: 1) supporting the NHIA's planned national rollout of capitation grants through NHIS to health facilities and providers; 2) engaging the NHIA to review the medicines component of the NHIS benefits package; 3) developing a process to disaggregate the medicines list, particularly antimalarials, to support developing a sustainable and implementable drug pricing model that directly benefits malaria outcomes.

Community-based Case Management
In 2013, 40% of the rural population had access to health services through CHPS compounds. From 2015 to 2017, PMI and USAID supported the strategic expansion and improvement of CHPS services to deliver an expanded package of proven interventions to reduce maternal and child mortality and morbidity, including malaria case management, child health services, and maternal health services (including IPTp). To improve the capacity of community health nurses at CHPS compounds to deliver services at the community level, PMI supported internships for 252 community health nurses at district hospitals to improve their skills in malaria case management.

Pre-service education
PMI supported the GHS eLearning Secretariat to develop an eLearning program to increase access to pre-service and in-service learning and training materials for the providers. The GHS eLearning Secretariat has made significant progress in developing new modules that can be used in the computer labs at training schools or on students' personal computers. The modules have also been adapted to fit onto mobile learning platforms. To institutionalize the program, several different approaches were taken at different levels. First, PMI provided supported the development of the GHS eLearning Secretariat which is guiding the development and maintenance of online learning materials, including posting them on their website. Second, at the school level, PMI worked with the MOH to build the capacity of tutors to manage the programs at their sites. The eLearning Secretariat is also working with the NMCP to accredit the modules so that they can be used not only in pre-service, but also for in-service training. PMI has successfully scaled up the development of skills labs in pre-service institutions. The skills labs are practical training sessions including role-plays and demonstrations on MIP and case management.

Commodity gap analysis
PMI supports the NMCP to make quantifications of malaria commodities requirements annually. This year, the approach to gap analysis was based on analysis of service data collected in DHIMS2 to understand

morbidity trends and the impact of current interventions and demographic dynamics to predict consumption needs for the future. During the quantification exercise, the team used at least two different data types (demographic and service data) to conduct two different forecasts and then the quantification team discussed the two forecasts on the strengths and weaknesses of the data sources and agreed on which forecast type best represents what is expected. In the case of RDTs, the team was of a strong view that both forecasts types had relatively equal strengths and weaknesses, though the numbers varied significantly. It was agreed then that the team would take an average of the demographic and service forecasts as the final forecast for RDTs. This approach was done only for RDTs.

In the case of RDTs, unlike ACTs, the NMCP intends to provide the commodity to private health facilities and even private pharmacies since they also treat malaria. Considering that there are some donors who do not allow their donated commodities to be distributed to the private sector, the NMCP/PMI quantification team needed to separate the public and private sector RDT needs. For ACTs, the targeted population will not include those seeking care from private sector because ACTs are not supplied by the NMCP to the private sector, hence all the ACTs forecasted were for those seeking care in the public sector.

Table 11: RDT Gap Analysis

Calendar Year	2017	2018	2019
RDT Needs			
Total country population	29,311,592	30,044,381	30,795,491
Population at risk for malaria	29,311,592	30,044,381	30,795,491
PMI-targeted at-risk population[1]	29,311,592	30,044,381	30,795,491
Total number of projected fever cases[1]	28,663,898	30,289,171	31,046,400
Country target for diagnostic coverage	85%	90%	95%
Percent of fever cases tested with an RDT[2]	85%	85%	85%
Total RDT Needed for routine service delivery[2]	**20,709,667**	**23,171,216**	**25,069,968**
% allocation of RDTs for others (outreach, research, training, validation and quality assurance)	0	0	0
% coverage of Public sector by RDTs[3]	85%	85%	85%
Total RDT Needs (Consumption) for Public sector health facilities (From Demographic Forecast)	20,243,699	22,649,863	24,505,894
Total RDT Needs (Consumption) for Public sector health facilities (From Service based Forecast)[4]	8,286,429	8,493,590	9,322,233
Total RDT Needs (Consumption) Public sector health facilities (Final)[5]	14,265,064	15,571,727	16,914,063
Total RDT Needs (Shipments) for Public sector health facilities	16,039,244	16,902,155	17,361,543
Partner Contributions (to PMI target population if not entire area at risk)			
RDTs carried over from previous year	0	0	0
RDTs from Government	0	0	0
RDTs from Global Fund	11,000,143	0[6]	0[6]
RDTs from Other Donors (DFID)	0	0	0
RDTs planned with PMI funding	2,500,000	4,000,000	5,300,000
Total RDTs Available	**13,500,143**	**4,000,000**	**5,300,000**
Total RDT Surplus (Gap)	**(2,539,101)**	**(16,502,155)**	**(12,061,543)**

1. Extrapolated from population based estimates based on assumptions from MICS 2011. (The DHS 2014 and MIS 2016 do not contain the data.)
2. 85% of all fever cases to be tested will be tested by RDTs. These include private health facilities that source RDTs from public system
3. Since PMI may not fund RDTs for use by private health facilities, the quantification team estimated the % coverage of these facilities that are exclusively public so to estimate their RDT need
4. In addition to the demographic forecast, the quantification team did a service based forecast and reports from the DHIMS2 to compare with the demographic and to arrive at a final forecast
5. The quantification team agreed to take an average of the demographic and service forecast as the final; for

these are total RDT shipments needed for each year, in updated supply plan based on stock on hand and country maximum and minimum stock levels.

6. This is TBD. The Global Fund request by the NMCP was recently submitted for review. PMI/Ghana will update the MOP accordingly once the Global Fund request is reviewed by the TRP.

Table 12: ACT Gap Analysis

Calendar Year	2017	2018	2019
ACT Needs			
Total country population	29,311,592	30,044,381	30,795,491
Population at risk for malaria	29,311,592	30,044,381	30,795,491
PMI-targeted at-risk population[1]	29,311,592	30,044,381	30,795,491
Total projected number of malaria cases[2]	4,768,406	4,577,669	4,386,933
Total ACT Needs (Consumption)	**4,768,406**	**4,577,669**	**4,386,933**
Total ACT Needs (Shipments)[3]	**7,138,608**	**4,004,381**	**4,303,635**
Partner Contributions (to PMI target population if not entire area at risk)			
ACTs carried over from previous year	5,578,780	1,859,593[4]	0
ACTs from Government	0	0	0
ACTs from Global Fund	4,549,163	0[5]	0[4]
ACTs from Other Donors	0	0	0
ACTs planned with PMI funding	2,589,445	2,132,300[6]	1,000,000
Total ACTs Available	**12,717,388**	**3,991,893**	**1,000,000**
Total ACT Surplus (Gap)	**5,578,780**	**(12,488)**	**(3,303,635)**

1. Extrapolated from population based estimates based on assumptions from MICS 2011. (The DHS 2014 and MIS 2016 do not contain the data.)
2. Forecast based on the number of cases reported historically in the DHIMS2 and applying country testing targets.
3. These are total ACT shipments needed for each year, in updated supply plan based on stock on hand and country maximum and minimum stock levels.
4. The surplus from 2017 was not carried over fully into 2018 (an estimated one-third will be carried over) because there will be some expiries of some ACTs, particularly some pediatric ACTs resulting from a number of reasons; There has been a significant reduction in number of malaria cases to be seen that will require ACTs for treatment, resulting from implementation of the Test, Treat and track policy. This surplus was coming from a year preceding the current quantification. The reduction in malaria cases was taken into consideration in the forecast years 2017 to 2019; There is a demonstrated preference of adult ALU over pediatric formulations since all age bands can be treated from the adult ALU formulations; There is some procurement of ACTs from the private sector
5. This is TBD. The Global Fund request by the NMCP was recently submitted for review. PMI/Ghana will update the MOP accordingly once the Global Fund request is reviewed by the TRP
6. Quantities estimated in the FY 2017 MOP (2million ACTs) plus a shipment 132,300 originally planned for 2017 but have been rescheduled to 2018

Plans and justification

PMI will continue to support comprehensive malaria case management training, supervision, and quality improvement in all ten regions of the country. PMI will support an integrated project in which malaria programming will continue to be the driver of activities in the USAID focus regions. PMI will also support

full scale implementation of PMI priority interventions, including MIP which was not previously supported, in the five non-focus regions. PMI will leverage resources of the Global Fund through joint planning and implementation to reduce costs and avoid duplication while building on each's comparative strengths. Over the last three years, primarily through clinical OTSS, PMI has focused significant efforts on improving the quality of malaria case management and data management, analysis and use, and quality at district, regional, and community level health facilities. Such efforts to ensure the high quality of malaria case management in all facilities are ongoing and will be continued in FY 2018. PMI will continue to procure commodities for the diagnosis and treatment of uncomplicated and severe malaria at all levels of the public health system. In determining the number of ACTs to procure as its contribution to the identified gap for FY 2018, PMI factored in its decision the practice by health facilities of procuring locally manufactured ACTs from the open market rather than from regional medical stores. This practice has led to the expiration of significant quantities of ACTs in regional medical stores. PMI therefore plans to procure reduced quantities of ACTs as compared to previous years.

PMI will continue to support the laboratory OTSS program and explore mechanisms to further integrate management of this program, along with Malaria Diagnostic Refresher Training and Proficiency Testing into the GHS Clinical Laboratories Unit.

Proposed activities with FY 2018 funding: ***($5,693,500)***

- *Procurement of RDTs:* Procure approximately 4 million RDTs, to fill identified gaps and ensure that health facilities maintain capacity to test fevers and diagnose malaria cases. *($2,120,000)*

- *Procurement of ACTs:* Procure approximately 1. 2 million ACTs, to meet estimated infant, toddler, and adolescent treatments (estimated at 40% of total annual ACT needs) for 2019. *($1,144,500)*

- *Procurement of severe malaria treatment:* Support the national injectable and rectal artesunate needs for severe malaria: procure approximately 150,000 ampules of injectable artesunate (100 mg/1ml) (estimated to cover 10% of the annual requirements). Procure an estimated 100,000 rectal artesunate suppositories (50mg/1ml and 100mg/1ml), which is 100% of the annual need. *($429,000)*

- *Support training of laboratory supervisors at the national level:* Provide technical assistance to support strengthening the capacity of laboratory supervisors at the national level to conduct diagnostic refresher training and proficiency testing on a quarterly basis. ($50,000)

- *Strengthen the quality of malaria microscopy and maintenance of microscopes:* Support laboratory OTSS and malaria diagnostic training-of-trainers on a quarterly basis. Funds will support the continued quality improvement of malaria microscopy, RDT use and scale-up, and coordination between laboratory staff and prescribers. *($300,000)*

- *Strengthen malaria case management in CHPS compounds (5 USAID focus regions):* In 5 USAID focus regions, support in-service training and supportive supervision of integrated case management, with a focus on malaria cases, to CHPS nurses and health officers in CHPS compounds. Support will aim to improve proper diagnosis with RDTs and prompt treatment of uncomplicated cases or referral for severe malaria cases. *($200,000)*

- *Strengthen malaria case management in CHPS compounds (5 non-USAID focus regions):* In 5 non-USAID focus regions, support in-service training and supportive supervision of integrated case

management, with a focus on malaria cases, to CHPS nurses and health officers in CHPS compounds. Support will aim to improve proper diagnosis with RDTs and prompt treatment of uncomplicated cases or referral for severe malaria cases. *($200,000)*

- *Strengthen malaria case management at health facilities (5 USAID focus regions):* In 5 USAID focus regions, support routine clinical OTSS to strengthen integrated case management, with a focus on malaria cases in health facilities. Support will work to improve proper diagnosis and prompt treatment and in-service training for prescribers. Support will encourage the engagement of the regional health management team and regional supervision teams to conduct quarterly clinical OTSS visits at district hospitals to improve malaria case management; support district health management teams and district supervision teams to conduct quarterly clinical OTSS at health centers and CHPS compounds; and conduct quarterly data coaching for district health information officers. *($450,000)*

- *Strengthen malaria case management at health facilities (5 non-USAID focus regions):* In 5 non-USAID focus regions, support routine clinical OTSS to strengthen integrated case management, with a focus on malaria cases in health facilities. Support will work to improve proper diagnosis and prompt treatment and in-service training for prescribers. Support will encourage the engagement of the regional health management team and regional supervision teams to conduct quarterly clinical OTSS visits at district hospitals to improve malaria case management; support district health management teams and district supervision teams to conduct quarterly clinical OTSS at health centers and CHPS compounds; and conduct quarterly data coaching for district health information officers. *($400,000)*

- *Technical assistance to improve supportive supervision at the national and regional level:* Funding to support GHS to monitor, coordinate and strengthen supportive supervision at the national and regional levels. To strengthen malaria case management, support will help develop and/or adapt tools to facilitate implementation of malaria prevention and control activities. Additionally, support will assist the regional OTSS teams to bolster supervision, management, leadership and data management. Effort will be made to further institutionalize the process and coordinate activities with the NHIA and other donor activities. *($150,000)*

- *Support NHIA to implement clinical audits:* Continue support for NHIA to conduct clinical audits to improve treatment standards and the quality of service provision among accredited providers, to ensure adherence to standard protocols, and to check against fraud and abuse. Clinical OTSS teams will join the clinical audit teams to learn first-hand how the clinical audits are conducted so as to improve the OTSS teams' capacity to audit cases treated during the intervening period between two clinical visits. Specific activities will include targeted mentorship and additional supervisory and on-the-job training for poorly performing facilities. *($250,000)*

b. Pharmaceutical management

NMCP/PMI objectives

A main strategy to achieve the objectives of the *National Malaria Control Strategic Plan for 2014-2020* includes universal coverage of malaria commodities through improved procurement and supply management. This requires a functioning supply chain system to ensure consistent access to and availability of quality-assured, essential malaria commodities. The NMCP and PMI plan to ensure stable availability of

malaria commodities through a strengthened supply chain, improved understanding and implementation of logistics management as well as an improved Logistics Management Information System for malaria commodities.

Progress since PMI was launched

Supply Chain Management

Prior to the 2015 CMS fire, the MOH managed the purchasing, in-country storage, and distribution of medicines in Ghana. The MOH procured drugs through government tenders and stored them at the CMS in Tema for distribution to RMS in the ten administrative regions. The CMS also warehoused and distributed program commodities procured by the key donors such as PMI, DFID, and the Global Fund. After the CMS fire, Global Fund and USAID developed an interim parallel private storage and scheduled central to regional medical stores (RMS) distribution system for USAID, including PMI, and Global Fund procured commodities. This system is ensuring secure storage of donor-procured commodities and increasing drug availability at the RMS level including providing more data and better oversight of commodities managed by and transiting through the RMS. In the immediate aftermath of the CMS fire, PMI also supported the emergency quantification of malaria commodities to avoid disruption in service delivery and procured ACTs and severe malaria medications. Additionally, PMI assisted with the redistribution of malaria commodities that were already in the RMS facilities to ensure each region had adequate quantities of malaria commodities, supported the inspection of RMS warehouse and storage facilities and the warehouse and storage facilities at three teaching hospitals, contracted a non-pharmaceutical grade warehouse to store PMI-procured ITNs to support continuous and mass distribution, and supported the development of an interim public-private partnership distribution plan for the distribution of commodities from the central to regional level.

The supply chain system in Ghana remains largely a “pull” system of distribution where the RMS, districts, health centers, and CHPS compounds submit requests and pick up or “pull” their needed health commodities from the higher level facilities as needed.

The NMCP now relies on the Global Fund’s Pooled Procurement Mechanism for accessing Global Fund grant supported malaria commodities. This ensures all malaria commodities procured with Global Fund support obtain the lowest unit cost and are quality-assured products. PMI, together with the President’s Emergency Plan for AIDS Relief and other USAID health programs, provides technical assistance and support to the MOH and GHS to strengthen the supply chain distribution system for all public health pharmaceuticals and other health commodities. With PMI and other USAID health funding and other donor support, the Government of Ghana has been working to fundamentally reform the public health supply chain system. Work started in 2011 to design a sector-wide Supply Chain Master Plan to guide the reform process. Due to a variety of influences, progress on the development of the plan was delayed until late 2014, after which a steering committee was formed including USAID leadership representation. The CMS fire and the underlying accountability concerns and allegations publicly linked to the fire brought the importance of a strong, transparent and accountable supply chain system to the forefront. The Steering Committee found the plan originally drafted in 2011 still valid. The Supply Chain Master Plan for 2015-2020 was finalized by the Steering Committee for implementation in 2014. This plan outlines a five-year strategy for a comprehensive restructuring of the public sector supply chain system and includes a series of strategic interventions and activities for creating a supply chain that fully supports the MOH’s objectives for a reliable, accountable, and transparent national health system. There is a list of specified milestones that have been established to monitor progress with implementation of the Supply Chain Master Plan.

There are many known supply chain system-related persistent challenges in Ghana. Among the most significant challenges is the very common practice by health facilities, and in some cases regional medical stores, of obtaining health commodities by initiating individual local procurement actions to source from local manufactures and/or from local suppliers of internationally manufactured but non-quality assured products. With respect to malaria commodities, this practice by which health facilities source ACTs and severe malaria drugs through local procurements seems to be increasing in frequency, and even becoming routine. Products prevalent in health facilities are manufactured from local pharmaceutical company based in Accra, Ghana including multiple presentations of artemether-lumefantrine tablets as well as ineffective pediatric presentations including liquid suspension and powder sachet and imported multiple presentations of artemether-lumefantrine tablets. During a recent monitoring visit, it was observed that the lowest level of the health system, the CHPS Compounds were the only facility routinely stocked with donor donated ACTs. This practice of locally sourcing antimalarial and other commodities is not driven by stockouts at RMS or central levels but by financial incentives provided to health facilities by the local manufacturers and suppliers. In addition to provision of non-quality assured product to the end user, this practice is putting donor procured ACTs at risk of expiry with lower consumption than anticipated.

Another key supply chain challenge in Ghana is ensuring that donor provided malaria commodities are free of charge. Although it is MOH and GHS policy that PMI and Global fund-donated ACTs, severe malaria drugs, SP, and ITNs are provided free of charge, regional medical stores require payment for them by health facilities which originates from a desire to establish a revolving fund that would be used for future antimalarial commodity procurements. At the same time, health facilities requesting PMI or Global fund donated commodities from their RMS are also receiving reimbursement from the NHIA for ACTs dispensed to patients as part of reimbursement for malaria case management services provided for those who are enrolled and covered by national health insurance. Currently, reimbursements provided by NHIA are for any ACT treatment, not for only quality assured antimalarial drugs.

Regulation and drug quality

The GH-FDA is the national regulatory body within the MOH that is mandated to regulate the manufacturing, importation, exportation, distribution, use and advertisements of food, drugs, cosmetics, medical devices and household chemicals with respect to ensuring their safety, quality, and efficacy. The GH-FDA is also responsible for providing regulatory oversight to ensure the quality, safety, and efficacy of malaria medicines in Ghana, including the registration of locally produced and imported ACTs.

The local pharmaceutical sector in Ghana is active and experienced record growth and increased sales in 2015, partly due to the demand for commodities created by the CMS fire. Antimalarial medicines are one of the top five therapy groups in Ghana by value, providing incentive for the pharmaceutical sector to produce large quantities of these medicines, many of which are known to be of poor quality and inconsistent with global and national treatment guidelines. As mentioned in the previous section, local procurement of medicines from these suppliers is allowed at all levels of government when the absence of the commodity is confirmed and authorization to procure is issued. The supply chain has evolved to a point where regional and district health offices and/or health facilities are directly carrying out local procurements from the private sector, often at high prices and questionable quality. Increased regulation and oversight of these local suppliers is needed.

Since 2008, PMI, alongside other USAID health funding, has supported collaboration with the GH-FDA to promote the safety and efficacy of medicines sold in Ghana. This has included annual rounds of antimalarial testing, with the seventh annual round completed in 2015. Beginning in 2012, these rounds of testing also included commonly prescribed analgesic preparations to relieve malaria fever. The GH-FDA

lab received an internationally renowned ISO/IEC 17025 accreditation in 2014, allowing the GH-FDA to test medicines (imported and funded by international donors) in-country rather than having to send them out to other accredited laboratories in South Africa or elsewhere. Furthermore, the GH-FDA is able to test medicines for other countries that do not have accredited laboratories.

Due to these abilities, the GH-FDA has been granted autonomy by the GOG under the condition that it be self-financing. The GH-FDA has a memorandum of understanding with Ghana's Global Fund principal recipient to conduct post-shipment testing for all Global Fund-procured medicines.

Progress during the last 12-18 months

PMI's investments in supply chain and pharmaceutical management have primarily focused on building NMCP capacity to better manage malaria commodities through participation in quantification training, integrated supportive supervision, improvements to the Logistics Management Information System, and quarterly EUV surveys.

Over the last year, antimalarial drug stock levels in country at central and RMS levels have been more consistent than previously with the system consistently showing low stock-out levels throughout the system for ACTs, severe malaria drugs and SP. However, facilities are stocked out of *WHO-pre-qualified ACTs*. What seems to be occurring is that the highly prevalent, routine practice by district level health facilities and RMSs of locally sourcing antimalarial drugs is resulting in Global Fund and PMI procured commodities resting longer in the central and RMS warehouses, with regular pulling of these commodities only occurring from CHPS compounds and some health centers. This is supported by the most recent EUV conducted in September 2016. The survey detected significant stock-outs of key WHO pre-qualified malaria commodities on the day of the visit at service delivery points (depending on the presentation, 47-100% of service delivery points were stocked out of various presentations of artemether-lumefantrine, with 31.4% stocked out of at least 1 WHO pre-qualified ACT of any type or presentation and 40% stocked out of a WHO prequalified ACT that can treat children). The September 2016 EUV survey also detected high stock availability for malaria RDTs and SP at both RMS and service delivery points, with stock-outs at service delivery points of 12.5% for RDTs and 10% for SP, with 100% availability at RMS, demonstrating a significant improvement over previous years for these 2 commodities. Confirmed by the last 12 months of the quarterly Procurement Planning and Monitoring Report for malaria, Central and RMS stock levels of WHO pre-qualified ACTS have improved.

PMI continues to support the use of stock cards in stock management training across all levels of health facilities. Periodic stock shortages remain a problem at all levels of the system for a number of reasons including incomplete implementation of scheduled delivery from central to regional and in last-mile regions to service delivery points; and lack of quality reporting from facilities.

Each year, PMI supports national quantification exercises for RDTs, ACTs, and severe malaria medicines for public health facilities. In addition, PMI continues to support the implementation of the Supply Chain Master Plan that aims to address the overall public sector supply challenges. Four ongoing key constraints are the availability and visibility of actual commodities consumption data at the facility and district levels, the quality, validity, and accuracy of facility level commodities consumption data that reflects the true need at the facility level, as already mentioned in detail, local procurement by health facilities and RMS of non-WHO qualified antimalarial drugs, and sale of donor donated ACTs contradicting national policy that they should be provided free of charge. With the placement of Regional Logistics Officers at the RMS level and the interim parallel central level private storage and scheduled distribution system from central to RMS levels for USAID, PMI, and Global Fund commodities, there continues to be improvements in data

visibility at the RMS level through the monthly stock reports and better NMCP oversight of commodity deliveries.

In collaboration with the Global Fund, USAID health program funding, and direct funding from Regional Health District budgets, PMI has also begun supporting Ghana's "last-mile distribution" initiative. Last mile distribution (LMD) is a modified pull system whereby health facilities make a monthly commodities request to the region by a specified date and the region delivers all requested commodities to all service delivery points following a GPS charted continuous route to bring delivery efficiencies. LMD has launched in the Northern and Eastern Regions with Greater Accra and Volta Regions to launch next and the remaining regions scheduled for FY 2018.

The antimalarial medicines quality monitoring program in Ghana has led to the identification of several substandard medicines, which has prompted the GH-FDA to send an official communication to all regional offices to ensure the recall of all affected batches from the market and to enact appropriate legal action against the distributors of the unregistered products. However, there remains progress to be made in this area. For example, as mentioned previously, there are antimalarial drugs routinely procured locally by regions and districts. One of the common locally-procured products available presently in health facilities is Combiart tablets (generic artemether-lumefantrine), a product that failed post-market surveillance quality testing in 2015 and thus should no longer be registered and available for procurement in Ghana. In addition to continuing the support post-marketing surveillance monitoring for antimalarial medicines available for sale in the private market place and promoting the implementation of regulatory measures to safeguard public health, PMI has supported strengthening the capacity at the GH-FDA National Quality Laboratory and ensured Good Manufacturing Practices.

Given the increase in local manufacturing of antimalarials in Ghana, the GH-FDA will need support to build the capacity of local manufacturers to meet GMP and WHP pre-qualification standards to improve and maintain the quality of drugs they bring onto the market.

Plans and justification

PMI will continue to provide support to strengthen supply chain, logistics, and pharmaceutical management including forecasting, quantification, training, supervision, and monitoring stocks. PMI will strive to ensure consistent availability of quality-assured malaria commodities at public health facilities throughout Ghana. PMI will work with the NMCP, MOH, and appropriate partners to support ongoing supply chain reform activities including support for implementation of the Supply Chain Master Plan to ensure that essential, life-saving drugs and commodities, including ACTs and RDTs, reach the end user. Support to the GOG in delivering malaria drugs and commodities to the RMS will continue. Support to regions for implementing LMD will continue with new regions added to the LMD initiative going forward. PMI will also contribute to strengthening the Logistics Management Information System for better data availability and use for decision making and to improve warehousing of malaria commodities at the district level. Going forward, PMI will work with the NMCP, high level leadership within the GHS and MOH, the National Supply Chain Committee, and NHIA leadership to develop and implement a plan to address the local procurement of non-quality assured antimalarial drugs by health facilities and regional health and RMS staff.

The Development Partners made recommendations to the Ministry of Health after the CMS fire and jointly agreed on the following milestones in the areas of LMD, LMIS, warehousing, and framework agreement:

- With regards to implementation of the Last Mile Distribution:
    - Reach 50% of health facilities at sub-districts and plan the expansion of LMD at lower level by June 2017

    - Reach 75% of health facilities at sub-districts and the expansion of LMD to lower level by March 2018
    - Reach 100% of health facilities at sub-districts and the expansion of LMD to lower level by June 2018

- With regards to implementation of the Logistics Management Information System:
    - Definition of user data requirement and system design by April 2017
    - Develop LMIS RFP, select a vendor and award a contract by June 2017
    - Provision of LMIS training and equipment by June 2017
    - LMIS roll out to RMS and/or zonal warehouses, teaching hospitals, regional and districts hospitals by July 2018
    - Interim LMIS solution to report HIV consumption data by December 2018

- With regards to Warehousing and HIS transition:
    - Use findings from GH-FDA report and Economic Benefit Analysis study to present a strategy to optimize warehousing and distribution by September 2017
    - Improve RMSs warehousing infrastructure to meet minimum GH-FDA requirements by December 2017
    - Present decision on the most efficient, effective, safe and secure long term strategy for warehousing and distribution by December 2018

- With regards to framework agreement:
    - Signature of a long-term framework agreement for essential medicines by June 2017
    - Evidence of use of the framework agreement by all regions by March 2018
    - each 50% of health facilities at sub-districts and plan the expansion of LMD at lower level by June 2017

Satisfaction of each milestone is associated with a certain dollar amount to be disbursed by the Global Fund, in total $27.4 million from current and future grants will be disbursed only after the MOH/GHS reach the fixed milestone.

If these recommendations are achieved successfully, this would allow for considering the reintegration of USAID commodities into the GOG public health supply chain system in the next 18 months, eliminating parallel central warehousing and distribution from central to regional levels.

Furthermore, PMI will continue to support the drug quality monitoring activities and measures focused on maintaining GH-FDA's ISO 17025 accreditation and work toward a country-owned sustainable post marketing surveillance, including samples from the public health pharmacies and the private distribution channel. With the GH-FDA's status as an autonomous institution, PMI will be studying the progress of the GH-FDA under the new funding arrangement to determine its ability to self-finance and maintain the malaria medicines post-market surveillance activities.

Proposed activities with FY 2018 funding: ***($1,625,000)***

- *Support interim warehousing and supply chain system strengthening:* Continue to provide technical assistance for strengthening logistics, warehousing, and distribution to improve availability of malaria commodities, in accordance with the national Supply Chain Master Plan. Activities will focus on addressing weaknesses in supply management, forecasting, transportation, and reporting

systems. Support quarterly EUV surveys to monitor the status of facility-level commodity stock levels including both WHO pre-qualified and locally procured ACTs and identify ongoing programmatic successes and challenges. Support will continue to include central warehousing and transportation of malaria commodities from central to RMS levels. Technical assistance will also include implementation of the plan developed during FY 2017 to address the local procurement of non-quality assured antimalarial drugs by health facilities and regional health and RMS staff. *($1,200,000)*

- *Strengthen "last mile" distribution in up to four regions*: Provide support for last mile distribution in up to four new regions (likely Ashanti, Central, Upper West and Upper East), with limited technical assistance continuing in regions where LMD was launched during 2017 to perfect distribution initiative (Northern and Eastern Regions and likely Greater Accra and Volta Regions). Support includes technical assistance for LMD regional implementation plan development, route mapping, logistics implementation support to regions, and monitoring LMD implementation performance. (*$275,000*)

- *Strengthen drug quality monitoring capacity and regulation of non-quality assured antimalarial drugs:* Provide support for continued strengthening of the GH-FDA's capacity to effectively monitor quality of antimalarial drugs available in Ghana. Support to GH-FDA to monitor and regulate locally procured non-WHO pre-qualified antimalarial drugs including batch testing of Ghana manufactured ACTs, SP and severe malaria drugs including support to increase regulation and removal of drugs that fail quality testing. PMI will support the GH-FDA to build the capacity of local manufacturers to meet GMP and WHO pre-qualification standards. *($150,000)*

4. Health system strengthening and capacity building

PMI supports a broad array of health system strengthening activities which 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

Sustained progress against malaria in Ghana requires new approaches, strategies, and solutions to combat the emerging threat of drug resistance, address presumptive prescribing and treatment practices, and ensure sustainability of existing programs. A widely-recognized approach to overcoming these challenges is to strengthen health systems to be more transparent, responsive, and effective so that medicines, including antimalarials, and other health products can be made widely available and accessible to those who need them. PMI prioritizes key health system investments to improve Ghana's capacity to meet its malaria control goals, including strengthening provision of health services; improving the health sector workforce; enhancing health information systems; supporting the supply chain to deliver essential medical products and technologies to health facilities; strengthening health finance; and enhancing leadership and governance, all necessary components of an effective health system and all critical to achieving long-lasting and sustainable progress against malaria. Table 13, below, summarizes the varied HSS investments PMI/Ghana is supporting throughout this MOP and over time.

Progress since PMI was launched

National Health Insurance Scheme

As detailed in the Strategy section of this document, an effective and well-functioning NHIS reimbursement system remains critical to reducing malaria-related mortality in Ghana. NHIS coverage has made a significant difference for its members in care-seeking and financial protection related to essential malaria services. Rigorous analysis from 2015 that controls for underlying population differences has shown even more dramatic results, with NHIS coverage leading to a 66% increase in the likelihood of seeking formal medical treatment for a child with a fever or a cough and an almost 72% increase in the likelihood of receiving malaria medication.[9] Simply put, those registered for NHIS are overwhelmingly more likely to seek care and treatment for malaria in regulated public and private facilities, as it reduces barriers to accessing services and thus promotes increased use of available services.

Since access to services alone is not sufficient to ensure provision of quality malaria diagnosis and treatment services, PMI and USAID support the NHIA in undertaking targeted clinical audits quarterly to validate provider claims and ensure that they have followed appropriate malaria diagnosis, treatment and resource utilization. During a clinical audit, malaria indicators (including: the number of malaria cases treated per population, the number admitted for severe malaria, and the type of drug prescribed in relation to diagnosis) are examined. The audit team (comprised of a doctor, nurse, pharmacist, and NHIA clinician) meets with each facility administrator and staff to conduct a full review of relevant paperwork with a full listing of symptoms, testing, and diagnosis to ensure that the diagnosis, treatment, and respective reimbursement were correct. Relevant issues for malaria revealed in the audits include inappropriate prescribing practices (including substitution of medicines), presumptive treatment, and poor documentation of consulting room and medical notes. To date, five rounds of NHIS clinical audits have occurred. Independent teams conduct these audits to validate individual facility reimbursement claims and confirm that established standard operating procedures are being followed. For malaria, facilities are only reimbursed for treatment, although confirmatory testing is part of the approved protocol SOP for receiving NHIA reimbursement for malaria treatment. If an audit finds a claim, for malaria treatment, with no evidence of a confirmatory test, the facility can be required to refund the full reimbursement amount to NHIA. Failure to test due to RDT stock-out is made on a case-by-case basis.

The clinical audits are working and improving quality of service delivery. Several health facilities have created their own health facility clinical audit committee, comprised of health workers from different departments, to follow up on the findings of the clinical audits. These committees are responsible for in-house monthly reviews of severe malaria treatment practices through root cause analysis designed to identify gaps and weaknesses and, through consensus, develop practical, specific, and time-bound action points to address the challenges therein. Performance is benchmarked against standards highlighted in previous meetings. It is expected that over time significant changes in the quality of malaria case management will be seen through this investment.

PMI has supported communication activities around the scale-up of capitation payment for primary care, including uncomplicated malaria, which is essential to ensure NHIS sustainability. Capitation is a payment mechanism in which health providers are paid a uniform per capita fee for a set number of health services in an effort to control escalating costs as well as improve the efficiency and effectiveness of health services

[9] Gajate-Garrido G, Ahiadeke C. "The effect of insurance enrollment on maternal and child health care utilization: The Case of Ghana". IFPRI Discussion Paper 01495. 2015.

and simplify claims processing. It was first introduced as a pilot in the Ashanti Region. It is expected that capitation will ultimately lead to more efficient use of resources and achieve greater value for money in malaria diagnosis and treatment, one of the largest cost drivers under the NHIS.

Supply Chain Support
In the aftermath of the CMS fire, as described in more details in the Pharmaceutical Management section of this document, PMI has invested considerable funds to support supply chain reforms aimed at improving efficiency and curtailing chronic stock-outs of health commodities. PMI has also supported the emergency and annual quantification of malaria commodities to ensure availability of malaria products and nationwide mass distribution of ITNs. PMI resources have strengthened ground logistics capacity, supply chain and logistics technical assistance, expert pharmaceutical management, and technical leadership to support the supply and financing of malaria commodities.

Progress during the last 12-18 months

National Health Insurance Scheme
During the last 18 months, PMI and USAID/Ghana have continued to support targeted clinical audits under the NHIS. The initial rounds of clinical audits supported by PMI and USAID in 2015 revealed that 100% of facilities--in certain districts largely in the Ashanti and Northern regions—were inappropriately diagnosing malaria. During the last round of audits, 66% of all audited facilities during this period were found to be treating malaria inappropriately. It is possible to attribute increases in provider compliance to the punitive measures which have been enforced over the past 18 months. Audited facilities are targeted because of indications that the facilities were not providing high quality services in accordance to national guidelines. Examples of inappropriate treatment include artemether and quinine injections for treatment of uncomplicated malaria or treatment of malaria with a negative RDT. Since 2010, approximately 10% of NHIA-accredited health facilities have been audited with the support of PMI and USAID/Ghana, yielding over $1.2 million in savings from claims denied for non-adherence to clinical guidelines or other treatment standards (across all services provided).

PMI has also continued support for the promotion and expansion of capitation into three additional regions (Upper East, Upper West, and Volta Regions) with enrollment currently ongoing in five more regions (Brong Ahafo, Central, Eastern, Northern, and Western Regions). Enrollment in the initial 3 regions exceeds 90% of active NHIS members in these locations (approximately 1.6 million members). Preferred primary care provider networks address the constraint that most providers are unable to provide the full set of essential services on their own. Based on experiences from the Ashanti Region capitation pilot and the results of a 2015 PMI and USAID/Ghana funded provider mapping survey in the Upper East, Upper West, Ashanti and Volta Regions, it is clear that network formation is a critical enabling step for successful capitation. The formation of preferred primary care provider networks has the potential to strengthen all primary health care services including malaria, maternal and child health, and reproductive health/family planning. An “early warning system” of nine routine indicators has also been designed to manage potential adverse consequences of capitation, including under-provision of services in the capitation basket or excess referrals. Indicators include the number of capitation visits per enrolled member, the percentage of claims in the capitation basket with a malaria diagnosis, and inappropriate referrals or overuse of antimalarial drugs.

Capacity Building
In 2016, PMI continued to support significant capacity development for malaria control efforts in Ghana. Provision of equipment and direct technical assistance support to the NMCP has facilitated the timely

compilation and transfer of malaria data from districts and regions to the national data center, leading to observed improvements in data reporting through the DHIMS2. PMI continued to focus on strengthening the NMCP's capacity to better manage malaria commodities through participation in quantification training, integrated supportive supervision, improvements to the logistics management information system, and EUV surveys. National quantification exercises for ITNs, SP, RDTs, ACTs, and severe malaria medicines have been undertaken for public health facilities and CHPS compounds.

PMI continued its support to the "malaria track" of the Field Epidemiology Laboratory Training Program at the School of Public Health at the University of Ghana. During the past 18 months, PMI has supported 3 residents in the malaria track of the program. Residents completed their practical training in field epidemiology, focusing on priority issues in malaria surveillance and scaling up malaria case management interventions. During the last 18 months, FELTP residents finalized their thesis topics, which included: assessing quality of case management of severe malaria in health facilities in Northern Region; prevalence of malaria and associated factors in artisanal mining in non-mining districts in the Upper East Region; and uptake of IPTp for malaria and birth outcomes among pregnant women in the Brong Ahafo Region. Historic PMI investments in the Field Epidemiology Laboratory Training Program have resulted in four alumni currently working with the NMCP including a medical epidemiologist, leading malaria SM&E activities, and a malaria diagnostic focal point.

PMI continued its partnership with the Peace Corps/Ghana "Stomping out Malaria in Africa" program to implement malaria prevention and control activities. Specific partnerships were established in 2016 to directly engage Peace Corps Volunteers in the school-based ITN distribution communication and education activities. Peace Corps Volunteers also utilize small grants to facilitate promotion activities in their communities such as behavior change communication activities aimed at improving use of ITNs and promote early health seeking behavior. A third-year volunteer is being recruited to start malaria control focused activities with PMI support.

Plans and justification
PMI will continue to support capacity building throughout the health care system within both the NMCP and NHIA. In addition, PMI will direct resources to initiatives, which will increase access to affordable quality malaria care and treatment and improve the planning and implementation of malaria interventions.

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

- *Build management capacity at NMCP, GHS, and other GOG partners:* Continue to provide support to the NMCP, GHS, and GOG for technical capacity building and improved malaria control systems. This activity will support: 1) attendance in malaria-specific trainings, conferences by select NMCP, GHS, and GOG employees to further build in-country capacity; 2) assisting NMCP with organizing meetings that are important for planning and management of malaria prevention and control activities; and 3) supporting limited information technology investments, such as computers, laptops, internet connection at the GHS's Regional Health Directorate level to ensure timely data reporting to DHIMS2. *($100,000)*

- *Ensure sustainability of NHIA by appropriately incentivizing reimbursement to increase access to appropriate malaria diagnosis and treatment:* Provide technical assistance to the scale up of a primary health care capitated package of services to five additional regions; improve provider incentives to ensure appropriate case management services by working with key stakeholders to identify examples of best practices, real time data analysis, and communication materials to address

the incentive constraints introduced with the preferred provider system. Specific investment will be co-funded with non-malaria USAID health funds, PMI will support NHIA to increase its efficiency and sustainability to improve access to health services in general and quality malaria treatment by:

- Refining diagnostic related groups to cut costs and as a tool to monitor clinical performance; strengthening management of claims, drug payment, and drug supply to ensure the continued sustainability of the NHIS.
- Improving and making better use of claims data and analytics to provide routine information on malaria service utilization and quality. This includes identifying an additional set of "early warning" indicators – including the number of malaria cases in which treatment complied with clinical guidelines; average treatment cost per malaria episode; and percentage of malaria cases that have been confirmed by parasitological test – to ensure that capitation is bringing the expected benefits for malaria access and treatment.
- Analyzing data to understand the factors driving the variability in malaria treatment costs across providers as uncovered through claims data, identifying root causes and developing appropriate measures to address the situation as necessary. Addressing these questions may contribute to malaria-related cost containment, case management and data management improvements.
- Ongoing support to the Presidential Commission on the Technical Review of the NHIS to do a thorough stock-taking of the achievements of the NHIS. Examining where the Scheme can be strengthened to expand access to essential health services throughout Ghana while protecting patients from the impoverishing costs of care. ($300,000).

- *Support NHIA capitation roll out:* Support to communication efforts to facilitate NHIA capitation roll out to five additional regions (Brong Ahafo, Central, Eastern, Northern, and Western) with the goal of promoting enrollment in NHIA and informing the public about how to access NHIA-accredited facilities among the general population. Since NHIS enrollment increases the likelihood of seeking formal care for malaria treatment, it is anticipated that this investment will contribute towards strengthening the overall health insurance program, increase enrollment, reduce the risk of insolvency, and ensure sustainability of NHIS. ($250,000).

- *Strengthen the role of civil society in malaria advocacy*: Build the capacity of local Ghanaian non-governmental organizations and civil society organizations to monitor the quality and ease of access to health services, with a focus on malaria diagnostics and treatment. Work with DHMT to promote adherence to national malaria guidelines and promote the use of district and regional report cards to monitor progress on indicators. Strengthen community structures for advocating for patients' rights and client-centered care, including the availability of malaria commodities. Empower civil society organizations to engage citizens to demand and participate in health service delivery and advocate for their interest. Strengthen the health sector monitoring of government institutions, officials and policy processes, and civil society organization monitoring of issues, including: transparency, accountability health system, and compliance with service standards, regulations, and patients' charter code. PMI estimates that approximately 20 local community groups in five regions will be supported annually through this activity. These groups will monitor the quality of health services and help to identify areas for improvement. *($200,000)*

- *Support Peace Corps Malaria Program*: Support Peace Corps volunteers based in Ghana to receive small grants from PMI to engage in malaria control and prevention activities, such as community mobilization for SBCC, ITN distribution, and (as needed) operational research. *($30,000)*

- *Support long-term field epidemiology and laboratory training:* Support long-term training of individuals to build capacity at the NMCP or GHS in epidemiology, M&E, or other malaria program management functions as needed through the Field Epidemiologic and Laboratory Training Program, which was established with USG support at the University of Ghana's School of Public Health in collaboration with the GHS. (*$120,000*)

Table 13: Health Systems Strengthening Activities

HSS Building Block	Technical Area	Description of Activity
Health Services	Case Management	Provide technical assistance to support strengthening of antimalarial drug quality monitoring in collaboration with the GH-FDA.
Health Workforce	Health Systems Strengthening	Support long-term training of individuals to build capacity at the NMCP or GHS in epidemiology, M&E or other malaria program management functions; support Peace Corps Malaria Program volunteers to engage in malaria control and prevention activities such as community mobilization, SBCC activities, and ITN distribution; strengthen the role of civil society and non-governmental organizations in malaria control advocacy.
Health Information	Health Systems Strengthening	In collaboration with Korean International Cooperation Agency and Samsung Corporation, support the GHS to strengthen electronic data capture under the DHIMS2. This will improve decision-making, planning, forecasting and program management.
	Health Systems Strengthening	Conduct studies to better understand the variability in malaria treatment costs across different NHIS network providers.
Essential Medical Products, Vaccines, and Technologies	Case Management	Support improved forecasting, procurement, quality control, storage, distribution, and EUV surveys of malaria commodities, such as ITNs, ACTs, and RDTs.
Health Finance	Health Systems Strengthening	Provide technical assistance to support of the financial sustainability of the NHIS by appropriately incentivizing reimbursement to increase access to appropriate malaria diagnosis and treatment.
Leadership and Governance	Case Management	Support NHIA government-to-government programming to scale-up quality assurance and quality control for malaria diagnosis and promote and ensure local ownership over the process.

5. Social and behavior change communication

NMCP/PMI objectives

The *Social and Behavior Change Communication (SBCC) Strategy for the National Malaria Control Programme (2015-2020)* was developed with support from UNICEF. The strategy provides strategic direction to guide the development, implementation, and monitoring and evaluation of the SBCC components of the national malaria prevention and control efforts. It defines communication and behavior change objectives, key target groups, messages, channels, and communication interventions. The strategy aims to guide the development of interventions and activities that raise awareness about malaria and address the key determinants of behavior for malaria prevention and control interventions, with the ultimate goal of a long-term normative shift in behaviors among the key target groups nationwide.

The National Malaria Communication Committee is the entity charged with oversight of the implementation of the strategy. Officially a subcommittee of the MICC, the National Malaria Communication Committee is a working group with responsibility for reviewing, approving, and initiating the development of communications materials for malaria. PMI is an active member of the committee. The committee provides oversight and input to the NMCP's Advocacy, Communication, and Social Mobilization (ACSM) sub-committee, which also, as a program of the GHS, receives technical and normative guidance and inputs from the GHS Health Promotion Department (HPD). The GHS HPD is responsible for the design, implementation, and evaluation of all SBCC activities in Ghana.

Progress since PMI was launched

Since its launch, PMI has supported the development of SBCC campaign and communication activities, including integrated mass media campaigns and community and facility-based interpersonal communication activities, and capacity strengthening of NMCP and GHS HPD staff. PMI has supported the design, implementation, and evaluation of SBCC activities promoting adherence to national malaria case management guidelines (i.e. correct and consistent use of ACTs and adherence to RDT results), adherence to IPTp guidelines, ANC attendance, prompt care seeking, acceptance of IRS, correct and consistent use of ITNs and ITN care practices.

SBCC activities have contributed to the increased uptake and use of malaria control and prevention interventions in Ghana, but challenges remain. According to the 2014 Ghana DHS, 93.5% of respondents heard or saw the following specific message: "Families should sleep under insecticide treated ITNs to protect them from malaria, especially pregnant women and children under age 5." As discussed earlier, while ITN availability, access, and use has increased among key populations (children under five and pregnant women), an overall "use gap" remains. Individuals with access to an ITN are not using it, which limits the overall impact that ITNs can have on preventing malaria infections in Ghana. This is a serious behavior challenge that Ghana needs to address quickly to continue to make progress on preventing malaria infections.

Previous efforts supported by PMI and USAID to promote correct and consistent use of ITNs and ITN care practices yielded significant results. An evaluation of "Aha Ye De" (a component of the original *"Good Life. Live it Well"* campaign), a comprehensive mass media and interpersonal communication campaign conducted in 2014, found a significant increase in the total number of ITNs owned by all participating households (60% at baseline vs. 78% at end line). Additionally, exposure to "Aha Ye De" was associated with increased use of ITNs ($p<0.001$) and with sleeping under a net the night before being surveyed ($p<0.01$). Three-fourths of those who reported sleeping under a net the previous night stated that they have heard "Aha Ye De" messages. There was a significant association between exposure to malaria campaign

spots and children under five sleeping under the net. More than half (56%) of respondents who heard these spots reported that the children in their households always slept under a net compared to 45% of participants who were not exposed to this campaign (p=0.04). Current and future PMI-supported SBCC activities will build on this success.

Regarding intermittent preventive treatment of MIP, according to the 2014 Ghana DHS, 76.4% of respondents heard or saw the following specific message: "Pregnant women should attend ANC and take 3 doses of SP/Fansidar during pregnancy to prevent malaria." From 2006 to 2014, the percent of women who received 2 or more doses of IPTp during their last pregnancy in the last 2 years increased from 28% (2006 Ghana MICS) to 67% (2014 Ghana DHS) to 78% (2016 Ghana MIS). Women reported receiving 3 or more doses of IPTp during their last pregnancy in the last 2 years increased from 38% (2014 DHS) to 60% (2016 MIS). Despite significant progress in IPTp-2 uptake, opportunities for increased IPTp uptake remain. According to the 2014 Ghana DHS, 87.3% of women reported attending 4 or more ANC clinic visits, indicating a missed opportunity for IPTp uptake improvement. Recognizing the gap in ANC2 and ANC3 attendance and IPTp-2 and IPTp-3 uptake, PMI is working with the NMCP and partners to address the issues through, primarily, better forecasting of SP needs and supply chain management and, where appropriate, SBCC activities.

Progress has also been demonstrated in malaria care seeking behaviors. From 2011 to 2016, according to the 2011 Ghana MICS and 2016 Ghana MIS, respectively, the percent of children under 5 years old with fever in the last 2 weeks for whom advice or treatment was sought increased from 50% to 72%. Yet, according to the 2014 Ghana DHS, 73.7% of respondents heard or saw the following specific message: "Treatment should be sought from health facilities within 24 hours of onset of fever, especially for children under age 5." Exposure and recall of appropriate case management messaging has not yet been translated into behavior and opportunities remain for increasing care seeking behaviors and adherence to national malaria case management guidelines.

PMI continues to explore the behavioral barriers to ITN use, IPTp uptake and adherence to IPTp guidelines, and care seeking and adherence to case management guidelines, that impede uptake and use of key malaria control interventions. Findings are incorporated into national, regional, and local mass media and interpersonal communication activities to address the identified barriers and facilitators.

Progress during the last 12-18 months

During the past 18 months, PMI has supported social and behavior change activities through a variety of channels including mass media, facility- and community-based interpersonal communication, and school-based interpersonal communication. Recent PMI mass media activities have focused primarily on promoting correct and consistent use of ITNs, ITN care, ANC attendance, and prompt care seeking for fever.

PMI's primary support for mass media activities has included—in collaboration with USAID/Ghana—refreshing the national *"Good Life. Live it Well."* mass media campaign. The revitalization of the campaign has been conducted with the GHS HPD in a concerted effort to strengthen the capacity of the HPD to design, implement, and evaluate malaria SBCC interventions. PMI contributed to support of at least 43,771 integrated TV and radio spots, programs, and interviews, which were aired on 6 national TV, 5 national radio, and 19 regional radio stations. Furthermore, 64,000 *"Good Life. Live it Well."* posters have been distributed to health facilities. The malaria-specific components of this mass media campaign seek to:

- Create a positive net culture to promote acquisition of ITNs, correct and consistent use of ITNs, and proper care behaviors;

- Promote timely and regularly scheduled ANC attendance;
- Increase adherence to national IPTp guidelines;
- Encourage prompt and timely care-seeking for febrile children;
- Increase adherence to national malaria case management guidelines, including correct and consistent use of ACTs and adherence to RDT results;
- Improve acceptance of IRS; and
- Increase population coverage of NHIS, increase provider enrollment in cost-containment capitation efforts, and promote key health-seeking behaviors to improve health outcomes.

Opportunities for national and regional mass media campaigns abound in Ghana: in 2015, Ghana reported 18 functional television stations, including four with a national reach, and over 200 local radio stations broadcasting in a variety of local languages. While radio station reach is more concentrated in urban areas, nearly all districts within the country are reached by local radio. Given the limited geographic reach of local radio stations, however, to achieve national coverage requires agreements with many different local radio stations. The 2014 Ghana DHS found that 63.6% of respondents reported receiving malaria messages through TV and 79.4% of respondents reported receiving malaria messages through radio. The print media in Ghana is not as well developed, and only a few news publications are national in scope. According the 2014 Ghana DHS, only 12.0% of respondents reported receiving malaria messages through newspapers or magazines.

Exposure to key campaign messages and recall of campaign messages were assessed through a mobile phone feedback survey using interactive voice response. Of the 675 audience members surveyed in the 5 USAID priority regions, 81% had high recall of malaria messages. A variety of actions were reported by respondents that recalled exposure to the campaign. For example, 40% of respondents who reported exposure to the campaign reported visiting a provider after exposure to the campaign, 61% sought information after exposure to the campaign, and 59% shared information after exposure to the campaign. To assess exposure over time to campaign messages and assess progress towards changes in behavior and related determinants, PMI is supporting—together with USAID—a mobile cohort survey.

Facility- and community-based interpersonal communication activities have targeted adherence to national malaria case management guidelines, adherence to IPTp guidelines, ANC attendance, and prompt care seeking. In the past year, PMI has supported the development and dissemination of job aids to enable frontline health workers in social and behavior change communication. Health facility based orientation has been done for 2,509 frontline workers in Volta and Greater Accra to help generate demand for malaria services at the community-level.

School-based interpersonal communication activities, in tandem with school-based ITN distribution activities, have focused on correct and consistent use of ITNs and ITN care practices. In 2016, these efforts targeted primary school pupils, teachers, parents and families, and community leaders in the 6 regions that participated in the school-based distribution activities. PMI supported the training of 618 district education officials (district SHEP coordinators and cultural officers) and health officers (district malaria focal persons and health promotion officers) on the materials and methods for school-based activities to promote ITN use and care. The officials subsequently trained 7,641 school-based SHEP coordinators representing a sub-set of the 16,026 primary schools participating in the school-based distribution activities. In 2016, PMI supported the development and distribution of 56,000 copies of the booklet “Promoting Malaria Prevention through Primary Schools—Communication Guide for Teachers”, 30,000 copies of the poster “Free ITN Distribution Campaign—Malaria-Free Children,” 40,000 copies of the chart “Key Facts on ITN Use and Care,” and 1,962 copies of drama scripts on malaria. Furthermore, while school-based IPC activities to date

have been limited to ITN-related behavioral interventions, the school-based platform will be used to deliver a full range of preventative and curative malaria messages.

World Malaria Day remains a high-profile event in Ghana with planned activities throughout the country engaging diverse partners including the NMCP, MOH, GHS, PMI/Ghana, USAID/Ghana, private sector, development partners, and other malaria control advocates and partners. In 2016, PMI supported the production and dissemination of interviews on national radio stations and six national television stations in English, Twi, and Ga. Additionally, PMI supported local news outlets across the country to cover and report on World Malaria Day events in their communities.

In 2016, PMI supported the NMCP to develop a malaria advocacy video titled "Domestic Financing of Malaria—Role of Corporate Ghana" in line with the NMCP's *Resource Mobilization Plan for National Malaria Control Strategy 2014-2020.* The video is designed to engage private sector corporations in malaria prevention and control by highlighting the economic costs of malaria in Ghana and presenting an argument for why the private sector should be involved in malaria prevention and control.

Plans and justification

To sustain progress made in malaria control and prevention in Ghana, PMI will continue to support a variety of SBCC activities including: the operationalization of the *Social and Behavior Change Communication (SBCC) Strategy for the National Malaria Control Programme (2015-2020),* strengthening the capacity of HPD to implement malaria SBCC, continuing the at-scale implementation of the "*Good Life. Live it Well"* integrated SBCC campaign, and monitoring the impact of PMI's SBCC activities.

PMI will build on previous PMI/Ghana and USAID/Ghana investments in SBCC and the branding of the *"Good Life. Live it Well"* integrated SBCC campaign. PMI will support the development, dissemination, and implementation of national and targeted mass communications campaigns, community mobilization activities, and interpersonal communication activities. Additionally, PMI will continue to support facility- and community-level SBCC activities to strengthen the role of health workers as active promoters of ITNs, IPTp, and ACTs. According to the 2014 Ghana DHS, 32.4% of respondents reported receiving malaria messages through a health worker and 12.9% of respondents reported receiving malaria messages through a community volunteer. PMI/Ghana will work through existing facility- and community-level channels to deliver targeted malaria SBCC interventions.

Recognizing the significant gap between net use and access in Ghana, according to the 2016 MIS, particularly among urban and wealthier Ghanaians, future PMI investments in SBCC to promote correct and consistent use of ITNs will be informed by ongoing and planned qualitative and quantitative research to understand the extent of outdoor sleeping and seasonal net use practices and understand the barriers to outdoor and indoor net use.

SBCC activities will be monitored and evaluated through routine monitoring and evaluation. Mass media activities will be monitored through local media monitoring organizations, which will monitor the number of spots aired on radio and television, and project-level monitoring and evaluation activities. Facility- and community-based activities will be monitored through project-level monitoring and evaluation activities.

Proposed activities with FY 2018 funding: ***($1,400,000)***

In FY 2018, PMI will support national and regional mass media and regionally focused school-, facility, and community-based interpersonal communication activities targeting key malaria-related behaviors. PMI support will focus primarily on the following key behaviors: adherence to national malaria case

management guidelines (i.e. correct and consistent use of ACTs and adherence to RDT results), adherence to IPTp guidelines, ANC attendance, prompt care seeking, acceptance of IRS, correct and consistent use of ITNs, and ITN care. Specifically, PMI will support the following SBCC activities:

- *Support mass media communication efforts to promote ITN ownership and use, IPTp uptake, and improved care seeking behavior at the national level:* Provide national-level coordination and technical assistance to promote ITN ownership and use, IPTp uptake and improved care-seeking behavior, develop new malaria-specific communication materials, and facilitate dissemination of malaria-related messages, especially mass media communication efforts. Technical assistance will be provided to the NMCP, the National Malaria Communications Committee as well as to the GHS/Health Promotion Unit. Support includes:
    - Determine barriers to and facilitators of ITN use, care seeking, and uptake of IPTp and adherence to national IPTp guidelines to inform SBCC activities;
    - Continue support for the *"Good Life. Live it Well."* campaign to disseminate malaria messages through integrated transmedia SBCC activities;
    - Strengthen the capacity of the GHS HPD to design, implement, and evaluate malaria-specific SBCC activities;
    - Support the GHS HPD, NMCP ACSM sub-committee, and MICC National Malaria Communication Committee to ensure the development and oversight of appropriate malaria SBCC materials and activities in Ghana;
    - Produce malaria-specific communication materials that will be used and disseminated through other PMI-funded SBCC activities; and
    - Work with the NMCP and Ghana Statistical Service to ensure indicators, as recommended by the Roll Back Malaria Communication Community of Practice and outlined in the *Malaria Behavior Change Communication (BCC) Indicator Reference Guide*, continue to be included in future national household surveys. *($400,000)*

- *Support school- and community-based activities to address barriers to correct and consistent use of ITNs and promote ITN care:* Design, implement, monitor, and evaluate school- and community-based activities to address identified barriers to correct and consistent ITN use and promote ITN care. Targeted ITN-specific technical assistance will be provided to the NMCP to ensure that overall ITN-related SBCC activities throughout Ghana remain state of the art. Support will also include efforts to increase effectiveness of school-based continuous distribution of ITNs through activities to increase awareness of and community participation in school-based distribution. *($400,000)*

- *Strengthen facility- and community-level behavior change and interpersonal communication (5 USAID focus regions):* In 5 USAID focus regions, support facility-and community-level outreach to promote correct and consistent uptake of both preventative and curative malaria interventions. Support will also engage CHPS nurses and health officers to engage with communities and promote malaria-related health seeking behaviors. *($300,000)*

- *Strengthen facility- and community-level behavior change and interpersonal communication (5 non-USAID focus regions):* In 5 non-USAID focus regions, support facility-and community-level outreach to promote correct and consistent uptake of both preventative and curative malaria interventions. Support will also engage CHPS nurses and health officers to engage with communities and promote malaria-related health seeking behaviors. *($300,000)*

- *Strengthen the role of civil society in malaria advocacy*: Support communications efforts to increase population coverage of NHIS, increase provider enrollment in cost-containment capitation efforts, and promote key health-seeking behaviors to improve health outcomes. (*Activity budgeted in the HSS section)*

6. Surveillance, monitoring, and evaluation

NMCP/PMI objectives

The Ghanaian NMCP adapts their implementation of malaria interventions through programmatic decision making based on various data sources, including the routine Health Management Information System (HMIS), periodic household surveys, and supportive supervision visits. The *National Malaria Control Monitoring and Evaluation Plan (2014-2020)* guides the M&E strategic framework for malaria control in Ghana. This plan complements the revised national strategic plan of the NMCP with technical assistance from PMI, WHO, and other partners. The objectives of the M&E plan are to reinforce the health information systems and processes to provide timely, accurate, reliable, and valid data for programmatic planning, management, and decision-making.

Progress since PMI was launched

Ghana uses routine HMIS as the main source of data for tracking and measuring programmatic progress. The DHIMS2 web-based platform is managed by the GHS Policy, Planning, Monitoring, and Evaluation (PPME) Division through the Centre for Health Information Management. This system is used for reporting and analyzing district level data from health facilities and is available in all 226 districts. PMI continues to provide support for the strengthening of DHIMS2, which includes a customized dashboard to report malaria-focused indicators. Entering patient information into this system is a multi-step process. In theory, data entries into DHIMS2 are first recorded into standard registers at health facilities with patient consultations. Data are then collated and aggregated from these registers into standardized reporting forms on a monthly basis. Facility health information officers are responsible for the collection and verification of data from facility departments at the end of every month and for submission to the district health information officer. The data is quality checked monthly by a district validation committee which provides recommendations to improve data quality. The head of the facility reviews and endorses the collated facility data after it has been cleared by the data validation committee, and before it is submitted to the district. Where the capacity exists, hospitals and some facilities may enter data directly into DHIMS2. However, local data entry and analysis software (i.e. HAMS – Healthcare Assessment and Management System) for patient information varied greatly and is not integrated with DHIMS2. The transition from paper-based to electronic record keeping also had challenges including lack of adequate training in the new software, missing variables (i.e. laboratory results), and infrastructure issues such as connectivity. The standard operating procedure for data collection, managing and reporting states that once data is received from the facilities, the district health information officer has ten days to verify, validate, and enter data into DHIMS2. It is mandatory that a validation committee review the data entered (i.e. data concurrence between facility and DHIMS2) before it is electronically signed and sent on to the regional level.

Table 14 summarizes the surveillance, monitoring, and evaluation data sources that are available to the NMCP and partners in Ghana. From 2008 to 2011, PMI supported 5 GHS sentinel surveillance sites, collecting patient-level and aggregate data on approximately 30 malaria indicators. In 2011, PMI stopped providing financial and technical support after an evaluation of the sites showed low testing rates and poor data use. In 2014, the NMCP established 30 sentinel sites (which are primarily district level hospitals) for monitoring trends in malaria burden and other disease indicators with support from the Global Fund and

DFID. Sentinel sites were re-established to alleviate concerns regarding data quality at the facility level and to create a platform for special studies, such as therapeutic efficacy testing of ACTs and assessing the motivation towards non-adherence to test results. For malaria, these sites provide data on number of suspected cases, number of suspected cases tested, and number of confirmed positive cases. Thick and thin stain smears are also performed on every suspect case. In 2015, a comparative analysis between the sentinel sites and the DHIMS2 data showed substandard record keeping and reporting at the sentinel sites. With support from the Global Fund, the NMCP will strengthen routine data quality audits and assessments to improve sentinel surveillance data quality.

Table 14: Surveillance, Monitoring, and Evaluation Data Sources

Data Source	Survey Activities	Year								
		2011	2012	2013	2014	2015	2016	2017	2018	2019
Household surveys	Demographic Health Survey (DHS)				X**					X**
	Malaria Indicator Survey (MIS)						X			
	Multi-Indicator Cluster Survey (MICS)	X								
Health Facility and Other Surveys	Baseline and midline survey to assess malaria control activities related to HSS					X		X		X
	EUV survey	X	X	X	X	X	X	X	X	X
Malaria Surveillance and Routine System Support	Support to malaria surveillance system	X		X	X*	X*	X*	X*	X*	X*
	Support to Outreach, Training and Supportive Supervision (OTSS)	X	X	X	X	X	X	X	X	X
	Support to HMIS	X	X	X	X	X	X	X	X	X
Entomology	Entomological surveillance and resistance monitoring	X	X	X	X	X	X	X	X	X
	Entomological bio-monitoring					X***				
Other Data Sources	Anemia and Parasitemia Monitoring (Northern Ghana)			X	X					
	LLIN durability monitoring							X	X	X
	Malaria Impact Evaluation								X	

*Not PMI-funded; **Included a full malaria module; ***PMI core-funded

In 2016, the third edition of the Standard Operating Procedure (SOP) for Health Information was developed and implemented by the NMCP with support from PMI and the Global Fund. Despite improvement in information management at the district and regional levels, it was realized that more needed to be done to improve overall data quality. The third edition takes into consideration the review of some reporting forms and the inclusion of other new forms within the health sector. New variables in the reporting forms have been included in the SOP and some definitions of existing variables have been clarified to conform to operational definitions. The focus of the third edition is to enhance information use for decision-making, improve efficiency in service delivery, positively impact supervision and monitoring, and contribute to pre-service training of health workers.

PMI has supported four national malaria household surveys: the 2008 DHS, 2011 MICS (with a full malaria component), 2014 DHS, and 2016 MIS. Many were conducted during the peak malaria season – late rainy season from August to December – with the latter two surveys including a malaria module that tested for anemia and parasitemia. The 2008 DHS serves as the baseline estimate for all PMI coverage indicators. The 2016 MIS reported significant progress in malaria indicators, most notably, IPTp2 uptake reported at 78% (the highest of any PMI country in sub-Saharan Africa). In comparison to the 2014 DHS, IPTp3 also increased from 39% to 60%. Net ownership increased from 68% to 73%. Net use among pregnant women increased from 43% to 50% and use among children under 5 years old increased from 47% to 52%. Yet, the 2016 MIS highlights a gap between ownership and use that requires more exploration. The 2016 MIS also showed a decrease in percentage of children under five with malaria by RDT from 36% to 27%; children under five years old with malaria by microscopy showed a decrease from 27% to 20%. A demographic health survey is planned in 2019 which will provide follow-up estimates of all-cause under-five mortality as well as national and regional malaria parasite positivity before the end of the MSP 2014-2020. Nationally representative surveys will serve as the key data sources for the 2018 Impact Evaluation.

From 2012 to 2016, according to HMIS, Ghana has almost doubled laboratory confirmation of malaria cases (43% versus 78%) (Figure 7). Expanded testing and complete and timely data reporting is improving the reliability trends in confirmed malaria cases over time. Malaria mortality has also decreased substantially from 19% to 4% (Figure 8) and subsequently malaria has been replaced by respiratory infections for the number 1 cause of death in Ghana.

Progress during the last 12-18 months

Strengthening HMIS malaria data quality, data analysis, and use for program improvement are the NMCP's most immediate challenges. During the past 18 months, PMI worked with the NMCP and other partners to improve the quality of data and build capacity for evidence-based decision-making. As shown in Figure 2a, DHIMS2 data has improved with PMI support with completeness >90% and improved timeliness. Increased laboratory confirmation with either RDTs or microscopy are also providing a better picture of the trends and burden of malaria throughout Ghana (Figure 7). Routine DQAs, data validation committees, and other data quality checks at different levels continue to increase the quality of the data entered in DHIMS2. Utility as defined by data analysis and use for program improvement is also a PMI Ghana priority and we are working at the CHPS, health center, regional hospital, and national NMCP levels to ensure this comes to fruition. Data analysis and use meetings provide weekly and monthly trends to health care personnel where malaria increases can be detected and responded to timely and effectively. Support included:

- Data coaching visits conducted in 47 districts across 5 regions (Northern, Volta, Greater Accra, Central and Western Regions). A total of 911 facilities received coaching on data collection and

reporting from a team comprised of 5 representatives from all health levels (a national level representative from the Policy, Planning, Monitoring and Evaluation Division, the regional health information officer, district head nurse, district health information officer and the malaria focal point person from an implementing partner). Supported DHIMS2 Technical Boot Camp Meetings.

- Trained 685 OTSS supervisors on malaria data management (including accurate completion of the consulting room register). Supervisor competency scores rose from 36% pre-test to 78% post-test. Twelve GHS staff trained as master trainers in OTSS and draft national supportive supervision guidelines were finalized and approved. In five USAID focus regions, PMI supported:
    - 1,272 facilities visited and 6,402 staff supervised – round 1
    - 2,020 facilities visited and 9,600 staff supervised – round 2
- All regions and districts completed four rounds of supportive supervision as of March 2017:
    - 3,578 facilities visited and 13,981 staff supervised total
- Supported five regional health directors to conduct data quality assessments of key malaria DHIMS2 indicators in 18 target districts in 125 facilities.
- Supported training of 11,094 staff in malaria case management, MIP, and correct RDT use
- Supported 252 community health officer (CHO) internships in fever case management
- Supported M&E technical working group activities and regional level review meetings.
- Supported PPME to update GHS Standard Operating Procedures on Health Information Management
-

Figure 7: Proportion of OPD malaria cases tested (microscopy and RDT), 2011 – 2016, Ghana

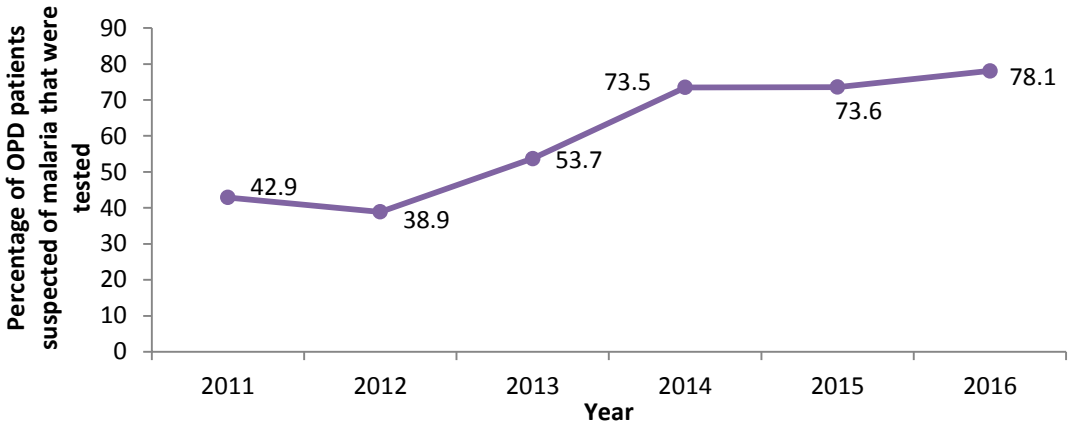
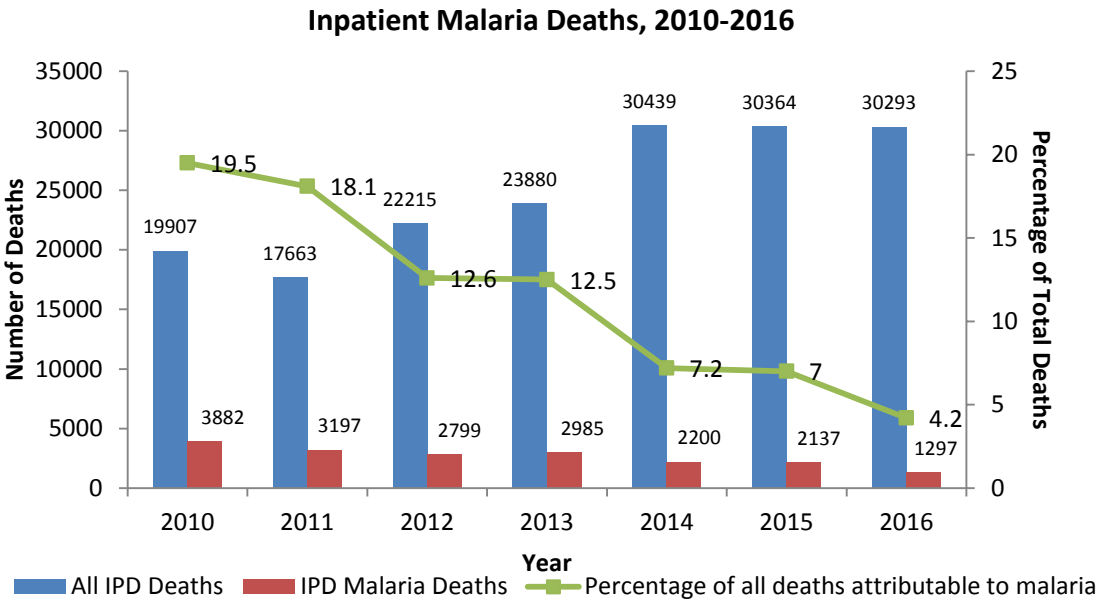


Figure 8: Inpatient deaths: Malaria deaths, total deaths and proportion malaria deaths, 2010 – 2016



Plans and justification

PMI continues to work with the NMCP to support the successful implementation of the national malaria M&E plan. In 2015, the Global Fund-supported national data quality assessment revealed widely inconsistent use of source data forms, application of data quality assurance mechanisms, data quality documentation, and adherence to data submission protocols. Periodic field visits showed challenges in data recording, analysis, and use dependent on level of health facility. CHPS facilities consistently reported in a complete and timely manner. Some health facilities and district hospitals had challenges transitioning from paper-based to electronic reporting and significant gaps with client data. Therefore, PMI will support quality assurance monitoring for data collected through DHIMS2, starting with data validation at the facility level, to ensure the programmatic and technical needs of the NMCP are met. This will be accomplished by: 1) improving supportive supervision and training at all health levels to ensure proper data collection, reporting, and interpretation; 2) continuing to support regional malaria data review workshops to discuss DHIMS2 data use and programmatic implications; and 3) work with the NMCP on the integration of DHIMS2 data with OTSS and other health facility data.

Global Fund, through the NMCP, will continue to support strengthening data quality and use at sentinel sites across all ten regions. Therefore, PMI's proposed SME investments in routine HMIS and strengthening the DHMIS2 and SME staff across all ten regions will synergize with the Global Fund efforts and not be duplicative. PMI will collaborate with the GHS to promote integration and coordination of health programs with reduced resources. However, PMI will work with the NMCP to stress malaria-specific M&E to ensure program objectives contribute to the national malaria M&E targets.

Proposed activities with FY 2018 funding: ***($1,160,000)***

- *Strengthen and support routine M&E systems at the national, regional, district and health facility levels (five USAID focus regions):* In five USAID focus regions support health facilities and districts to strengthen data quality to help inform programmatic decisions. Activities will include: providing integrated data coaching visits to health facility data management staff to validate and audit data collection, analysis and reporting to improve data quality; supporting regional mid-year review meetings that focus on improved analysis and data use; supporting the Policy, Planning, Monitoring and Evaluation Division's Center for Health Information Management boot camp

meetings to routinely assess and discuss malaria data; and integrated supportive supervision by GHS to improve collection and reporting of data from the health facility up to the district level. (*$325,000*)

- *Strengthen and support routine M&E systems at the national, regional, district and health facility levels (5 non-USAID focus regions):* In 5 non-USAID focus regions support health facilities and districts to strengthen data quality to help inform programmatic decisions. Activities will include: providing integrated data coaching visits to health facility data management staff to validate and audit data collection, analysis and reporting to improve data quality; supporting regional mid-year review meetings that focus on improved analysis and data use; supporting the Policy, Planning, Monitoring and Evaluation Division's Center for Health Information Management boot camp meetings to routinely assess and discuss malaria data; and integrated supportive supervision by GHS to improve collection and reporting of data from the health facility up to the district level. (*$325,000*)

- *Provide support for the malaria module in the 2019 demographic health survey:* PMI will support the planning, implementation, analysis, and dissemination of the malaria module in the 2019 demographic health survey. Malaria specific indicators will include ITNs, case management, MIP, and national/regional malaria parasite positivity in children under five. *($500,000)*

- *Provide M&E technical assistance:* Support for a technical assistance visit from the headquarters PMI M&E team. Technical assistance will include working with the NMCP to support strengthening M&E and health management information system activities. *($10,000)*

7. **Operational research**

NMCP/PMI objectives

The *National Malaria Control Strategic Plan for 2014-2020* reinforces operational research (OR) as a means to mobilize resources and inform programmatic direction. OR activities in Ghana have become an integral strategy to measure impact of malaria control and prevention activities, and to identify gaps and weaknesses to improve program implementation. The OR studies implemented and proposed for PMI support are identified jointly by the NMCP and have focused on assessing the impact of vector control activities on malaria infection.

Progress since PMI was launched

Table 15, below, summarizes the 3 OR studies supported by PMI in the past 5 years. During 2010-2012, PMI conducted an operational research "Anemia and Parasitemia Study" to compare the impact of annual compared to biannual pyrethroid IRS in Bunkpurugu Yunyoo District in Northern Region of Ghana. The study (described in greater detail in the FY 2016 MOP) found that in Bunkpurugu Yunyoo District there was a modest, but significant decline in parasitemia prevalence between 2010 and 2012 among children under 5, from 52.4% to 47.7% ($p=0.005$). Other health indicators also showed significant but not dramatic decreases at endline, as compared to baseline. The percent of children with a positive RDT result decreased from 69.9% to 66.0% ($p=0.01$), while the percent of children with anemia decreased from 77.7% to 67.8% ($p<0.001$). However, the percent of children with fevers had a greater decrease, from 69.4% to 43.9% ($p<0.001$). ITN use was approximately 95% in 2010 and 2012, but decreased to 82.2% in 2011. Throughout the anemia and parasitemia study the entomological inoculation rate showed a dramatic, near linear decline from 0.35 infective bites/person/night in 2010 to 0.021 in 2012 ($p=0.018$).

Despite the implementation of IRS and distribution of ITNs, malaria infection in northern Ghana remains high. In 2014, a qualitative formative study on outdoor sleeping and night time activities was conducted in the Upper West and Northern Regions. In-depth interviews and night time observations were used to document outdoor sleeping and a variety of social, cultural, and economic activities that occur during night time. Outdoor sleeping due to heat was reported and observed frequently among household members of all ages. Outdoor sleeping at some point during the night was reported in 42% of the study population.[10] ITN use was observed to be low irrespective of whether people slept indoors or outdoors, in both regions. In addition to outdoor sleeping, a variety of outdoor night time activities were documented including cooking and other household chores, socializing both within the household compound and elsewhere, and studying both within the household compound and at night school classes. Funerals emerged as a common large-scale night time event with participants reporting that they attended funerals up to once a week.

Table 15: Operational Research Studies

Title	**Start date**	**End date**	**Budget**
Prevalence of *Plasmodium falciparum* parasitemia and anemia in children under five years of age at baseline and following annual versus biannual indoor residual spraying (IRS) in Bunkpurugu-Yunyoo District, northern Ghana	April 2010	April 2012	$480,000
Outdoor-sleeping and other night-time activities in northern Ghana: implications for residual transmission and malaria prevention	February 2014	March 2014	$70,322
Ongoing OR Studies			
Title	**Start date**	**End date**	**Budget**
Effect of Indoor Residual Spraying on *Anopheles* vector behaviors and their impact on malaria transmission in the northern region of Ghana (Vector Behavior Study)	June 2017	June 2019	$225,000
Planned OR Studies FY 2018			
Title	**Start date (est.)**	**End date (est.)**	**Budget**
No planned OR Studies			

Progress during the last 12-18 months

Documenting and understanding human-vector interaction and its effect on malaria control is essential. Findings from the outdoor-sleeping study suggest that human outdoor exposure to malaria vectors may limit the impact of indoor-oriented vector control measures and epidemiological and entomological research is needed to quantify the relative risk of the different night-time activities described in this study. The limitations of this study were that it was conducted during dry season when malaria transmission is low and lacks sufficient vector data. To understand this dynamic interplay better, PMI will begin to examine the roles that vector behavior plays in outdoor exposure to malaria transmission during the high transmission season in Northern Ghana.

In 2016, PMI approved a new operations research project "Effect of Indoor Residual Spraying on *Anopheles* vector behaviors and their impact on malaria transmission in Northern Region of Ghana (Vector

[10] Monroe A, Asamoah O, Lam Y, Koenker H, Psychas P, Lynch M, *et. al.* Outdoor-sleeping and other night-time activities in northern Ghana: implications for residual transmission and malaria prevention. *Malaria Journal* 2015, 14:35-46

Behavior Study)". The aim of this study is to better understand malaria vector outdoor behavior (feeding and resting), to later determine how these behaviors overlap with human outdoor behavior, and the relation of vector behavior to IRS and ITN insecticide pressures and insecticide resistance development. The main research questions are: 1) to what extent does mosquito vector behavior impact malaria transmission in Northern Region of Ghana; and, 2) does insecticide resistance play a significant role in observed mosquito behaviors impacting malaria transmission, and, if so, how these behaviors differ in IRS versus non-IRS areas. The study area will be four villages/communities in two districts in Northern Region, two in IRS intervention areas (Gbullung and Gupanarigu in Kumbungu District) and two in non-IRS intervention areas (Kulaa and Tugu in the Tamale area). All four villages are similarly rural with high mosquito populations in the peak transmission season. The villages also have similar bed net coverage. Baseline vector bionomics will be measured during high malaria transmission season. Mosquitoes will be collected using various outdoor and indoor collection methods. The various physiological states of mosquitoes (blood-fed, gravid, parous, non-parous and source of host blood) will be analyzed and compared between IRS and non-IRS areas. The locations of collected mosquitoes (e.g. inside versus outside room locations), will determine the behavior patterns of the vectors. Mosquitoes will be collected from 3 compounds throughout the transmission season in each of the IRS and non-IRS districts (24-32 rooms per village per month for each district) using pit traps, indoor and outdoor resting collections, human landing catches. Data on weather and rainfall will also be collected.

Plans and justification
No operational research studies are planned with FY 2018 funding.

Proposed activities with FY 2018 funding: ***($0)***
No operational research is planned for FY 2018

8. Staffing and administration

Two health professionals serve as Resident Advisors (RAs) to oversee PMI in Ghana, one representing CDC and one representing USAID. In addition, one or more 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 development and implementation of PMI strategies and work plans, coordination 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: ***($1,810,000)***

- *In-country staff and administrative expenses*: To support the coordination and management of all in-country PMI activities including support for salaries and benefits for two resident advisors and local staff, office equipment and supplies, and routine administration and coordination expenses. *($1,810,000)*

Table 1: Budget Breakdown by Mechanism

President's Malaria Initiative – GHANA
Planned Malaria Obligations for FY 2018

Mechanism	Geographic Area	Activity	Budget ($)		%
TBD IRS Project	National	Entomological and insecticide resistance monitoring	$235,500	$5,835,500	22.4%
	7 Districts	IRS program implementation	$5,600,000		
GHSC-PSM	National	Procurement of ITNs	$5,107,000	$10,275,500	39.5%
		Procurement of RDTs	$2,120,000		
		Procurement of ACTs	$1,144,500		
		Procurement of severe malaria treatment	$429,000		
		Supply chain system strengthening	$1,200,000		
		Last mile distribution strengthening	$275,000		
VectorWorks	National	Distribution of ITNs	$1,600,000	$2,000,000	7.7%
		School- and community-based SBCC	$400,000		
TBD-New Vector Control IDIQ	Select sites	ITN durability monitoring	$150,000	$150,000	0.6%
GEMS	7 Districts	Environmental compliance monitoring	$40,000	$40,000	0.2%
CDC IAA	National	TA for entomological monitoring	$29,000	$819,000	3.2%
		Ghana - FELTP	$120,000		
		TA for SM&E	$10,000		
		In-country staff and administrative support	$660,000		
Systems for Health	5 USAID focus regions	Strengthen IPTP implementation	$275,000	$1,650,000	6.3%
		Strengthen malaria case management in CHPS compounds	$200,000		
		Strengthen malaria case management at the health facility level	$450,000		

		Build management capacity at NMCP, GHS and other GOG partners	$100,000		
		Strengthen facility- and community-level behavior change and interpersonal communication	$300,000		
		HMIS strengthening at the national, regional, district and health facility levels	$325,000		
TBD Service Delivery	5 non-USAID focus regions	Strengthen IPTP implementation	$275,000	$1,500,000	5.8%
		Strengthen malaria case management in CHPS compounds	$200,000		
		Strengthen malaria case management at the health facility level	$400,000		
		Strengthen facility- and community-level behavior change and interpersonal communication	$300,000		
		HMIS strengthening at the national, regional, district and health facility levels	$325,000		
TBD	National	Malaria microscopy QA	$50,000	$850,000	3.3%
		Sustainability of NHIA to provide access to appropriate malaria treatment	$300,000		
		2019 DHS	$500,000		
G2G-GHS/CLU	National	Laboratory OTSS	$300,000	$300,000	1.2%
TBD-G2G-ICD	National	TA for supportive supervision at national and regional levels	$150,000	$150,000	0.6%
G2G-NHIA Clinical	National	Support to NHIA to implement clinical audits	$250,000	$250,000	1.0%
USP-PQM	National	Strengthen drug quality monitoring capacity	$150,000	$150,000	0.6%
G2G-NHIA Communications	National	Support NHIA capitation rollout	$250,000	$250,000	1.0%

People for Health	5 USAID focus regions	Strengthen the role of civil society in malaria advocacy	$200,000	$200,000	0.8%
Peace Corps SPA	National	Small grants to engage in malaria control and prevention activities	$30,000	$30,000	0.1%
Communicate for Health	National	Support mass media communication efforts to promote ITN ownership and use, IPTp uptake, and improved care seeking behavior at the national level.	$400,000	$400,000	1.5%
USAID/Ghana	National	In-country staff and administrative support	$1,150,000	$1,150,000	4.4%
Total			**$26,000,000**	**$26,000,000**	**100.0%**

Table 2: Budget Breakdown by Activity

President's Malaria Initiative – GHANA
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					
Insecticide resistance monitoring	TBD IRS Project	$50,000	$0	National	In collaboration with another partner and national research institutions, PMI will continue to support insecticide resistance monitoring at 10 of the 20 existing NIRMOP entomological sentinel sites. Insecticide resistance monitoring will be conducted using standard WHO susceptibility testing with at least six insecticides from the four insecticide classes. The funding supports technical assistance, equipment, training, oversight, data collection, and reporting. This activity will leverage other vector control partner resources for entomological and insecticide resistance monitoring activities and will help fill gaps to ensure national coverage.

Entomological monitoring	TBD IRS Project	$185,500	$0	National	IRS routine entomological monitoring will continue at 17 entomological monitoring sites in Northern Region. The activities include: WHO bottle assay insecticide susceptibility testing, cone bioassays (for spray quality and durability of insecticide), molecular analysis for species identification and resistance genes, and the determination of entomological inoculation rates, and parity rates from indoor and outdoor human landing catches and pyrethroid spray catches.
Subtotal Ento monitoring		$235,500	$0		
Insecticide-treated Nets					
Procurement and transportation of ITNs	GHSC-PSM	$5,107,000	$5,107,000	National	Procure approximately 1.3 million long-lasting ITNs to support continuous distribution channels (schools, ANC clinics and CWCs) to ensure Ghana maintains universal coverage of ITNs following the completion of the planned mass distribution in 2018. The budget includes transportation of ITNs to regional distribution points.
Technical assistance for ITN distribution and supply chain	VectorWorks	$1,600,000	$0	National	Support the GHS/NMCP and GES in distributing ITNs from regional warehouses to schools and health facilities. Funds will support the costs of training, planning, supervision, operations, and M&E.
ITN durability monitoring	TBD - New Vector Control IDIQ	$150,000	$0	Select monitoring sites - TBD	Support year two of the ITN durability monitoring which will include the 24 month survey to assess net survivorship, attrition, physical integrity and bio-efficacy analysis from a sample of ITNs from the 2018 mass distribution campaign.

Subtotal ITNs		$6,857,000	$5,107,000		
Indoor Residual Spraying					
IRS program implementation and management	TBD IRS Project	$5,600,000	$1,215,160	7 Districts	Support IRS implementation and programmatic monitoring and evaluation in seven districts in Northern Region. Funding will support spray operations, data collection, environmental assessment and compliance monitoring, logistics, and SBCC activities including community mobilization. Proposed activities include support for procurement of insecticide and equipment; support for supervision by GHS, Environmental Protection Agency, and Noguchi personnel; and collaboration with the NMCP, MaVCOC, the AGAMal IRS program, and other partners. Programmatic monitoring and evaluation includes the activities that measure the performance of IRS, particularly those relating to monitoring coverage levels.
Environmental compliance for IRS implementation	TBD Environmental Compliance Award	$40,000	$0	7 Districts	Support environmental compliance monitoring for IRS implementation in seven districts in Northern Region. Funding will support environmental assessment and compliance monitoring.
Technical assistance to support entomological monitoring for IRS	CDC IAA	$29,000	$0	National	Provide technical assistance and quality assurance, through two visits by a CDC entomologist, for ongoing entomological monitoring of the PMI IRS program.
Subtotal IRS		$5,669,000	$1,215,160		
SUBTOTAL VECTOR MONITORING AND CONTROL		$12,761,500	$6,322,160		
Malaria in Pregnancy					

Strengthen IPTp implementation	Systems for Health	$275,000	$0	5 USAID focus regions	In *5 USAID focus regions (Western, Central, Volta, Greater Accra and Northern),* support health care workers at health facilities and CHPS compounds to effectively deliver malaria prevention services to pregnant women, including supportive supervision and on-site training of IPTp at every ANC visit and ensuring the distribution of an ITN at first ANC visit.
	TBD Service Delivery	$275,000	$0	5 non-USAID focus regions	In *5 non-USAID focus regions (Upper West, Upper East, Eastern, Ashanti, Brong-Ahafo),* support health care workers at health facilities and CHPS compounds to effectively deliver malaria prevention services to pregnant women, including supportive supervision and on-site training of IPTp at every ANC visit and ensuring the distribution of an ITN at first ANC visit.
Subtotal Malaria in Pregnancy		$550,000	$0		
SUBTOTAL PREVENTIVE		$13,311,500	$6,322,160		
CASE MANAGEMENT					
Diagnosis and Treatment					
Procurement of RDTs	GHS-PSM	$2,120,000	$2,120,000	National	Procure approximately 4 million RDTs, to fill identified gaps and ensure that health facilities maintain capacity to test fevers and diagnose malaria cases.
Procurement of ACTs	GHS-PSM	$1,144,500	$1,144,500	National	Procure approximately 1. 2 million ACTs, to meet estimated infant, toddler, and adolescent treatments (estimated at 40% of total annual ACT needs) for 2019.

Procurement of injectable artesunate for treatment of severe malaria	GHS-PSM	$429,000	$429,000	National	Support the national injectable and rectal artesunate needs for severe malaria: procure approximately 150,000 ampules of injectable artesunate (100 mg/1ml) (estimated to cover 10% of the annual requirements). Procure an estimated 100,000 rectal artesunate suppositories (50mg/1ml and 100mg/1ml), which is 100% of the annual need.
Strengthen quality of malaria miscroscopy and maintenance of microscopes.	TBD	$50,000	$0	National	Provide technical assistance to support strengthening the capacity of laboratory supervisors at the national level to conduct diagnostic refresher training and proficiency testing on a quarterly basis.
	G2G GHS/CLU	$300,000	$0	National	Support laboratory OTSS and malaria diagnostic training-of-trainers on a quarterly basis. Funds will support the continued quality improvement of malaria microscopy, RDT use and scale-up, and coordination between laboratory staff and prescribers.
Strengthen malaria case management in CHPS compounds	Systems for Health	$200,000	$0	5 USAID focus regions	In 5 USAID focus regions, support in-service training and supportive supervision of integrated case management, with a focus on malaria cases, to CHPS nurses and health officers in CHPS compounds. Support will aim to improve proper diagnosis with RDTs and prompt treatment of uncomplicated cases or referral for severe malaria cases.
	TBD Service Delivery	$200,000	$0	5 non-USAID focus regions	In 5 non-USAID focus regions, support in-service training and supportive supervision of integrated case management, with a focus on malaria cases, to CHPS nurses and health officers in CHPS compounds. Support will aim to improve proper diagnosis with RDTs and prompt treatment of uncomplicated cases or referral for severe malaria cases.

Strengthen malaria case management at health facilities	Systems for Health	$450,000	$0	5 USAID focus regions	In *5 USAID focus region*, support routine clinical OTSS to strengthen integrated case management, with a focus on malaria cases in health facilities. Support will work to improve proper diagnosis and prompt treatment and in-service training for prescribers. Support will encourage the engagement of the regional health management team and regional supervision teams to conduct quarterly clinical OTSS visits at district hospitals to improve malaria case management; support district health management teams and district supervision teams to conduct quarterly clinical OTSS at health centers and CHPS compounds; and conduct quarterly data coaching for district health information officers.
	TBD Service Delivery	$400,000	$0	5 non-USAID focus regions	*In 5 non-USAID focus region*, support routine clinical OTSS to strengthen integrated case management, with a focus on malaria cases in health facilities. Support will work to improve proper diagnosis and prompt treatment and in-service training for prescribers. Support will encourage the engagement of the regional health management team and regional supervision teams to conduct quarterly clinical OTSS visits at district hospitals to improve malaria case management; support district health management teams and district supervision teams to conduct quarterly clinical OTSS at health centers and CHPS compounds; and conduct quarterly data coaching for district health information officers.

Technical assistance to improve supportive supervision at the national and regional levels.	TBD (G2G ICD)	$150,000	$0	National	Funding to support GHS to monitor, coordinate and strengthen supportive supervision at the national and regional levels. To strengthen malaria case management, support will help develop and/or adapt tools to facilitate implementation of malaria prevention and control activities. Additionally, support will assist the regional OTSS teams to bolster supervision, management, leadership and data management. Effort will be made to further institutionalize the process and coordinate activities with the NHIA and other donor activities.
Support NHIA to implement clinical audits	G2G NHIA-Clinical	$250,000	$0	National	Continue support for NHIA to conduct clinical audits to improve treatment standards and the quality of service provision among accredited providers, to ensure adherence to standard protocols, and to check against fraud and abuse. Clinical OTSS teams will join the clinical audit teams to learn first-hand how the clinical audits are conducted so as to improve the OTSS teams' capacity to audit cases treated during the intervening period between two clinical visits. Specific activities will include targeted mentorship and additional supervisory and on-the-job training for poorly performing facilities.
Subtotal Diagnosis and Treatment		$5,693,500	$3,693,500		
Pharmaceutical Management					

Support interim warehousing and supply chain system strengthening	GHSC-PSM	$1,200,000	$0	National	In accordance with the Supply Chain Master Plan, continue to provide technical assistance for strengthening logistics, warehousing, and distribution to improve availability of malaria commodities, in accordance with the national Supply Chain Master Plan. Activities will focus on addressing weaknesses in supply management, forecasting, transportation, and reporting systems. Support quarterly EUV surveys to monitor the status of facility-level commodity stock levels including both WHO pre-qualified and locally procured ACTs and identify ongoing programmatic successes and challenges. Support will continue to include central warehousing and transportation of malaria commodities from central to RMS levels. Technical assistance will also include implementation of the plan developed during FY 2017 to address the local procurement of non-quality assured antimalarial drugs by health facilities and regional health and RMS staff.
Support last mile distribution	GHSC-PSM	$275,000	$0	National	Provide support for last mile distribution in up to four new regions (likely Ashanti, Central, Upper West and Upper East), with limited technical assistance continuing in regions where LMD was launched during 2017 to perfect distribution initiative (Northern and Eastern Regions and likely Greater Accra and Volta Regions). Support includes technical assistance for LMD regional implementation plan development, route mapping, logistics implementation support to regions, and monitoring LMD implementation performance.

Strengthen drug quality monitoring capacity	USP-PQM	$150,000	$0	National	Provide support for continued strengthening of the GH-FDA's capacity to effectively monitor quality of antimalarial drugs available in Ghana. Support to GH-FDA to monitor and regulate locally procured non-WHO pre-qualified antimalarial drugs including batch testing of Ghana manufactured ACTs, SP and severe malaria drugs including support to increase regulation and removal of drugs that fail quality testing. GH-FDA will be supported. PMI will support the GH-FDA to build the capacity of local manufacturers to meet GMP and WHO pre-qualification standards.
Subtotal Pharmaceutical Management		$1,625,000	$0		
SUBTOTAL CASE MANAGEMENT		$7,318,500	$3,693,500		
HEALTH SYSTEM STRENGTHENING / CAPACITY BUILDING					
Build management capacity at NMCP, GHS and other GOG partners	Systems for Health	$100,000	$0	National	Continue to provide support to the NMCP, GHS, and GOG for technical capacity building and improved malaria control systems. This activity will support: 1) attendance in malaria-specific trainings, conferences by select NMCP, GHS, and GOG employees to further build in-country capacity; 2) assisting NMCP with organizing meetings that are important for planning and management of malaria prevention and control activities; and 3) supporting limited information technology investments, such as computers, laptops, internet connection at the GHS's Regional Health Directorate level to ensure timely data reporting to DHIMS2.

Ensure sustainability of NHIA by appropriately incentivizing reimbursement to increase access to appropriate malaria diagnosis and treatment	TBD	$300,000	$0	National	Provide technical assistance to the scale up of a primary health care capitated package of services to five additional regions; improve provider incentives to ensure appropriate case management services by working with key stakeholders to identify examples of best practices, real time data analysis, and communication materials to address the incentive constraints introduced with the preferred provider system. Specific investment will be co-funded with non-malaria USAID health funds, PMI will support NHIA to increase its efficiency and sustainability to improve access to health services in general and quality malaria treatment.
Support NHIA capitation rollout	G2G - NHIA Communications	$250,000	$0	National	Support to communication efforts to facilitate NHIA capitation roll out to five additional regions (Brong Ahafo, Central, Eastern, Northern, and Western) with the goal of promoting enrollment in NHIA and informing the public about how to access NHIA-accredited facilities among the general population. Since NHIS enrollment increases the likelihood of seeking formal care for malaria treatment, it is anticipated that this investment will contribute towards strengthening the overall health insurance program, increase enrollment, reduce the risk of insolvency, and ensure sustainability of NHIS.

Strengthen the role of civil society in malaria advocacy	People for Health	$200,000	$0	5 USAID focus regions	Build the capacity of local Ghanaian non-governmental organizations and civil society organizations to monitor the quality and ease of access to health services, with a focus on malaria diagnostics and treatment. Work with DHMT to promote adherence to national malaria guidelines and promote the use of district and regional report cards to monitor progress on indicators. Strengthen community structures for advocating for patients' rights and client-centered care, including the availability of malaria commodities. Empower civil society organizations to engage citizens to demand and participate in health service delivery and advocate for their interest. Strengthen the health sector monitoring of government institutions, officials and policy processes, and civil society organization monitoring of issues, including: transparency, accountability health system, and compliance with service standards, regulations, and patients' charter code. PMI estimates that approximately 20 local community groups in five regions will be supported annually through this activity. These groups will monitor the quality of health services and help to identify areas for improvement.
Peace Corps Malaria Program	Peace Corps SPA	$30,000	$0	National	Support Peace Corps volunteers based in Ghana to receive small grants from PMI to engage in malaria control and prevention activities, such as community mobilization for SBCC, ITN distribution, and (as needed) operational research.
Long-term field epidemiology and laboratory training	CDC IAA	$120,000	$0	National	Support long-term training of individuals to build capacity at the NMCP or GHS in epidemiology, M&E, or other malaria program management functions as needed through the Field Epidemiologic and Laboratory Training Program, which was established with USG support at the University of Ghana's School of Public Health in collaboration with

					the GHS.
SUBTOTAL HSS & CAPACITY BUILDING		$1,000,000	$0		
SOCIAL AND BEHAVIOR CHANGE COMMUNICATION					
Support mass media communication efforts to promote ITN ownership and use, IPTp uptake, and improved care seeking behavior at the national level.	Communicate for Health	$400,000	$0	National	Provide national-level coordination and technical assistance to promote ITN ownership and use, IPTp uptake and improved care-seeking behavior, develop new malaria-specific communication materials, and facilitate dissemination of malaria-related messages, especially mass media communication efforts. Technical assistance will be provided to the NMCP, the National Malaria Communications Committee as well as to the GHS/Health Promotion Unit.
• Support school- and community-based activities to address barriers to correct and consistent use of ITNs and promote ITN care	VectorWorks	$400,000	$0	National	Design, implement, monitor, and evaluate school- and community-based activities to address identified barriers to correct and consistent ITN use and promote ITN care. Targeted ITN-specific technical assistance will be provided to the NMCP to ensure that overall ITN-related SBCC activities throughout Ghana remain state of the art. Support will also include efforts to increase effectiveness of school-based continuous distribution of ITNs through activities to increase awareness of and community participation in school-based distribution.
Strengthen facility- and community-	Systems for Health	$300,000	$0	5 USAID focus	In 5 USAID focus regions, support facility-and community-level outreach to promote correct and

level behavior change and interpersonal communication				regions	consistent uptake of both preventative and curative malaria interventions. Support will also engage CHPS nurses and health officers to engage with communities and promote malaria-related health seeking behaviors.
	TBD Service Delivery	$300,000	$0	5 non-USAID focus regions	In 5 non-USAID focus regions, support facility-and community-level outreach to promote correct and consistent uptake of both preventative and curative malaria interventions. Support will also engage CHPS nurses and health officers to engage with communities and promote malaria-related health seeking behaviors.
SUBTOTAL SBCC		$1,400,000	$0		
SURVEILLANCE, MONITORING, AND EVALUATION					
Strengthen and support routine health management information system at the national, regional, district and health facility levels.	Systems for Health	$325,000	$0	5 USAID focus regions	In *5 USAID focus regions* support health facilities and districts to strengthen data quality to help inform programmatic decisions. Activities will include: providing integrated data coaching visits to health facility data management staff to validate and audit data collection, analysis and reporting to improve data quality; supporting regional mid-year review meetings that focus on improved analysis and data use; supporting the Policy, Planning, Monitoring and Evaluation Division's Center for Health Information Management boot camp meetings to routinely assess and discuss malaria data; and integrated supportive supervision by GHS to improve collection and reporting of data from the health facility up to the district level.

	TBD Service Delivery	$325,000	$0	5 non-USAID focus regions	In *5 non- USAID focus regions* support health facilities and districts to strengthen data quality, with a focus on malaria-specific indicators, to help inform programmatic decisions. Activities will include: providing data coaching visits to health facility data management staff to validate and audit data collection, analysis and reporting to improve data quality; supporting regional mid-year review meetings that focus on improved analysis and data use; providing supportive supervision by GHS to improve collection and reporting of data from the health facility up to the district level.
Support for 2019 DHS	TBD	$500,000	$0	National	Support for the initial planning and coverage of a malaria module for the 2019 DHS. FY 2019 funds will be added to supplement costs for malaria module.
Technial assistance for SM&E activities	CDC IAA	$10,000	$0	National	Support for a technical assistance visit from the CDC PMI M&E team. Technical assistance will include working with the NMCP to support strengthening M&E and health management information system activities.
SUBTOTAL SM&E		$1,160,000	$0		
OPERATIONAL RESEARCH					
SUBTOTAL OR		$0	$0		
PRE-ELIMINATION					
SUBTOTAL PRE-ELIMINATION		$0	$0		
IN-COUNTRY STAFFING AND ADMINISTRATION					

CDC	CDC IAA	$660,000	$0	National	To support the coordination and management of all in-country PMI activities including support for salaries and benefits for two resident advisors and local staff, office equipment and supplies, and routine administration and coordination expenses.
USAID	USAID/Ghana	$1,150,000	$0	National	
SUBTOTAL IN-COUNTRY STAFFING		$1,810,000	$0		
GRAND TOTAL		**$26,000,000**	**$10,015,660**		