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 2017 appropriation. If any further changes are made to this plan it will be reflected in a revised posting.

USAID
FROM THE AMERICAN PEOPLE

U.S. PRESIDENT'S MALARIA INITIATIVE

PRESIDENT'S MALARIA INITIATIVE

GHANA

Malaria Operational Plan FY 2017

TABLE OF CONTENTS

ABBREVIATIONS and ACRONYMS **3**

I. EXECUTIVE SUMMARY **5**

II. STRATEGY **9**

1. Introduction 9
2. Malaria situation in Ghana 10
3. Country health system delivery structure and Ministry of Health (MOH) organization 11
4. National malaria control strategy 14
5. Updates in the strategy section 16
6. Integration, collaboration, and coordination 16
7. PMI goal, objectives, strategic areas, and key indicators 18
8. Progress on coverage/impact indicators to date 19
9. Other relevant evidence on progress 21

III. OPERATIONAL PLAN **22**

1. Vector monitoring and control 22
2. Malaria in pregnancy 35
3. Case management 38
4. Health system strengthening and capacity building 51
5. Social and behavior change communication 57
6. Surveillance, monitoring, and evaluation 62
7. Operational research 67
8. Staffing and administration 69

Table 1: Budget Breakdown by Mechanism **71**

Table 2: Budget Breakdown by Activity **74**

ABBREVIATIONS and ACRONYMS

ACT	Artemisinin-based combination therapy
AGA	AngloGold Ashanti Mining Company
AGAMal	AngloGold Ashanti Malaria Control Program
ANC	Antenatal care
AP	Anemia and parasitemia monitoring
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 bednet
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
NIRMOP	National Insecticide Resistance Monitoring Partnership
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
RDT	Rapid Diagnostic Test
RMS	Regional Medical Stores
SBCC	Social and behavior change communication

SHEP	School Health Education Program
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 (IPTp). With the passage of the Tom Lantos and Henry J. Hyde Global Leadership against HIV/AIDS, Tuberculosis, and Malaria Act in 2008, PMI developed a U.S. Government Malaria Strategy for 2009–2014. This strategy included a long-term vision for malaria control in which sustained high coverage with malaria prevention and treatment interventions would progressively lead to malaria-free zones in Africa, with the ultimate goal of worldwide malaria eradication by 2040-2050. Consistent with this strategy and the increase in annual appropriations supporting PMI, four new sub-Saharan African countries and one regional program in the Greater Mekong Subregion of Southeast Asia were added in 2011. The contributions of PMI, together with those of other partners, have led to dramatic improvements in the coverage of malaria control interventions in PMI-supported countries, and all 15 original countries have documented substantial declines in all-cause mortality rates among children less than five years of age.

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

Ghana was selected as a PMI focus country in FY 2007.

This FY 2017 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 2017 funding.

The proposed FY 2017 PMI budget for Ghana is $28 million. PMI will support the following intervention areas with these funds:

Entomological monitoring and insecticide resistance management: PMI continues to support routine IRS entomological monitoring in 14 existing sites in the Northern region of Ghana, which includes: WHO bottle assay insecticide susceptibility testing (with molecular and genetic resistance testing), cone bio-assays (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. PMI also collaborates with in-country partners and national research institutions to support insecticide resistance monitoring for at least 6 insecticides from the 4 insecticide classes.

Insecticide-treated nets (ITNs): Ghana's ITN strategy aims to achieve universal coverage of ITNs through complementary distribution channels: mass campaigns and continuous distribution via primary schools, antenatal care (ANC) clinics, and vaccination programs offered through child welfare clinics (CWC). In 2016, Ghana completed its latest mass distribution efforts by distributing over 4 million nets in 6 regions. Further, by the end of the year it is anticipated that over 1 million nets will be distributed through the school-based channel and an additional 1.4 million nets through facility-based distribution through ANC and CWC clinics. With FY 2017 funding, PMI will continue working with the NMCP, Global Fund, and DFID to sustain universal coverage through the continuous distribution strategy. PMI will procure and distribute 1.36 million ITNs through continuous distribution and mass campaign channels, support the Government of Ghana (GOG) to support a successful national continuous distribution system, and promote ITN use through targeted, effective communication efforts.

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). To ensure efficacy, >85% IRS coverage of structures in a community is required. However, since this target was not met following the 2014 spray round in Savelugu-Nanton due to multiple challenges, IRS was withdrawn and re-started in Kumbungu, where it had been withdrawn after 2012. PMI IRS, has continued to maintain high coverage (93% in 2016), by using a multi-pronged approach to expanding community mobilization. During the 2016 spray season, one spray round of long-lasting organophosphates was conducted in five IRS districts (Bunkpurugu-Yunyoo, East Mamprusi, Mamprugu Moagduri, West Mamprusi, and Kumbungu), covering 211,283 structures and protecting a population of 570,871 people. With FY 2017 funding and the co-payment on insecticide from the UNITAID-funded Next Generation Indoor Residual Spraying Program (NGenIRS), PMI plans to increase its coverage to six districts, including the five from 2016, in the Northern Region using a long-lasting insecticide.

Malaria in pregnancy (MIP): In 2015, Ghana's National Guidelines for Malaria in Pregnancy (MIP) were adapted to apply WHO's three-pronged approach: providing sulfadoxine-pyrimethamine (SP) for the intermittent preventive treatment of malaria in pregnancy (IPTp), 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. 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 the five USAID focus regions (Greater Accra, Central, Western, Volta and Northern Regions). With FY 2017 funding, PMI will support ANC clinics at health centers and, where available, at CHPS compounds to effectively deliver a package of malaria prevention services to pregnant women. PMI support will focus on supportive supervision, on-site training as needed, and quality improvement to increase provision of

IPTp at every ANC visit, and ensure distribution of an ITN to every pregnant woman during their first ANC visit.

Case management: In accordance with WHO guidelines, the NMCP requires confirmation of all suspected malaria cases in all age groups, by either microscopy or rapid diagnostic test (RDT). 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 RDTs at all levels, particularly in peripheral settings, including CHPS compounds. Currently, PMI's clinical outreach training and supportive supervision (OTSS) covers all public sector facilities quarterly, and since 2012, eleven rounds of clinical OTSS have successfully trained more than 97% of public sector health workers in malaria case management.

PMI has worked closely with NMCP, the National Public Health Reference Lab, and GHS Clinical Laboratories Unit to improve the quality and scale up of malaria diagnosis in Ghana. 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. All staff at the enrolled facilities have been trained in malaria diagnosis. With FY 2017 funds, PMI will continue to support comprehensive case management training, supervision, and quality improvement through pre-service training, continuation of OTSS, and ensure the procurement of an estimated 4 million RDTs and 2 million treatments. PMI will continue to support strengthening Ghana's supply chain system to improve the management, distribution and availability of malaria commodities throughout the country.

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 GOG agencies such as the National Health Insurance Authority (NHIA) with a vested interest in malaria treatment and control. Ghana's National Health Insurance Scheme (NHIS) has greatly increased access to health care services—particularly malaria care and treatment. Today, approximately 44 percent of the population is covered under the NHIS. PMI also prioritized support for strengthening the 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 (NHIA) to build the capacity of private sector providers in under-served areas of Ashanti, Brong Ahafo, Central, Western and Eastern Regions to access financing and information on standards of quality for malaria services. With FY 2017 funds, PMI will continue to support a diverse range of activities, including: strengthening the capacity of the NMCP, ensuring that the NHIA continues to improve access to malaria diagnosis and treatment, and the NHIA capitation roll out.

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 RDT results), adherence to IPTp 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 (SM&E) system, and the number of health facilities reporting timely and complete data to the district health management information system (DHMIS2) 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 DHS, the 2011 MICS, and the 2016 MIS). According to the 2014 DHS, 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 2017 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. With FY 2017 funds, PMI will support a national-level, malaria-specific SM&E advisor to support the NMCP to conduct malaria specific data analyses and operate as a malaria liaison for the health-sector wide M&E collaborations.

Operational research: The NMCP in Ghana has strong in-country technical capacity to conduct operational research (OR). PMI supported OR is guided by the 2014 – 2020 National Strategic Plan and falls in line with PMI OR priorities. In 2015, GHS, in collaboration with the NMCP held a research symposium to discuss OR priorities in Ghana. Based on results from a 2013 formative study on outdoor sleeping and nighttime activities in the Upper and Northern Regions that suggests 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 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 four proven and highly effective malaria prevention and treatment measures: insecticide-treated mosquito nets (ITNs); indoor residual spraying (IRS); accurate diagnosis and prompt treatment with artemisinin-based combination therapies (ACTs); and intermittent preventive treatment of pregnant women (IPTp). With the passage of the Tom Lantos and Henry J. Hyde Global Leadership against HIV/AIDS, Tuberculosis, and Malaria Act in 2008, PMI developed a U.S. Government Malaria Strategy for 2009–2014. This strategy included a long-term vision for malaria control in which sustained high coverage with malaria prevention and treatment interventions would progressively lead to malaria-free zones in Africa, with the ultimate goal of worldwide malaria eradication by 2040-2050. Consistent with this strategy and the increase in annual appropriations supporting PMI, four new sub-Saharan African countries and one regional program in the Greater Mekong Subregion of Southeast Asia were added in 2011. The contributions of PMI, together with those of other partners, have led to dramatic improvements in the coverage of malaria control interventions in PMI-supported countries, and all 15 original countries have documented substantial declines in all-cause mortality rates among children less than five years of age.

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

Ghana was selected as a PMI focus country in FY 2007.

This FY 2017 Malaria Operational Plan (MOP) presents a detailed annual implementation plan for Ghana, based on the PMI Strategy 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 proposed PMI-supported activities are in line 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 2017 funding.

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. In the northern part of the country, there is a six to seven month transmission season, 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 24.2 million 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.

Malaria cases seen in health facility outpatient departments have increased from approximately 250 per 1,000 population in 2000, to about 437 per 1,000 population in 2012. Over the same period, 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. Malaria admissions also increased from approximately 5 per 1,000 persons to approximately 17.5 per 1,000 persons, driven largely by the same reasons as those driving the increase in outpatient department cases. However, significant reductions in malaria mortality have been observed with the institutional case fatality rate among children under five declining from 14.1% in 2000 to 0.6% in 2012. Most recently, the number of OPD cases has fluctuated from 11.4 million in 2013 to 8.4 million in 2014, to 10.2 million in 2015[1]. The cause of the fluctuation is unclear, however, a combination of access to care, as cited above, and changes in surveillance practices are most likely involved. Geographically, those regions that had the highest parasitemia prevalence in 2011 have seen large decreases, while most of the other regions have seen small increases (Figure 1). As a result the national parasitemia prevalence among children under five has remained stable at approximately 27-28% between 2011 and 2014.

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, and the DHS 2014, malaria transmission tends to be significantly less intense in urban areas, with parasite prevalence of 15% in urban areas compared to 38% in rural areas in 2014. The Urban Malaria Study further revealed that parasitemia rates among children under five years in the three largest cities (Accra, Kumasi and Tamale) were found to be significantly lower than in rural areas within the same ecologic zones (3%, 5% and 16% vs. 24%, 35% and 52%, respectively).

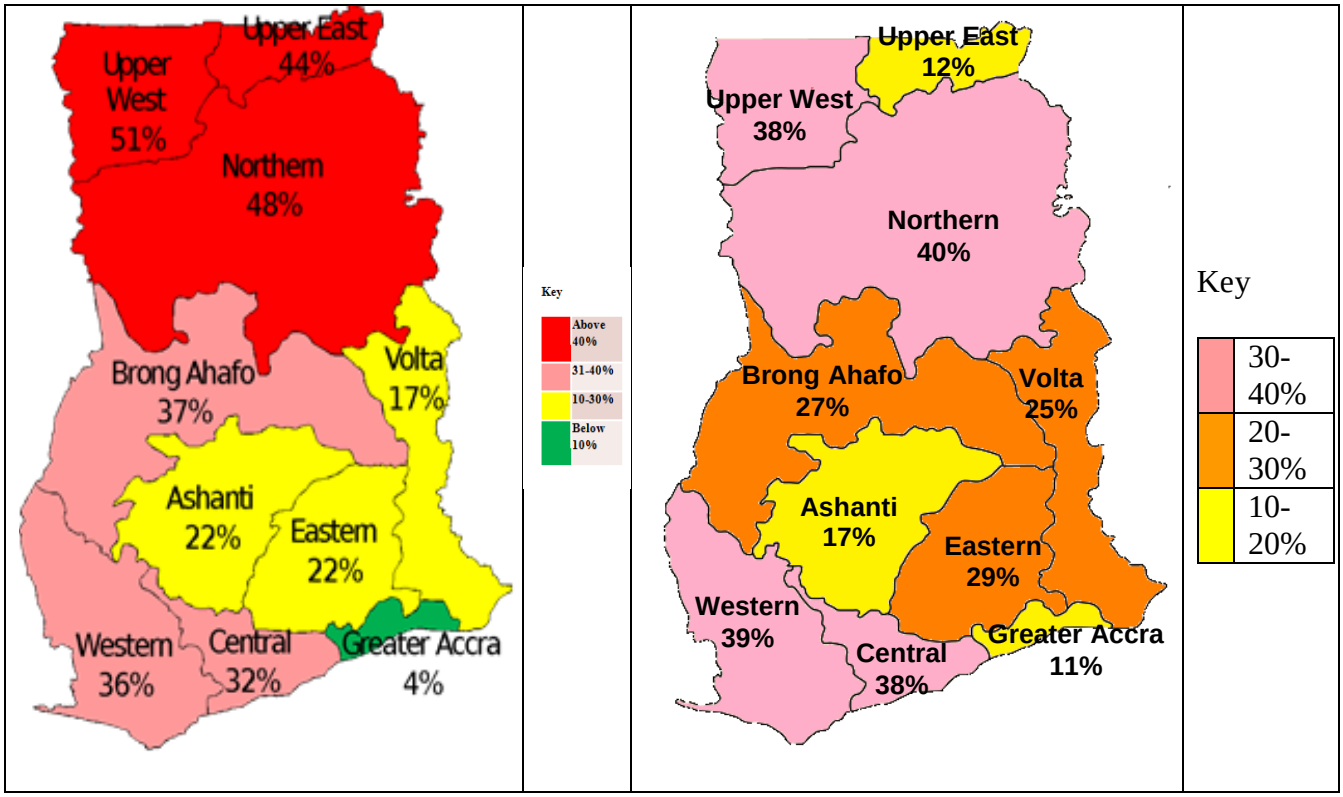
Plasmodium falciparum accounts for 85-90% of all infections. *Plasmodium malaria (*<10%) is also found and more rarely *P. ovale* (0.15%). No cases of *P. vivax* infection have been detected in Ghana. Mixed infections of *P. falciparum* and *P. malariae* are not uncommon. The major vectors are *Anopheles 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

[1] 2015 NMCP Annual Report

sites in the northern region). *An. melas* is found in the mangrove swamps of the southwest and *An. arabiensis* has been observed in the savannah areas of northern Ghana.

Figure 1: Malaria Prevalence (by microscopy) in Children 6-59 months, by Region, 2011 and 2014.

2011 MICS **DHS 2014**



*Both 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 NHIS represents a major development in health system financing and has increased attendance at health facilities.

National Health Insurance Scheme

Ghana's National Health Insurance Scheme (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 rolled out in four regions, with roll out for another five regions scheduled to start by the end of 2016. 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 5, 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 42% of the population (roughly 11 million people). Because individuals are required to register for NHIS each year, the list of enrollees has varied, however, the trend of enrollees continues to increase annually. Efforts are ongoing to increase the number of enrolled participants and retention.

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 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 benefits package provides a comprehensive package, covering about 95% of health conditions affecting the population, including curative services (including 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 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 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

However, 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. PMI is encouraging NHIA's efforts to improve the NHIS by supporting clinical audits and capitation.

Ghana Health Service

The GHS operates at three levels: national, regional (10 regions), and district (226 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 District Health Information Management 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 GHS uses CHPS compounds to extend services to underserved communities. 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. CHPS compounds provide access to community health nurses and midwives in communities of at least 6,000 people. The GOG completed 742 functional CHPS compounds in 2015 and plans to complete 100 compounds in 2016. 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. There are currently 5,968 demarcated CHPS throughout Ghana and 3,951 functioning CHPS zones, and the numbers of CHPS zones with compounds built is 1,672. The number of CHPS compounds in functional CHPS zones has increased from approximately 30 in 2002 to 1,991 in 2015. 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. 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.

The NMCP is a program within GHS that is the principal recipient of grants from Global Fund. The NMCP manages all clinical and community-based interventions related to malaria. With government

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

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 artemisinin-based combination therapy (ACTs) 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. 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, DFID, 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 new strategic plan.

The scope of the new 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 new standard operating procedure for IRS.

Since 2008, 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] Recently, however, these activities have been suspended due to financial constraints.

5. Updates in the strategy section

PMI updated the strategy section in the FY 2017 MOP to provide more specific detail about the NHIS and its contribution to malaria treatment. Results from the USAID health systems baseline survey are also included, which provides PMI with additional insight into how best to strengthen health facility capacity to provide high quality malaria treatment services.

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 Government of Ghana (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 now been consolidated under the Global Fund's New Funding Mechanism.

Under Global Fund's New Funding Model, implemented in 2015, Ghana has approximately $118 million through year end 2017. This represents a substantial decrease from Ghana's past allocations

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

from the Global Fund. 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 cover other malaria control activities. Therefore, AGAMal reduced its coverage from current 25 districts in 2014 to 10 districts in 2016. At present, there is no source of funds for this IRS project after 2016, although current GF re-programming is expected to ensure continued coverage of the 10 districts through 2017.

DFID expects to provide approximately £10 million (approximately $16 million) over five years beginning in 2013 to support malaria control in Ghana, including support for ITNs and malaria case management. DFID support includes financing the medicines for a SMC pilot in Upper West Region, in coordination with Global Fund, and support to improve data quality in the DHIMS2. PMI and DFID are coordinating closely on future program planning.

The USG 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 USG coordinates with malaria control stakeholders through multiple committees and subcommittees organized under the NMCP, including the MaVCOC, the ITN Coordinating Subcommittee, Case Management Subcommittee, Communications Subcommittee, Resource Mobilization and Sustainability Subcommittee, and the Surveillance, Evaluation and Monitoring Committee. Ghana's Malaria Interagency Coordinating Committee (MICC), convened 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 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.

PMI also works with larger private sector companies involved in malaria control in Ghana. AngloGold Ashanti Mining Company, as part of its corporate social responsibility program, established a malaria control program in Obuasi in 2005 that includes IRS, targeted larviciding, and other interventions. The PMI and AGAMal IRS programs frequently collaborate in areas such as training and community mobilization, and continue to share best practices in operations, timing and duration of spray rounds, entomological monitoring, spray quality, insecticide selection, and procurement.

Within USG

PMI collaborates with other USG 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 USG 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 Global Health Initiative areas, in a concerted effort to improve supply chain management for all pharmaceuticals and health commodities. PMI's contributions and technical assistance to strengthening IPTp is integrated with the ANC program and includes 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.

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

As in many African countries, PMI and the NMCP rely on nationally representative health surveys to track progress in coverage of malaria control interventions in Ghana. There have been five 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 2014 DHS is the most recent population-based health survey.

The 2014 DHS was led by Ghana Statistical Service in collaboration with the National Public Health and Reference Laboratory, with support from PMI, Global Fund, UNICEF, United Nations Development Program (UNDP), United Nations Population Fund (UNFPA), Danish Ministry of Foreign

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

Affairs (DANIDA), and International Labor Organization (ILO). The DHS program, a USAID-funded project, offered technical assistance in the implementation. Although the 2003 DHS and 2008 DHS included anemia testing, a new feature in the 2011 MICS and 2014 DHS included malaria prevalence data (using both microscopy and RDTs). The survey provided a unique nationwide snapshot of peak season malaria point-prevalence in children age 6-59 months, as referenced in Figure 1.

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

Table A: Evolution of Key Malaria Indicators in Ghana from 2006 to 2014

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

* Source: Abt/AIRS annual report for 2008, 2011 and 2014; ** 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."

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 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
PMI supports a comprehensive, integrated vector management program, as outlined in the NMCP's *National Malaria Control Strategic Plan for 2014-2020*. In collaboration with partners, PMI supports universal ITN coverage through mass campaigns 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. With PMI support, the NMCP also conducts communication and community mobilization activities to promote correct and consistent ITN use, with a target of 85% of pregnant women and 85% of children under five years of age sleeping under an ITN every night. Currently, the NMCP plans IRS coverage of 15 districts with PMI and Global Fund support: Upper West (9 districts), Northern (5 districts), and Ashanti (1 district) Regions. PMI currently supports IRS and related entomological monitoring in 5 Northern Region districts, with the objective of spraying 85% of eligible structures in these districts. PMI supports national insecticide resistance monitoring and the implementation of a national database for entomological and resistance data, with the objective of mitigating the impact of resistance on current malaria control activities and developing plans to prevent the development of future resistance.

a. Entomological 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. During the eighth IRS round in 2015, increased emphasis was placed on evaluation, monitoring, and quality control. Advanced molecular entomological testing, using mosquitoes collected in PMI IRS districts, has demonstrated that insecticides (from ITNs and IRS) have had a positive impact on several entomological parameters, including entomological inoculation rates, parity, and indoor resting densities in PMI IRS districts in the northern region. There were 13 PMI entomological monitoring sites in in 2014 and 14 in 2015, in Northern Region (Figure 2, below).

Progress during the last 12-18 months
As noted in Table B, results from PMI's entomological monitoring activities demonstrate that IRS has contributed to the decline in malaria transmission potential in high transmission areas in Northern Region. In parallel to the positive impact caused by the presence of insecticides, when IRS is withdrawn, entomological indicators cease to indicate improvement in vector control or indicate a decrease in vector control, as was the case in Savelugu-Nanton and Tolon-Kumbungu. The impact of the IRS program on these entomological variables within the period could be attributed to the impact of pirimiphos-methyl in killing high proportions of the older female *An. gambiae* and *An. coluzzii* mosquitoes that rest in the rooms. It also confirms that the local vector species in the area are susceptible (98-100%) to pirimiphos-methyl, which was used for the 2015 IRS operations. Reduction in mean annual rainfall between 2010 and 2015 (from 121.9mm in 2010 to 78.2 in 2014 and then to 69.3mm in 2015) could also partly explain variations in entomological parameters. Continued monitoring of the trend in 2016 and beyond is planned using data from Ghana's meteorological services or third party sources (e.g. https://ddarko.shinyapps.io/RainOerMe/).

Figure 2: 2015 PMI-supported IRS districts, previously sprayed districts, and entomological sites

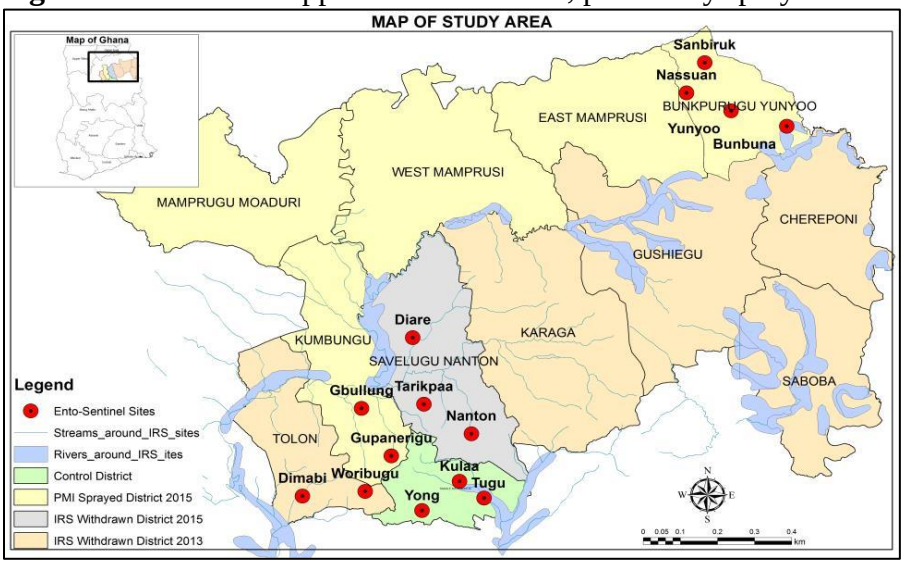


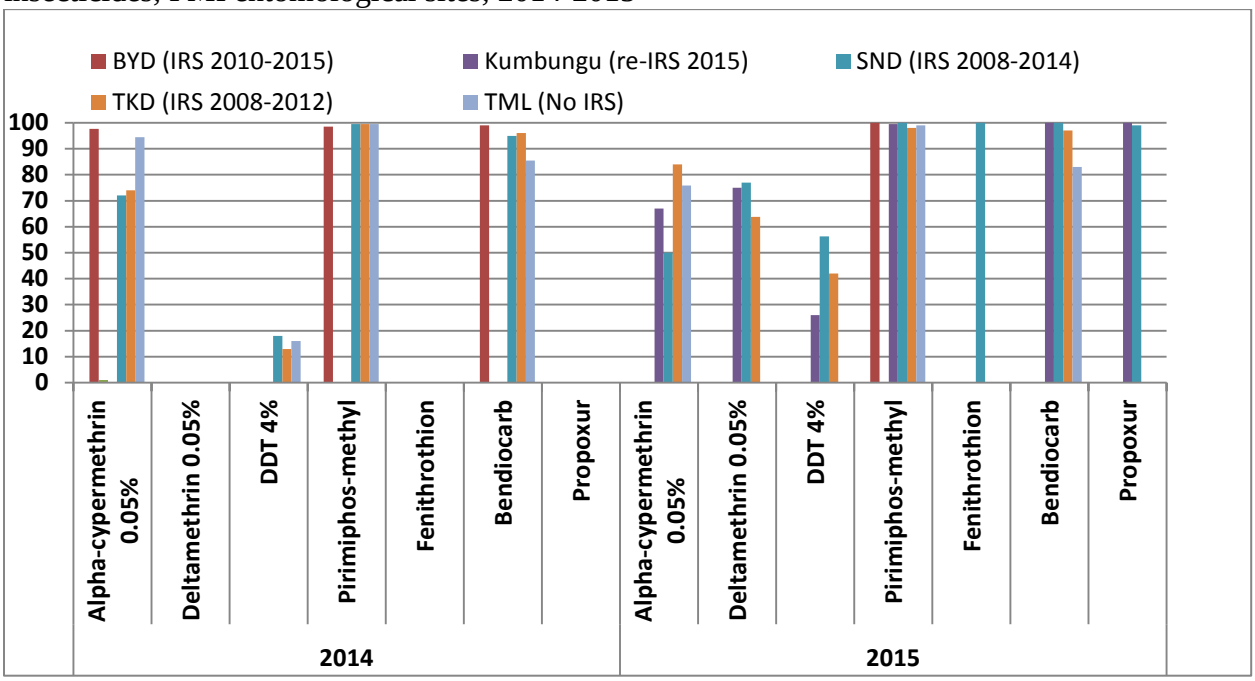
Table B: Selected entomological variables, IRS and non-IRS Districts, 2010-2015

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

[1]Mosquito 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 in PMI IRS districts in Northern Region has revealed that mosquitoes remain susceptible to the organophosphate (pirimiphos-methyl, 0.025%, WHO assay) selected for IRS (Figure 3). Monthly wall bioassays in 2014 and 2015 demonstrated IRS pesticide efficacy for pirimiphos-methyl of >80% mortality for at least seven months, which was comparable in longevity to the previously used pyrethroid insecticide. After the IRS spray round was completed in 2015, standard WHO cone assays were conducted in communities in Savelugu-Nanton District (SND), Bunkprugu-Yunyoo District (BYD), Tolon-Kumbungu District (TKD) (now Tolon District), 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 when attaching the cones to all surfaces.

Figure 3: Percentage mortalities of *Anopheles gambiae* s.l. exposed to diagnostic doses of different insecticides, PMI entomological sites, 2014-2015



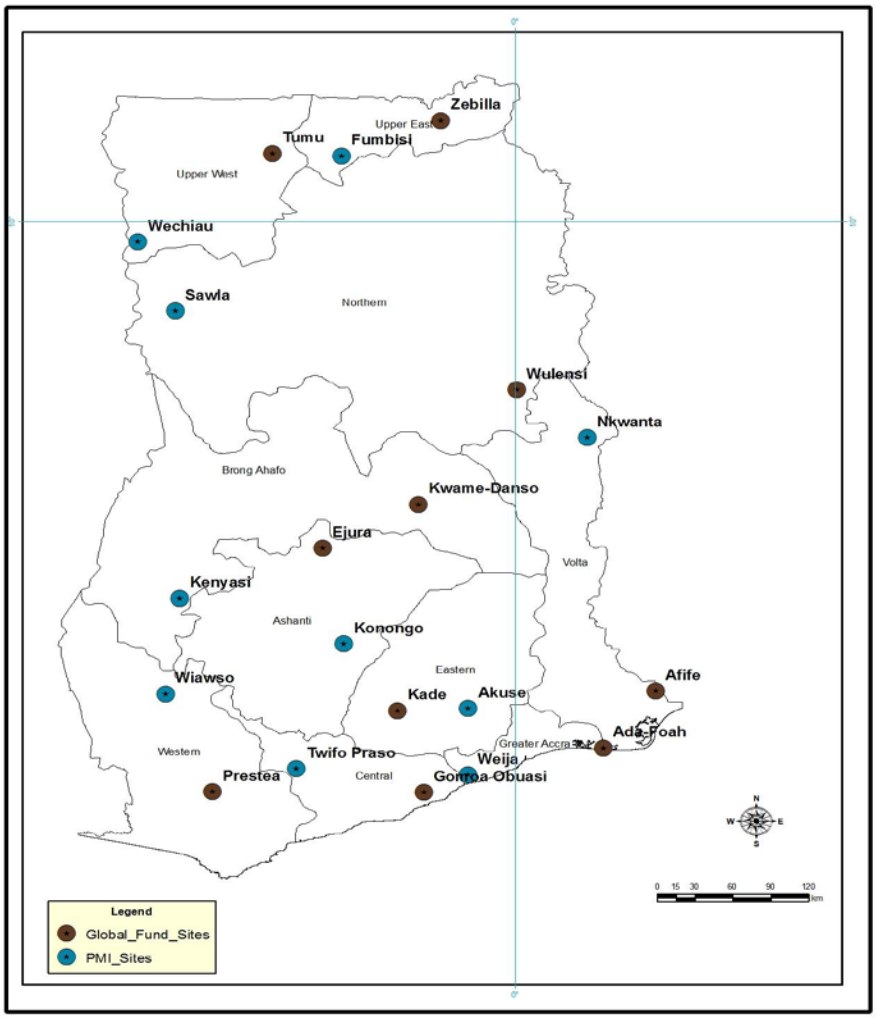
N.B. Testing for deltamethrin and fenitrothion not done in 2014 due to insufficient number of female mosquitoes. No tests conducted for propoxur in 2014.

National Insecticide Resistance Monitoring Partnership (NIRMOP)

Progress since PMI was launched

In 2011, PMI began supporting national insecticide resistance monitoring at 20 selected sites across the country (two per region) (Figure 4), to help manage resistance development and complement initial monitoring activities in PMI IRS districts. There was mixed success in completing assays due to oversight and accountability issues. In 2014, resistance testing was reported from only 75% of the 20 sites, with less than half of those completing testing of the required ten insecticides; deltamethrin, permethrin, alphacypermethrin, DDT, bendiocarb, malathion, pirimiphos-methyl, fenitrothion, propoxur and cyfluthrin.

Figure 4: Map of 2015 NIRMOP Sites



Progress during the last 12-18 months

In 2015, PMI and the Global Fund each provided half the funding for NIRMOP, with the consolidated activity led by Noguchi Memorial Institute for Medical Research (Noguchi). Future support from Global Fund is expected. Resistance testing was completed at all of the 20 selected sites, with 90% completing the minimum of six insecticides being tested. Due to a shortage of testing papers, sites located in the Southern regions of the country were not able to test pirimiphos-methyl, propoxur, and cyfluthrin. However, all surveys were done according to NIRMOP's standard operating procedures.

Organophosphates, and to a lesser extent carbamates, were effective in many of the sites (Table C.1 and C.2). *An. gambiae* s.l. was susceptible to pirimiphos-methyl, an organophosphate, in three of the four regions where it was tested, with possible resistance detected at one region. However, among the organophosphates only pirimiphos-methyl demonstrated consistent efficacy (>97% mortality) across the regions. Pirimiphos-methyl is the insecticide currently being used for IRS in Northern Region and Upper West Region.

Table C.1: Percentage mortalities of *Anopheles gambiae* s.l. exposed to diagnostic doses of different insecticides in the five Northern regions of Ghana, 2015

Region / Insecticides	Northern	Upper East	Upper West	Brong Ahafo	Ashanti
	Sawla	Fumbisi	Wechiau	Kenyase	Konongo
Deltamethrin	18.2 (77)	20.0 (95)	20.2 (84)	17.9 (84)	12.8 (78)
PBO+Deltamethrin	84.8 (79)	94.3 (88)	75.9 (87)	52.4 (84)	73.4 (79)
Permethrin	15.2 (79)	42.9 (84)	10.4 (82)	7.1 (84)	-
PBO+Permethrin	36.3 (80)	94.0 (84)	49.4 (83)	20.5 (83)	-
Alphacypermethrin	67.5 (80)	80.7 (83)	49.4 (83)	33.3 (84)	-
DDT	6.3 (79)	25.3 (87)	0.0 (86)	9.6 (82)	-
PBO+DDT	-	-	-	-	-
Bendiocarb	90.0 (80)	52.4 (84)	81.0 (84)	64.6 (82)	70.9 (79)
Malathion	68.4 (79)	83.0 (88)	88.6 (88)	90.2 (92)	90.0 (80)
Pirimiphos methyl	98.8 (80)	100.0 (87)	100.0 (84)	97.3 (82)	-
Fenitrothion	-	95.2 (84)	100.0 (84)	-	-
Propoxur	-	-	70.2 (84)	-	-
Cyfluthrin	-	-	-	-	

N.B. Numbers in brackets ( ) are number of mosquitoes exposed

Table C.2: Percentage mortalities of *Anopheles gambiae* s.l. exposed to diagnostic doses of different insecticides in five southern regions of Ghana, 2015

Region / Insecticides	Greater Accra	Volta	Central	Western	Eastern
	Weija	Nkwanta	Twifo	Sefwi	Akuse
Deltamethrin	16.3 (80)	82.4 (80)	36.3 (80)	25.0 (80)	37.5 (80)
PBO+Deltamethrin	43.8 (80)	100.0 (80)	82.5 (80)	98.8 (80)	97.5 (80)
Permethrin	12.5 (80)	27.5 (80)	21.3 (80)	15.0 (80)	51.3 (80)
PBO+Permethrin	7.5 (80)	77.5 (80)	76.3 (80)	90.0 (80)	98.8 (80)
Alphacypermethrin	82.5 (80)	62.5 (80)	91.0 (100)	91.3 (80)	41.3 (80)
DDT	12.5 (80)	15.0 (80)	6.0 (100)	27.5 (80)	15.0 (80)
Bendiocarb	47.5 (80)	78.8 (80)	98.8 (80)	95.0 (80)	96.3 (80)
Malathion	91.3 (80)	68.8 (80)	95.0 (80)	97.5 (80)	47.5 (160)
Fenitrothion	-	-	-	-	63.8 (80)

N.B. Numbers in brackets ( ) are number of mosquitoes exposed

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 the most complete and comprehensive national picture of insecticide resistance and vector control, but will also ensure each contributor has control and usage of their data. Control of the database will be transferred to the NMCP, but the contributors will have control over usage of their data for publication.

Plans and justification
Entomological monitoring is a key component to 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 in 2015 and given the importance of insecticide resistance monitoring in the NMCP strategy, in FY 2017, PMI will continue to support 10 of the 20 existing NIRMOP sites. Funding for this activity is 50% PMI and 50% Global Fund. PMI will support the continuing development of a national database for insecticide resistance and entomological monitoring data (See IRS section).

Proposed activities with FY 2017 funding: ($235,500)

- *Support nationwide insecticide resistance monitoring:* In collaboration with another partner and national research institutions, continue to support insecticide resistance monitoring, using standard WHO susceptibility testing, at 20 sites (two in each of the ten regions), using 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)*

- *Support routine entomological monitoring:* IRS routine entomological monitoring will continue at existing 14 entomological monitoring sites in Northern Region for the period, April through December 2018. IRS entomological activities include: WHO bottle assay insecticide susceptibility testing, cone bio-assays (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. *($185,500)*

b. Insecticide-treated nets

Progress since PMI was launched

Mass Distribution
In 2012, Ghana completed its first nationwide door-to-door distribution campaign with a hang-up component. This universal coverage campaign 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 excluded from the mass distribution campaign). The mass distributions began in late 2014; however, the January 2015 CMS fire (which destroyed over 1.4 million ITNs) forced the NMCP to adjust the distribution schedule and extend the rolling campaign into 2016. The final 4.1 million nets are scheduled to be distributed in the last three regions by mid-2016 (Greater Accra, Upper East and Northern Regions). The next planned national mass distribution is scheduled to take place nationwide in 2018, pending the confirmation of funds and support from NMCP partners.

Continuous Distribution

Following the 2012 mass distribution campaign, 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 with e-vouchers in partnership with private sector shops in Eastern Region. The evaluation of Eastern Region's continuous distribution pilot confirmed that it was successful in sustaining the ownership gains made with the mass campaigns by replacing older nets as well as filling ownership gaps in households that the campaign did not completely reach.[6] 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. It was organized in all ten regions during the second term of the 2013/2014 academic school year. Class enrollment registers were used to identify the students eligible for distribution. The supply chain for the nets was a successful collaboration between the NMCP and GES SHEP. ITNs were positioned at the district stores and circuit supervisors coordinated the movement of the nets to schools in their catchment area. Once the nets arrived at the schools, the head teacher supervised distribution to students. Students received instruction on malaria and ITN use and care. Parent-teacher association meetings provided 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 nets and information on ITN use.

Facility-Based Distribution: The facility-based distribution aims to distribute ITNs to pregnant women at their first ANC visit and 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 quantify, request, 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 aren't 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 education, 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, in 2014, over 1.1 million ITNs were distributed 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

[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

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.

Progress during the last 12-18 months

In 2015, the distribution of ITNs through schools was suspended in the aftermath of the CMS fire, due to a shortage of nets in country. All available nets were reallocated to support the mass distribution efforts already planned and underway. Distribution of nets through schools will recommence with the 2016/2017 academic year. By the end of 2016, PMI will have distributed over 1 million ITNs through approximately 14,000 primary schools in six regions (those that did not receive ITNs through a mass distribution campaign in 2016). With an estimated 84,000 teachers participating in the program, over 1 million students will be given lessons in malaria prevention and ITN use and care messages by the end of the year.

In 2016, PMI anticipates training over 1,350 persons from nine regional and district health management teams as well as over 9,000 providers from health facilities, on health facility-based ITN distribution. PMI also supported monitoring visits to 2,400 ANC clinics and CWCs in 2016. These efforts are improving the number of health facilities that submitted correct monthly reports on facility-based ITN 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 2016, PMI procured a total of 1.16 million long-lasting ITNs and supported their distribution through schools, ANC clinics and CWCs. In addition, over the course of the three-year 2014-2016 mass distribution campaign, PMI provided technical assistance to support the implementation of the campaign in five of the nine participating regions, including: supporting regional micro-planning meetings, training 896 district and sub-district officers to validate registration data, and monitoring distribution activities to ensure high quality.

Communication and mobilization

Ghana continues to face a concerning net use gap—even among those with access to an ITN. The 2014 DHS indicated regional ITN use among those with access to an ITN ranged from a low of 32% in Greater Accra Region to a high of 77% in Volta 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 remaining barriers to ITN use and to develop appropriate measures to address them.

In 2016, USAID/Ghana will launch a revitalized national mass media campaign called *"Good Life. Live it Well."* (more details are discussed in the SBCC section, below), which will include key messages to promote correct and consistent use of ITNs. These messages will be aired nationally on key television and radio stations to ensure wide coverage. By the end of 2016, PMI will have supported SBCC activities targeting students and caregivers on use and care of ITNs through approximately 84,000 school teachers in over 14,000 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

[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/

will have been used to air key malaria in pregnancy messages, which include promotion of ITN use and care. PMI recognizes that additional effort and focus to increase ITN use is needed and will be a primary focus in the coming year.

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. The current rolling mass distribution campaign (2014-2016) is scheduled to conclude in 2016.

Table D: ITN Gap Analysis

Calendar Year	**2016**	**2017**	**2018**
Total Country Population	28,596,675	29,311,592	30,044,381
Total Targeted Population[1]	26,958,778	27,634,453	28,327,021
Continuous Distribution Needs			
Channel #1: ANC Clinics [2]	782,074	801,675	821,767
Channel #2: EPI [3]	622,748	638,356	654,354
Channel #3: Schools[4]	1,014,300	1,480,369	0
Estimated Total Need for Continuous	2,419,122	2,920,401	1,476,121
Mass Distribution Needs			
2016 & 2018 mass distribution campaigns [5]	4,144,135	0	15,737,234
Total Calculated Need: Routine & Campaign	**6,563,257**	**2,920,401**	**17,213,355**
Partner Contributions			
ITNs carried over from previous year	278,636	135,014	1,610,164
ITNs from Global Fund[6]	2,570,535	1,395,550	TBD
ITNs from other donors (AMF)	2,689,100	0	0
ITNs planned with PMI funding [7]	1,160,000	3,000,000	1,360,000
Total ITNs Available	**6,698,271**	**4,530,564**	**2,970,164**
Total ITN Surplus *(Gap)	**135,014**	**1,610,164**	**(14,243,191)**

1. Target population excludes people living in districts covered by IRS
2. Assuming 3% 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. 2014-2016 rolling mass distribution campaign is scheduled to end in 2016 with nets being distributed to the final four regions (the other 6 regions received their nets in late 2014 and in 2015). The NMCP is planning to conduct a national mass distribution in 2018 to be completed in one calendar year, with coverage of one net per two individuals in the household.
6. The next Global Fund Concept Note, which will fund activities in 2018, has not been written.
7. PMI 2017 procurement will be funded from FY 2016 (1.4 million ITNs) and FY 2015 carry over funds (1.6 million ITNs). The ITNs will be purchased in 2017, to ensure that PMI's contribution to the mass campaign in 2018 will arrive in time to support its launch.

Plans and justification

PMI will 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 facility-based ITN 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 uptake and sustained 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, and establish an overall net use culture by promoting correct and consistent ITN use and proper care of ITNs.

Further detail on the ITN SBCC strategy, background, and rationale for promotion of ITN use and maintenance is covered in the SBCC section of the MOP. In FY 2017, 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 2017 funding: ($ 6,902,000)

- *Procure and transport long-lasting ITNs:* Procure approximately 1,360,000 long-lasting ITNs to support continuous distribution channels (ANC clinics and CWCs) and/or mass distribution efforts to ensure Ghana maintains universal coverage of ITNs. The budget includes transportation of ITNs to regional distribution points. *($5,302,000)*

- *Support, technical assistance for ITN distribution and supply chain:* Support the continuous distribution of ITNs through health facilities (ANC clinics and CWCs) with support to the GHS/NMCP. Funds will support the costs of training, planning, supervision, operations, and M&E. Additional support will be provided for mass distribution, as needed. *($1,600,000)*

- *Support community-based communication efforts to promote correct and consistent use of ITNs:* Enhance the effectiveness of ITN distribution efforts through interpersonal, and community based communication activities that specifically promote correct ITN use and correct care practices. Targeted ITN-specific technical assistance will be provided to the NMCP to ensure that overall ITN messages throughout Ghana remain state of the art. Support will also include community-level promotion of malaria prevention messaging through schools and engagement of community networks designed to increase ITN use in a correct and consistent manner throughout Ghana. (*This activity is budgeted in the SBCC section.*)

c. Indoor residual spraying

Progress since PMI was launched
PMI began supporting IRS in Ghana in 2007, with a focus on local capacity building, strict environmental compliance, and entomological monitoring. In consultations with NMCP, a cluster of districts in the Northern Region was selected for spraying due to a high malaria burden (>40% parasitemia in children under five), poor healthcare and economic infrastructure, and a relatively short unimodal malaria transmission season.

Within the first two years, the PMI IRS program demonstrated that IRS can be scaled up quickly and safely in remote rural areas. By 2011, working 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. 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.

Until 2014, the program exceeded the 90% national target for coverage of eligible structures sprayed. However, improved enumeration of structures and improved 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 is believed to be due to its more 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 potentially emerging in the vector population (detected using ACE-1, the genetic resistance marker for acetylcholine esterase insensitivity). As a result of low IRS coverage and the entomological indicators, the NMCP recommended that PMI-supported IRS be discontinued in Savelugu Nanton and re-started in Kumbungu District in the 2015 spray season (Figure 5). Kumbungu was chosen to replace Savelugu Nanton because it was one of the high coverage districts from which PMI-supported IRS was withdrawn in 2013. It was also chosen based on logistic considerations and the deterioration in its entomological indicators since the withdrawal of IRS. 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 that the district would be included in ITN distributions. Table D illustrates the scale-up of PMI-supported IRS from 2008-2017.

Figure 5: Map of 2015 PMI-supported IRS districts and previously sprayed districts

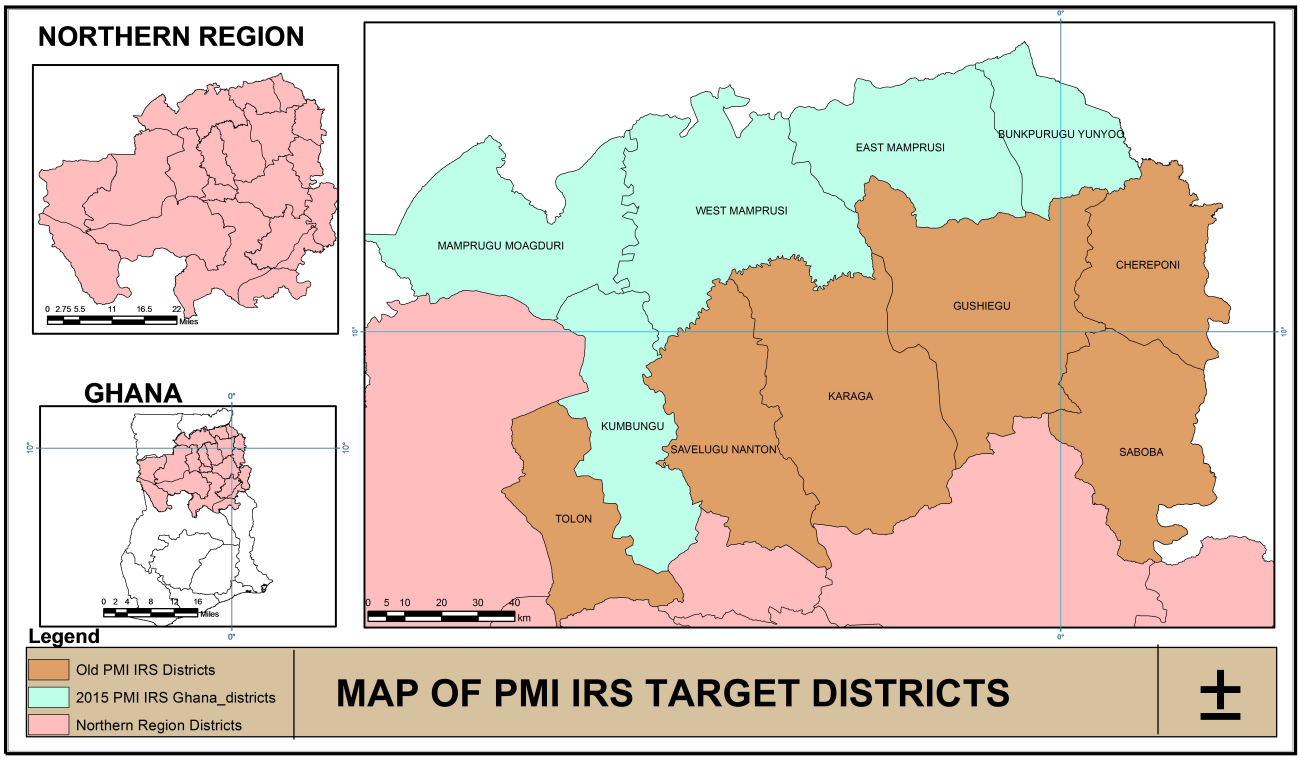


Table E: PMI-supported IRS activities, 2008-2018

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**	6	Organophosphates	288,592	90%	776,312
2018**	6	Organophosphates	288,592	90%	776,312

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

From 2010 to 2014 PMI, supported anemia and parasitemia (AP) monitoring in Bunkpurugu-Yunyoo District, to monitor the long term impact of IRS. From 2011 to 2012, when a pyrethroid insecticide was used, there was a modest, but statistically significant decline in parasitemia levels in Bunkpurugu-Yunyoo from 52.4% to 47.7% ($p=0.005$). However, in 2013, when the insecticide was switched to an organophosphate, there was a significant decrease in parasitemia to 20.6% ($p<0.005$). Decreases in other malaria indicators occurred as well and all improvements were sustained through 2014 (See Ghana's FY 2016 MOP for greater detail).

To contribute toward the NMCP's and PMI's objective of national IRS capacity building, PMI supported the establishment of the MaVCOC, to help the NMCP coordinate and guide vector control activities, including IRS implementation. The committee includes partners such as AngloGold Ashanti Malaria Control Program, Ltd. (AGAMal), Noguchi, Ghana Environmental Protection Agency, Ghana Atomic Energy Commission, Vestergaard, Bayer, and other vector control and IRS partners. The committee has been meeting quarterly since 2009 and has proven to be a dynamic, well-attended forum that provides technical guidance on vector control to support the NMCP in meeting national objectives for quality control, environmental compliance, and insecticide resistance management. It has established and disseminated national IRS standard operating procedures and facilitated information exchange and coordination of efforts for all major malaria control partners in Ghana.

Ghana was the beneficiary of a five-year, $120 million Global Fund grant to further scale up IRS through AGAMal, a not-for-profit subsidiary of the gold mining company, AngloGold Ashanti Mining Company. Due to decreased funding, AGAMal scaled-down spraying from 25 districts in 2014 to 10 districts (nine in Upper West Region and one in Ashanti Region) during the 2016 spray season. Following PMI's lead and model, AGAMal will now spray only once a year and reduce their spray

season from five to three months. These recommended actions are expected to save considerable funds in future years. Although the current Global Fund grant to AGAMal ends after the 2016 spray season, Global Fund re-programming is expected to maintain IRS coverage in these 10 districts through 2017.

Although AGAMal, with support from the Global Fund, is the largest IRS implementer in Ghana, its decreased funding underscores the importance of PMI's focus on continuing to develop IRS practices that maintain high quality spray operations and monitoring, while also optimizing efficiency and targeting for increased impact. With MaVCOC helping to institutionalize a culture of evidence-based decision making in IRS, both the AGAMal and PMI programs have increased their investments in entomological and epidemiological monitoring over time.

Progress during the last 12- 18 months

During the 2015 spray season, PMI (with core funding) implemented a biomonitoring pilot in Ghana to: (1) evaluate worker OP exposure levels, and (2) determine whether a biomonitoring program was logistically feasible. The pilot was conducted at five of the sixteen operational sites and included 242 workers. During this pilot, some workers were temporarily removed from spray operations due to cholinesterase depression; however, there were no clinical symptoms reported among spray personnel. In addition, the pilot found that biomonitoring was logistically difficult, notably due to test kit storage requirements. As a result of these findings, PMI will not conduct biomonitoring in Ghana in FY 2017. A full report on the pilot will be published in the USAID Programmatic Environmental Assessment.

In 2016, PMI sprayed in all five IRS districts (Bunkpurugu-Yunyoo, East Mamprusi, Mamprugu Moagduri, West Mamprusi, and Kumbungu). The coverage exceeded the PMI target of 85%, with overall coverage being 93%; this protected a population of 570,871, including 10,881 pregnant women and 96,150 children under five. There were 16 operational sites across the five districts, and the program provided seasonal employment to almost 700 workers from local communities, of which approximately one-third were women. The project also hired an additional 796 people for IRS operations, including 747 GHS community mobilizers. During the 2016 spray season, GHS and district assembly staff were embedded in PMI IRS operations and Regional EPA staff participated in poison management trainings and environmental inspections.

Ghana has been proposed as a country for 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. The price reduction will enable Ghana to expand coverage of long-lasting IRS from baseline levels, and participation in the NGenIRS Project confirms Ghana's commitment to do so. It is estimated that expansion would result in the additional spraying of approximately 64,000 structures.

The PMI/Ghana IRS program has matured, completing its ninth spray round in 2016, with increased emphasis on evaluation, monitoring, and quality control. Improved monitoring and evaluation has increased the reliability and validity of spray coverage data, while the AP monitoring has demonstrated the impact of IRS. Although the bio-monitoring project did not indicate the need for further monitoring, it underscored the importance of worker training and safety.

Plans and justification

Anticipating a successful participation in the NGenIRS project, which will bring cost savings, PMI anticipates being able to add an additional district to its current five districts while continuing to use long-lasting organophosphates. The selection of the new district will be made with the involvement of

the MaVCOC. PMI will also continue to play a critical role in building national capacity for IRS and informing the national strategy through its support of entomological monitoring sites in PMI-supported IRS areas.

Proposed activities with FY 2017 funding: ($4,843,500)

- *Support IRS program implementation:* Support IRS implementation and programmatic evaluation in six districts in the Northern Region. Funding will support spray operations, data collection, environmental assessment and compliance monitoring, SBCC activities including community mobilization, and logistics. Proposed activities include continued 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 evaluation includes the M&E activities that measure the performance of IRS, particularly those relating to monitoring coverage levels. *($4,814,500)*

- *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-funded IRS program. *($29,000)*

2. Malaria in pregnancy

NMCP/PMI objectives
In 2015, Ghana's National Guidelines for Malaria in Pregnancy (MIP) were adapted to apply WHO's three-pronged approach: providing sulfadoxine-pyrimethamine (SP) for the intermittent preventive treatment of malaria in pregnancy (IPTp), which is recommended for all pregnant women at each scheduled ANC visit; distributing ITNs at first ANC visit and promoting the use of ITNs during pregnancy; and effective case management of malaria during pregnancy.

The GHS MIP guidelines recommend that SP should be given from 16 weeks of gestation or at quickening, and subsequent doses should be given at four week intervals for a minimum of five doses and a maximum of seven doses, until delivery. 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 life saving or when other antimalarials are considered to be unsuitable. Malaria treatment during the second and third trimester is artesunate-amodiaquine or artemeter-lumefantrine.

Progress since PMI was launched
Over the past few years, high ANC clinic attendance rates in Ghana have provided great opportunity to achieve the NMCP and PMI IPTp goals. In 2011, there was a nationwide training of health staff at ANC clinics followed by supportive supervision in 2012 to ensure skills taught were applied correctly. Additional training of health staff began in 2015 when the GHS MIP guidelines were updated. The 2014 DHS indicates that 87% of pregnant women reported attending ANC clinics four or more times and that Ghana continues to make progress on IPTp coverage. Nationally, the proportion of women reporting that they received at least two doses of IPTp during their most recent pregnancy increased from 64% (2011 MICS) to 68% (2014 DHS). In spite of this relatively high coverage and significant progress, the gap between ANC clinic attendance and IPTp2 uptake remains significant. The main driver for this anomaly,

as in the past, has been frequent SP stockouts due to procurement and supply chain challenges. The long delay in getting SP into the country (a considerable problem from 2012-2014) has been a major contributing factor, and the subsequent destruction of nearly the entire national SP supply in the 2015 CMS fire only exacerbated the situation.

Progress during the last 12-18 months

During the past 18 months, PMI strengthened pre-service education for midwives and community and public health nurses by updating technical MIP and IPTp training materials within an integrated maternal health training that includes ANC clinics and other maternal and child health activities. A total of 38 health professional schools (10 community health nursing schools, one public health nursing school, one medical assistant training school, and 26 midwifery schools) representing all of the public sector facilities in these categories were supported in pre-service education. The revised curriculum was completed and disseminated to all health professional schools for the 2015/2016 academic year, starting in September 2015. An estimated 2,000 students will benefit from a standalone e-learning module on MIP, which was recently introduced to improve the knowledge and skills associated with and adherence to the GHS MIP guidelines. An additional 8,500 copies of the GHS MIP guidelines have been distributed to all the health training facilities. Further, PMI collaborated with NMCP and GHS to train more than 3,700 health care providers in MIP services.

Due to the CMS fire and the immediate need for SP, PMI procured 3 million treatments, which arrived in May 2016 and are expected to meet approximately one and half years' worth of SP needs at ANC clinics in Ghana. The GOG made a commitment to cover any remaining gaps through their own procurement system in 2017. However, these commodities have not yet been distributed to facilities as they are pending clearance by the Ghana Food and Drugs Authority (GH-FDA). PMI and the Global Fund are working with the NMCP and GOG to ensure an adequate national stock of SP.

Table F. Status of IPTp policy in Ghana

WHO policy updated to reflect 2012 guidance	October 2012
Status of training on updated IPTp policy	Ongoing
Number of health care workers trained on new policy in the last year	3,700
Are the revised guidelines available at the facility level?	Yes
ANC registers updated to capture 3 doses of IPTp-SP?	Yes
HMIS/DHIS updated to capture 3 doses of IPTp-SP?	Yes

Table G: SP Gap Analysis for Malaria in Pregnancy

Calendar Year	2016	2017	2018
Total Country Population	28,596,675	29,311,592	30,044,381
PMI-targeted at-risk population	28,596,675	29,311,592	30,044,381
SP Needs			
Expected pregnancies per year[1]	857,900	879,348	901,331
Total number of pregnant women visits at ANC[2]	2,144,751	2,295,098	2,451,622
Total SP Need (in treatments)	**2,144,751**	**2,295,098**	**2,451,622**
Partner Contributions			
SP carried over from previous year	0	1,855,249	2,560,152
SP from Government*	1,000,000	0	0
SP from Global Fund	0	0	0
SP from Other Donors	0	0	0
SP planned with PMI funding*	3,000,000	3,000,000	0
Total SP Available	**4,000,000**	**4,855,249**	**2,560,152**
Total SP Surplus (Gap)	**1,855,249**	**2,560,152**	**108,530**

[1] It is estimated that 3% of the population will be pregnant for each year, based on 2010 census data
[2] Total number of pregnant women visits to ANC clinics calculated based on expected attendance. For 2018 targets are: IPTp1: 80%; IPTp2: 80%; IPTp3: 75%; IPTp4: 25%; IPTp5: 12%

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 the five USAID focus regions (Greater Accra, Central, Western, Volta and Northern 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 2017 funding: ($550,000)

- *Strengthen provision of malaria prevention tools through ANC clinics (five focus regions):* Support ANC clinics at health centers and, where available, at CHPS compounds to effectively deliver a package of malaria prevention services to pregnant women. PMI support will focus on supportive supervision, on-site training as needed, quality improvement to increase provision of IPTp at every ANC visit, in accordance with national guidelines. Ensure distribution of an ITN to every pregnant woman at first ANC visit. *($550,000).*

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 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. Ghana's first-line therapy for uncomplicated malaria includes artesunate-amodiaquine (adopted in 2004). 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 supported as therapies for severe malaria. 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 refocused community-based management of fever from community-based agents through iCCM to 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 any meaningful reporting by the community-based agents. Conversely, community health nurses, well-trained regular staff of the GHS at CHPS compounds, are 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 NMCP in Upper West Region and there are plans to expand to Upper East Region and eligible parts of Northern Region. Although not directly supporting SMC, PMI remains engaged in national level discussions on the future of SMC in Ghana

Progress since PMI was launched

PMI's primary strategy for improving malaria case management (diagnosis and treatment) is clinical and laboratory Outreach Training and Supportive Supervision (OTSS). OTSS is designed to provide long-term, ongoing support for strengthening malaria case management in health facilities by identifying areas that require improvement and providing support to clinicians and laboratory staff. OTSS consists of regularly scheduled supervisory visits to health facilities and their laboratories, if applicable, where a checklist is used to assess key issues such as: the relevant infrastructure, personnel factors such as staffing, level of training, and performance in malaria case management. Clinical OTSS focuses on the clinical aspects of 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, although 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, at this time, their visits do not necessarily coincide. However, PMI plans to facilitate a coordinated approach in the coming year as the GHS moves to adopt an integrated clinical and lab OTSS approach.

GHS has made significant progress in improving malaria case management capacity at health facilities throughout the country. Currently, PMI supported clinical OTSS covers all public sector facilities quarterly, and since 2012, eleven rounds of clinical OTSS have successfully trained more than 97% of public sector health workers in malaria case management. For severe malaria, all prescribers at referral facilities trained under the revised case management protocol were trained in the use of injectable artesunate and prescribers at lower level facilities were trained in the use of rectal artesunate. PMI has also facilitated extensive training in data management for health information officers and includes data monitoring in the standard package of clinical OTSS activities.

PMI has worked closely with NMCP and GHS Clinical Laboratories Unit 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. 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. All staff at the enrolled facilities have been trained in malaria diagnosis. A national archive of malaria slides has been established to support proficiency testing of laboratory personnel. PMI has also supported proficiency testing and annual malaria diagnostic refresher training for health facility laboratory staff. PMI is supporting increased use of RDTs in the private sector, particularly in private clinics, pharmacies, and OTCMS shops. Through a special arrangement with the NMCP, OTCMS and private sector associations receive supplies of RDTs from the national stock and distribute to their members. Through this initiative over 54,000 RDTs were distributed to OTCMS shops between November 2014 and July 2015.

Availability of microscopes in public sector and quasi-public sector (semi-autonomous public institutions) facilities has significantly improved over the last few years. 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 since 2009. 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 continues to support malaria case management pre-service education, with support for midwife and nursing training. PMI support has supported curriculum update for all public Registered General Nursing, Registered Midwifery, Registered Community Nursing and Registered Nurse assistant schools that at were in existence before 2013. As a result of this work 45 schools have had their curriculum updated and 142 tutors who teach courses that cover malaria have been trained in malaria case management and MIP. In addition 8587 students have been trained in malaria case management and MIP. The e-learning component of the pre-service education has reached 9487 students in 34 schools with case management and MIP modules. Also the skills lab component has equipped 33 schools to offer practical training in case management and MIP to students.

. Ensuring that the new cohorts of public and private sector health care workers have been trained on best practices for malaria case management will help ensure that high quality services continue to be provided in all health facilities throughout Ghana.

The GHS continues to strategically increase the quantity of 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 the placement of 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 is in line with and in support of the GHS and NMCP strategies.

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 also provided support for monitoring efficacy of the two first-line ACTs used for the treatment of uncomplicated malaria since the launch of PMI. Efficacy studies are typically conducted and supported by the Global Fund, biennially. In 2015, therapeutic efficacy studies were supported in ten sites, one in each region – five testing only artemether-lumefantrine and the other five testing only artesunate-amodiaquine.

Progress during the last 12-18 months

Clinical and laboratory OTSS

Although Ghana has a long history of presumptive treatment of malaria and while diagnostic testing rates have been historically low, the investment in training and outreach training and supportive supervision (OTSS) is beginning to show results. In collaboration with GHS Clinical Laboratory Unit, PMI supported national Malaria Diagnostic Refresher Training and Proficiency Testing to improve regional capacity to conduct laboratory OTSS and improve the quality of microscopy. The GHS Clinical Laboratory Unit regional laboratory technicians conducted laboratory OTSS in 186 facilities covering 1,257 laboratory health workers. Adherence to negative test results, as reported from the last quarter of 2015 laboratory OTSS, improved with prescribers currently adhering to negative test results 77% of the time, compared to 72% for the first quarter of 2015 and only 50% in 2010.

During the past 12 months, PMI continued to support the GHS to complete the final validation of the Ghana national archive of malaria slides as an international reference slide set for malaria microscopy. PMI also continued supporting pre-service training in 38 public health schools (community health nursing, public health nursing, and midwifery schools).

To strengthen malaria treatment, PMI's recent technical assistance to the NMCP has focused primarily on supervision of health care workers. PMI trained 4,386 health workers on the updated malaria case management guidelines that were adopted in Ghana in 2013. In the last year, PMI also provided technical and financial support to regional and district directorates to conduct clinical OTSS for treatment and diagnostics in 3,875 facilities in all ten regions covering over 90% of all public health facilities and reaching an estimated 8,990 health workers, 80% of prescribers in hospitals and 100% of prescribers at CHPS compounds.

Results from the February 2016 end-use verification (EUV) survey (non-generalizable) that sampled 38 service delivery points in the Northern, Upper East, and Upper West Regions, showed that although 34% of health facilities visited that day were stocked out of RDTs, nearly 100% of staff using RDTs had received training. Additionally, of the 760 patient records examined, 69.5% were diagnosed with malaria and 41% were under five years of age. Of the malaria cases, 43% were diagnosed by RDTs, 7%

by microscopy and 50% clinically (an increase in clinical diagnosis compared to the health facilities surveyed last quarter). Ninety-five percent of malaria cases in children under five years of age were treated with an ACT.

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 the practice of pharmacy, has trained 8,973 OTCMS out of an estimated 10,000 OTCMS at OTCMS shops 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 is collaborating 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. Five regions received supplies of DFID-funded RDTs that lasted through April 2015. Based on the reporting developed by the NMCP and completed and submitted by OTCMS, over 35,000 tests have been conducted and reported. Approximately 63% of these tests were negative. An analysis of the reporting template data indicated that only 4% of those who tested negative were given ACT. Unfortunately, due to the 2015 CMS fire and the cancellation of a scheduled PMI-funded RDT order in 2015 due to quality issues, national-level RDT stockouts forced the government to prioritize deliveries to public sector facilities. At the time of writing, DFID had procured and delivered 1 million RDTs for use in the private sector. The NMCP was developing the modalities for distributing the RDTs to OTCMS shops and other private sector facilities.

National Health Insurance Scheme
Unique among PMI focus countries, the NHIS administered by 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 above and the HSS section below), 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, including: 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 support to 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. In 2015, 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 350 community health nurses at district hospitals to improve their skills in malaria case management.

Pre-service education
The eLearning program has made significant progress in developing new modules and shorter learning objects that can be used on the computers in the computer labs at the training schools or students'

personal computers for those who have them. The modules have also been broken down to fit onto mobile learning platforms. In addition, a private creative company has been contracted to produce innovative malaria game, which can be found on Google Play. To institutionalize this process several different steps and approaches are being taken at different levels. First, PMI's implementing partner is working at the national level to develop the eLearning secretariat at GHS which will guide the further development and maintenance of these materials including posting them on their website. Second, at the schools level, our implementing partner is working with IT tutors to enable them to manage the programs at their sites. The use of the mobile modules and game has been beta tested at three schools to date as the programs continue to be refined. The program is being transitioned to train tutors to develop eLearning content themselves. The program is also working with NMCP to accredit these modules so that they could be used not only in pre-service, but also in-service training as continuing education credits. PMI is scaling 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 DHIMS2 data to understand morbidity trends to predict consumption needs for the future.

Table H: RDT Gap Analysis

Calendar Year	2016	2017	2018
RDT Needs			
Total country population	28,596,675	29,311,592	30,044,381
Population at risk for malaria	28,596,675	29,311,592	30,044,381
PMI-targeted at-risk population	28,596,675	29,311,592	30,044,381
Total number of projected fever cases[1]	14,474,336	14,006,756	12,808,345
Percent of fever cases tested with an RDT	85%	85%	85%
Number of fever cases tested with an RDT	12,303,186	11,905,743	10,887,093
Number of RDT required for training[2]	246,064	238,115	217,742
Number of RDTs required in 2016 to fill pipeline[3]	1,380,417	0	0
Total RDT Needs	**13,929,667**	**12,143,857**	**11,104,835**
Partner Contributions			
RDTs carried over from previous year	0	4,111,417	4,611,417
RDTs from Government	0	0	0
RDTs from Global Fund	8,510,306	8,709,674	TBD
RDTs from Other Donors (DFID)[4]	1,830,778	1,434,183	0
RDTs planned with PMI funding	7,700,000	2,500,000	4,000,000
Total RDTs Available	18,041,084	16,755,275	8,611,417
Total RDT Surplus (Gap)	4,111,417	4,611,417	(2,493,418)

[1]Projected fever cases factoring in increasing use of vector control measures

[2]RDTs required for training are 2% of RDTs required for testing due to ongoing commitment to national refresher training to support the change from Point of Care RDT test kits to test kits of 25

[3]Due to historically low stock previous to 2016, 11% of additional stock is required to build levels up to minimum stock at central level to avoid stockouts

[4]DFID procures an additional estimated 1,000,000 RDTs for the private sector that are not included in this table as these estimates are for public only

[5]PMI RDTs for 2016 and 2017 shipment have been placed and scheduled to arrive in the appropriate years. Half of Global Fund's 2016 commitment has been confirmed while 2017 have not been confirmed. PMI's commitment in 2018 is to ensure adequate stocks of RDTs as can be afforded at the moment but will be adjusted as needed based on future Global Fund commitments

Table I: ACT Gap Analysis

Calendar Year	2016	2017	2018
ACT Needs			
Total country population	28,596,675	29,311,592	30,044,381
Population at risk for malaria	28,596,675	29,311,592	30,044,381
PMI-targeted at-risk population	28,596,675	29,311,592	30,044,381
Total projected number of malaria cases[1]	6,932,644	5,234,022	5,214,597
Number of ACTs required in 2016 to fill pipeline[2]	2,842,384		
Total ACT Needs	**9,775,028**	**5,234,022**	**5,214,597**
Partner Contributions			
ACTs carried over from previous year	0	0	0
ACTs from Government	0	0	0
ACTs from Global Fund	7,271,900	5,234,022	TBD
ACTs from Other Donors	0	0	0
ACTs planned with PMI funding[3]	2,432,040	0	2,000,000
Total ACTs Available	9,703,940	5,234,022	2,000,000
Total ACT Surplus (Gap)	(71,088)	0	(3,214,597)

[1]Calculated by factoring in increased use of diagnostics for appropriate treatment
[2]Due to historically low stock levels, an additional 41% of treatments are included in year 2016
[3]Global Fund has committed to providing the projected numbers for ACTs. Current projections do not indicate that PMI needs to fund ACTs in 2017. To ensure adequate stocks, enough funds in the pipeline have been set aside to procure enough to cover pediatric treatment needs in 2017 if/as needed. Until Global Fund is able to make a commitment in 2018, PMI plans to procure all ACT needs for under 14 in 2018.

Plans and justification

PMI will continue to support comprehensive case management training, supervision, and quality improvement. 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 and quality at district, regional, and community level health facilities. Such efforts to ensure quality of malaria case management in all facilities are ongoing and will be continued in FY 2017. PMI will continue to procure commodities for the diagnosis and treatment of uncomplicated and severe malaria at all levels of the public health system.

PMI will continue to support the laboratory OTSS program and seek mechanisms to further integrate management of this program, along with Malaria Diagnostic Refresher Training and Proficiency Testing into the GHS Clinical Laboratories Unit. PMI will also support the roll-out of RDTs in the private sector through OTCMS shops.

In the long run the Ghana mission plans to extend pre-service education to private accredited nursing training schools as well as expand the provision of skills lab and e-learning facilities to public and private pre-service training schools not served under the current program. Following the implementation of an accelerated program to bridge a very low nurse-patient ratio, teacher-student ratio has dramatically decreased with a consequent decline in effectiveness of teaching and learning outcomes. In view of this, e-learning and skills development are becoming the-state-of-the art in pre-service education as a way to

compensate for the negative consequences of very small teacher-student ratio. PMI will continue to support curriculum development and e-learning in institutions that are not covered under current PMI investments.

Proposed activities with FY 2017 funding: *($8,634,000)*

- Procure essential commodities for malaria diagnosis and treatment, including:
    - *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 2 million ACTs, to meet the estimated infant, toddler, and adolescent treatments (estimated at 40% of total annual ACT needs) for 2018. *($2,000,000)*
    - *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 200mg/1ml), which is 100% of the annual need. *($429,000)*

- *Strengthen the quality of malaria microscopy capacity of lab supervisors*: Provide technical support to successfully conduct quarterly Malaria Diagnostic Refresher Training and Proficiency Testing nationwide. Conduct quarterly laboratory OTSS nationwide to support continued quality improvements to malaria microscopy and RDT use and scale up, including improvement of coordination between laboratory staff and prescribers. *($400,000)*

- *Strengthen the community-based management of fever via CHPS compounds:* Support in-service training of community health nurses to improve integrated management of childhood illness (IMCI) to strengthen community-based management of fever; support supportive supervision of community health volunteers by community health nurses; support referral system to CHPS compounds, health center, and district hospitals. *($600,000)*

- *Strengthen the provision and quality of malaria case management at health facilities in USAID focus regions:* Support in-service training of health facility staff on malaria case management; Engage 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; conduct quarterly data coaching for district health information officers. *($850,000)*

- *Provide technical assistance to support GHS and NMCP:*
    - At the national level, provide critical technical assistance to the GHS and the NMCP to strengthen national oversight of malaria case management, including activities such as: support for case management technical workings groups, revision of guidelines (as needed). *($250,000)*
    - In the five non-USAID focus regions, support the regional health management teams to strengthen capacity of facilities to provide high quality malaria case management. This

support will be provided through malaria-focused quarterly clinical OTSS visits and data coaching. *($650,000)*

- *Provide technical assistance to improve malaria case management at regional levels in the five non-focus regions:* Support GHS Institutional Care Division to provide oversight for regional clinical OTSS; support regional supervision teams with improved management, leadership, data management, and supervision; facilitate regional-level planning to ensure that malaria activities are properly documented and captured. *($300,000)*

- *Support pre-service training for health care workers and physicians to improve malaria case management capacity:* Support pre-service training and skills lab-based practical application of training for general nurses, midwives, and medical assistants to improve competencies in knowledge, skills, and practices for malaria diagnosis and case management and malaria in pregnancy, in compliance with GHS guidelines and protocols. Funding will also support the institutionalization program such as the eLearning secretariat at GHS, and training IT tutors to enable them to manage the programs at their sites *($400,000)*

- *Strengthen the malaria case management capacity of OTCMS shops and pharmacies:* Support activities to build the capacity of licensed OTCMS and pharmacists to comply with GHS malaria diagnosis, treatment, and referral guidelines. Address issues related to for-profit, business motivations to comply with GHS guidelines. Provide TA to OTCMS associations for distribution of RDTs and fund the Pharmacy Council to provide supportive supervision to the OTCMS with IT tutors to develop new content and enable them to manage the programs at their sites *($300,000)*

- *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 at 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 audit visits. Specific activities will include targeted mentorship and additional supervisory and on-the-job training for poorly performing facilities. *($325,000)*

- *Technical assistance for diagnostics:* Provide technical assistance for lab OTSS, proficiency testing, microscopy quality assurance, and RDT proficiency and scale-up. *($10,000)*

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 essential malaria commodities. The NMCP and PMI plan to increase the 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 commodities procured by the key donors such as PMI, DFID, and the Global Fund. The supply chain system was largely a "pull' system of distribution where the RMS, districts, health centers, and CHPS compounds picked up or "pulled" their needed health commodities from the higher level facilities as needed. Community-based agents obtain their health commodities from the CHPS compounds.

After the CMS fire, Global Fund and USAID developed an interim parallel private storage and scheduled distribution system for USAID, including PMI, and Global Fund commodities. This "push" system is increasing drug availability at the RMS level and providing more data and better oversight of commodities. In addition to increasing availability, this will enhance quantification and forecasting to ensure appropriate levels of drug availability to maintain these improvements long term. Over the next few years, efforts will be made to extend the "push" model of distribution to the service delivery point.

In the immediate aftermath of the CMS fire, PMI 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 to ensure each region had adequate quantities of malaria commodities; supported the inspection of RMS warehouse and storage facilities and warehouse and storage facilities at three teaching hospitals; contracted a non-pharmaceutical grade warehouse to store PMI-procured ITNs earmarked for mass distribution; and supported the development of an interim public-private partnership distribution plan for the distribution of commodities from the central level.

Though procurement challenges encountered in previous years have been largely addressed by the NMCP's decision to use the Global Fund's Pooled Procurement Mechanism for accessing malaria commodities, PMI, together with President's Emergency Plan for AIDS Relief and other USAID programs, has been supporting the MOH and GHS to improve supply chain mechanisms for all pharmaceuticals and health commodities. With PMI support, work started in 2011 to design a sector-wide Supply Chain Master Plan. Due to a variety of influences, the development of the plan was delayed until late 2014, after which a steering committee was formed. The CMS fire brought the importance of a strong supply chain system to the forefront. The Steering Committee found the outlined plan originally developed in 2011 still valid and the Supply Chain Master Plan for 2015-2020 was developed for implementation. This plan outlines a five-year strategy for a comprehensive restructuring of the public sector supply chain and includes a series of strategic interventions and activities for creating a supply chain that fully supports the MOH's objectives for a strong and reliable national health system.

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. Local procurement of medicines from these suppliers is allowed at all levels of government and the supply chain has evolved to a point where regional and district health offices are 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 supported collaboration with the GH-FDA to promote the safety and efficacy of medicines sold in Ghana. This includes seven annual rounds of testing of antimalarials. 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 Ghana government on grounds of ability to 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. This is expected to generate revenue in the future to support the lab's accreditation. Currently GH-FDA's newly established Enforcement Department has acquired some field screening devices and has begun post-market surveillance for medicines used for non-communicable diseases.

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. In addition, in response to the CMS fire, PMI has supported the procurement of additional stock of malaria commodities to meet the urgent need required to reach the demand for testing and treatment.

Stock levels in country have historically been inconsistent and the system consistently shows low stock levels, particularly in RDTs and SP. In February 2016, an EUV survey detected significant stockouts of key malaria commodities on the day of the visit (34.2% of service delivery points were stocked out of RDTs; depending on the presentation, 42-97% of service delivery points were stocked out of various presentations of artemether-lumefantrine, and depending on the presentation, 21-68% of service delivery points were stocked out of artesunate-amodiaquine). Despite the observation that health facilities in most cases have the ability to treat clients with malaria due to availability of alternative ACTs (the February EUV survey showed 100% of facilities had at least one presentation of ACTs) these stockout rates are a

matter of concern. Based on the last 15 months of the quarterly Procurement Planning and Monitoring Report, Central stock levels of ACTS have improved. However, maintaining adequate RDT and SP stock levels is still a challenge. As a result, PMI supports the use of stock cards in stock management training, particularly for RDTs and SP. Stock shortages are a problem at all levels of the system for a number of reasons including incomplete implementation of nationwide scheduled delivery; lack of quality reporting from facilities, and debt between the levels within the system.

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 development, including the establishment of an interim management team, to address the overall public sector supply challenges.
Two ongoing constraints are the availability and visibility of actual commodities consumption data at the facility and district levels, and the quality, validity, and accuracy of facility level commodities consumption data that reflects the true need at the facility level. With the placement of Regional Logistics Officers at the RMS level and the interim parallel private storage and scheduled distribution system for USAID, PMI, and Global Fund commodities, there continues to be improvements in data visibility at the regional level through the monthly stock reports, better NMCP oversight of commodity deliveries, and overall efficiency.
In addition to continuing the support and strengthening of post-marketing surveillance monitoring for antimalarial medicines 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.

The antimalarial medicines quality monitoring program in Ghana, which is in its seventh round, 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. The poor quality medicines included both imported and locally produced batches, the majority of which were not registered in Ghana. The overall failure rate for antimalarials has continually decreased from 7.7% in 2012, to 2.8% in 2015. Overall, the failure rate for analgesics has decreased from 19.8% in 2012 to 14.9% in 2015, however this has not been a steady pattern with the failure rate in 2013 only at 7.3% before rising back up to 18.6% in 2014.

PMI supported a USAID/Ghana activity to conduct key trainings and provide technical assistance to GH-FDA laboratory staff and review 26 new standard operating procedures for pharmaceutical microbiology and 12 medical device standard operating procedures. Currently Ghana FDA’s newly established Enforcement Department has acquired some field screening devices and has begun PMS for medicines used for non-communicable diseases. It is expected that funds generated from fines as a result of PMS activities would also be used to cover medicines from other therapeutic groups in the next 2-3 years including malaria. In view of the success of the program with USP and the FDA's own income generating activities, we are of the view that the Ghana FDA will need limited or no further support from USP. However, PMI will study the progress of the FDA under the new funding arrangement to determine its ability to self-finance and maintain the malaria medicines PMS activities

Plans and justification
PMI will continue to strengthen supply chain, logistics, and pharmaceutical management including forecasting, quantification, training, supervision, and monitoring stocks. PMI will strive to increase the

amount of malaria commodities to the appropriate stock levels in country as the initial emergency stock required has stabilized since the CMS fire. PMI will work with the NMCP, MOH, and appropriate partners on supply chain reform through the interim working group to implement the Supply Chain Master Plan to ensure and sustain 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. 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.

The Development Partners made the following recommendations to the Ministry of Health after the CMS fire:

- Acceleration of the investigation into the fire and the loss of commodities, release of the report and the speedy implementation of recommendations from the investigations report;
- Assurance of safe, secure and insured warehouses with the requisite management controls at the Regional level for storage and distribution of pharmaceutical supplies and commodities;
- Acceleration of pharmaceutical supply management reforms, including the appropriate and rapid revision of the Supply Chain Master Plan;
- Assessment and reporting of the debt levels of the Regional Medical Stores to the Central Medical Stores and information on the plan for the collection and use of those monies.

If these recommendations are achieved successfully, this would allow for considering the reintegration of USAID commodities into the GOG supply chain system in the next 18 months. One key requirement is the implementation of the Supply Chain Master Plan. USAID has coordinated with the GOG and Global Fund to agree upon benchmarks in the areas of last mile distribution, warehousing at the central and regional level, LMIS and framework contracts. PMI will support the GOG in successfully meeting these benchmarks.

Furthermore, PMI will continue to support the drug quality monitoring activities and activities toward maintaining GH-FDA's ISO 17025 accreditation and work toward a country-owned sustainable post marketing surveillance. 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 2017 funding: ($1,900,000)

- *Support national and regional supply chain system strengthening:* Provide technical assistance for strengthening logistics, warehousing, and distribution to improve availability of malaria commodities, in accordance with the national Supply Chain Master Plan and interim working group. 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 and identify ongoing programmatic successes and challenges. In addition, approximately half of the supply chain strengthening funding will go towards the warehousing and transportation of all commodities to RMS. *($1,200,000)*

- *Strengthen the district level supply chain system:* Strengthen the overall supply chain management capacity nationally and down to the district and facility levels within the five

priority regions, including support of scheduled delivery to certain regions. Facilities in the districts will receive supportive supervision on supply chain management which will focus on ensuring the use of logistics records (stock cards, logistic management information system), commodity management training integrated into capacity building activities and assessing the storage conditions. Continuous on-the-job training will be provided and action plans will be developed to improve supply chain management. *($550,000)*

- *Strengthen drug quality monitoring capacity:* Provide support for the strengthening of a country-owned sustainable antimalarial drug quality monitoring with the GH-FDA. Support to GH-FDA for increased enforcement capacity and education to heighten responsiveness to counterfeit and substandard medicines will continue. New activities of testing RDTs and ITNs will be added onto the activities from past years. *($150,000)*

4. Health system strengthening and 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 J, below, summarizes the varied HSS investments PMI/Ghana is supporting throughout this MOP and over time.

Table J: 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 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.
	Health Systems Strengthening	Support NHIA government-to-government programming to improve NHIS financial sustainability and promote and ensure local ownership over the process.

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 65.5% increase in the likelihood of seeking formal medical treatment for a child with a fever or a cough and almost a 72%

increase in the likelihood of receiving malaria medication.[8] 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 to periodically undertake targeted clinical audits 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 o 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 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 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 detailed 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 stockouts of health commodities. PMI has also supported

[8] 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.

the emergency and annual quantification of malaria commodities to ensure availability of malaria products and nationwide mass distribution of ITNs. PMI resources have also strengthened ground logistics capacity, supply chain and logistics technical assistance, and 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 for targeted clinical audits under the NHIS. Audited facilities are targeted because of indications that the facilities were not providing high quality services in accordance to national guidelines. In some regions, up to 70% of targeted health facilities that were purposefully audited had been inappropriately treating malaria. Examples of inappropriate treatment include artemeter 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 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). Initial enrollment has included about 80% of active NHIS members in these three regions (approximately1.5 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 recent PMI and USAID/Ghana funded provider mapping survey in the Upper East, Upper West, 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 antimalarials.

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 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 three residents in the malaria track of the program. Residents conducted advanced classroom and practical training in field epidemiology, focusing on priority issues in malaria surveillance and

operational research identified by the NMCP and PMI. Ongoing projects include an evaluation of the malaria diagnosis and treatment practices in Tolon District, Northern Region; adherence to WHO recommended parasite count and species identification method of malaria diagnosis by trained laboratory personnel in the Greater Accra Region; and factors associated with intermittent preventive treatment update among pregnant women in Denkyembour District. Historic PMI investments in the Field Epidemiology Laboratory Training Program have resulted in two alumni currently working with the NMCP as a medical epidemiologist, leading malaria SM&E activities, and the 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.

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 2017 funding: ($1,200,000)

- *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:* 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:
    - Providing expert technical assistance to the NHIS to facilitate a successful scale-up of a primary health care capitated package of services to five additional regions (Eastern, Central, Western, Brong Ahafo, and Northern regions).
    - Refining diagnostic related groups to cut costs and as a tool to monitor clinical performance; strengthening claims management and drug payment and drug supply management 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 treatments costs across providers as uncovered through claims data, identify root causes and develop appropriate measures to address the situation as necessary. Addressing these questions may contribute to malaria-related cost containment, case management and data management improvements.
    - Supporting the Presidential Commission on the Technical Review of the NHIS to do a thorough stock-taking of the achievements of the NHIS and where the Scheme can be strengthened to continue to expand access to essential health services to more Ghanaians while protecting them from the impoverishing costs of care. *($300,000)*

- *Support targeted communication efforts related to NHIA capitation rollout*: Continue to support targeted communication activities at both the provider and patient levels to facilitate NHIA capitation roll-out to at least three additional regions (Central, Western, and Brong Ahafo). The goal of the communication activities is to promote an increase in patient enrollment in NHIS and inform 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 and ensure sustainability of NHIS. Within the past year the larger USAID investment has helped increase enrollment from 40% to 44% of the population Activities will include developing communication materials including print, radio and television messaging; procuring radio, air and TV time and local community engagement activities to promote active enrollment in NHIS and access to NHIA-accredited facilities among the general population, with a focus on high burden rural areas. PMI support to NHIS is part of $2.2 million USG annual investment into NHIS, aimed at building a sustainable NHIS. Specifically for malaria, PMI investment is planned to strengthen the best practice of "test, treat, and track" and total adherence to test results among service providers. Adherence to test results will ensure cost control and higher sustainability of NHIS. *($350,000)*

- *Strengthen the role of civil society in malaria advocacy*: Build the capacity of local 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. Empower civil society organizations to engage citizens to demand and participate in health service delivery and advocate for their interest. Activity will also 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 through this activity. These groups will monitor the quality of health services and help to identify areas for improvement. *($300,000)*

- *Support Peace Corps Malaria Program*: Support two third-year Peace Corps Volunteers through the "Stomping out Malaria in Africa" initiative. All Peace Corps Volunteers based in Ghana will also be able to apply for small grants from PMI to engage in malaria control and prevention activities such as community mobilization, SBCC activities, and ITN distribution. *($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*)

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 Ghana Health Service, 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 nets (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 PMI- and USAID-supported efforts 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 total number of nets 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 previous night ($p<0.01$). Three-fourths of those who reported sleeping under a net the previous night stated that they have heard "Aha Ye De" messages. There was 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 malaria in pregnancy, 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 two or more doses of IPTp during their last pregnancy in the last two years increased from 28% (2006 Ghana MICS) to 67% (2014 Ghana DHS). However, only 38% of women reported receiving three or more doses of IPTp during their last pregnancy in the last two years (2014 DHS). 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 four or more antenatal clinic visits, indicating a missed opportunity for IPTp uptake. 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 2014, according to the 2011 Ghana MICS and 2014 Ghana DHS, respectively, the percent of children under five years old with fever in the last two weeks for whom advice or treatment was sought increased from 50% to 56%. 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 and facilitators of 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. In 2015, during the scale-up phase, over 9,000 television and radio spots addressing integrated health messages were aired nationally; however, in 2016, after scale-up is achieved, 55,749 integrated television and radio spots are expected to be aired. The malaria-specific components of this mass media campaign include radio, television and social media initiatives 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, changes in behavioral determinants, and behavioral trends are currently being monitored nationally through mobile cross-sectional surveys and regionally through mobile cohort surveys. Secondary mass media activities have included and will continue to include social media campaigns targeting specific malaria-related behaviors, such as *"It's an #everydaything"* promoting correct and consistent ITN use, and incorporation of messages targeting malaria-related behavior into a popular national television series called *"You only live once (YOLO)"*.

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 1,700 frontline health workers in Northern and Volta to help generate demand for malaria

services at the community-level. These efforts were complemented through community radio promotions in 13 districts.

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. These efforts have targeted primary school pupils, teachers, parents and families, and community leaders. For the 2016 program, PMI has supported the training of 419 malaria focal persons, health promotion officers, cultural officers, and district school health education program officers in four regions to implement and supervise school-based interpersonal communication activities. Activities are underway to engage a total of 84,000 primary school teachers in school-based interpersonal communication activities and 630 Ghana Education Service, malaria focal persons, and health promotion officers to oversee school-based activities in 14,000 primary schools in six regions participating in the 2016 school-based ITN distribution. 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. Finally, approximately 200 public service announcements were broadcast on regional and national radio stations in multiple languages.

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. In addition to regular broadcasting on regional and national television stations and private viewings, the malaria advocacy video was aired on five national television stations on World Malaria Day 2016.

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 NMCP's National Malaria Behavior Change Communication Strategy (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.

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 2017 funding: ($1,500,000)
In FY 2017, 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:* Provide national-level mass media communication efforts to disseminate core malaria messages via television, radio and through key events (e.g. World Malaria Day and the 2018 ITN mass distribution campaign). 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 health spots on television and radio stations;
    - 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. *($650,000)*

- *Support correct and consistent use of ITNs through school-based communication and education program:* Build on the existing school-based interpersonal communication outreach program to promote increased malaria prevention awareness and to promote correct ITN use and correct care practices, as the mass ITN campaign is conducted. This activity will be timed to correspond with the 2018 national mass distribution efforts so that at the community level, there will be an a) increased awareness of the campaign (timing, registration plans, etc.); b) promotion of correct and consistent use of ITNs and ITN care, and c) increased mobilization of the community to participate in the mass campaign activities. Nationwide, teachers, students, parents and community leaders will be engaged through this activity. *($300,000)*

- *Implement facility-based and community-based interpersonal communication activities:* Operating as PMI/Ghana's principal interpersonal communication activity, this work will include supporting facility-based and community-based IPC activities to promote correct and consistent uptake of both preventative and curative malaria interventions. It will also include working with community health nurses and community health workers to improve their skills to engage with communities and promote malaria-related preventive and health seeking behaviors. This activity will also improve health care workers' adherence to national malaria case management and IPTp guidelines and strengthen the capacity of health workers to effectively communicate key preventative and curative malaria messages to patients. *($550,000)*

- *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 *National Malaria Control Monitoring and Evaluation Plan (2014-2020)* guides the strategic framework for M&E in malaria control in Ghana. The plan was developed in conjunction with the revised national strategic plan by 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 health management information system data as the main source of data for tracking and measuring programmatic progress. Managed by the GHS Policy, Planning, Monitoring and Evaluation Division, through the Centre for Health Information Management, the updated DHIMS2 platform for reporting and analyzing district level data from health facilities was rolled out in April 2012, and is available in all 216 districts. PMI provided support towards the DHIMS2 upgrade, which includes a customized dashboard to report malaria-focused indicators. Routine malaria data collected from patient care are first recorded into standard registers. Data are then collated from these registers into standardized reporting forms. The facility health information officer is responsible for collection and verification of data from facility departments at the end of every month and onward submission to the district health information officer, after validation by a team. The head of the facility reviews and endorses the collated facility data after it has been cleared by the data validation team, before submission to the district. However, where capacity exists, hospitals and some facilities may enter data directly into DHIMS2. 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 team review the data entered (i.e. compare the data entered into DHIMS2 to that received from the facilities) before it is electronically signed and sent to the region.

Table K, below, summarizes the surveillance, monitoring, and evaluation data sources that are available to the NMCP and partners in Ghana. Specifically, from 2008-2011, PMI supported five GHS sentinel surveillance sites, collecting patient-level and aggregate data on approximately 30 malaria indicators. Following an evaluation of the sites in 2011 that showed low testing rates and poor data use, PMI

stopped providing financial and technical support. In 2014, with support from the Global Fund and DFID, the NMCP established 30 sentinel sites (which are primarily district level hospitals) for monitoring trends in malaria burden and other disease indicators. The impetus for establishing these sentinel sites was based on concern regarding data quality at the facility level and as a platform to conduct special studies, such as assessing the motivation towards non-adherence to test results. These sites are an expansion of the ten therapeutic efficacy study sites, and were established to ensure quality weekly and monthly reporting to DHIMS2 of multiple disease indicators including malaria. For malaria, these sites provide data on number of suspected cases, number of suspected cases tested, and number of tested who are positive. Thick and thin stain smears are also performed on every third suspect case. The first year of sentinel site surveillance is complete and a comparative analysis with DHIMS2 data was recently conducted. Preliminary results showed that there was substandard record keeping and reporting at the sentinel sites. With support from the Global Fund, the NMCP plans to implement routine data quality audits and assessments to improve sentinel surveillance data quality.

Table K: Surveillance, Monitoring, and Evaluation Data Sources

Data Source	Survey Activities	Year								
		2010	2011	2012	2013	2014	2015	2016	2017	2018
Household surveys	Demographic Health Survey (DHS)					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	
	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 HMIS	X	X	X	X	X	X	X	X	X
Therapeutic efficacy monitoring	In vivo efficacy testing				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				
	Malaria Impact Evaluation							X		

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

In 2014, with support from PMI and the Global Fund, and in collaboration with the NMCP, the second edition of the Standard Operating Procedure for Health Information was developed. The first edition of the Standard Operating Procedure was used to train health information officers and other regional and district health management team members in all of the ten regions. It created awareness about availability of information, stimulated better understanding of HMIS issues, and the production of quality data and use for decision makers. However, despite the improvement in information management, more needed to be done to improve data quality overall. The second edition takes into consideration the importance of data validation, the review of reporting forms, and documents the inclusion of other new forms in the sector. New variables in the reporting forms have been included and some existing variables have had their definitions clarified to conform to operational definitions. It is hoped that this second edition will enhance information use for decision-making, improve efficiency in service delivery, improve supervision and monitoring and contribute to pre-service training of health workers.

PMI has supported three national malaria household surveys, the 2008 DHS, 2011 MICS (with a full malaria component), and the 2014 DHS. All 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. In 2016, the NMCP will be in the third year of its current M&E strategic framework, providing optimal timing for PMI and the Global Fund to support a Malaria Indicator Survey to continue to measure progress of malaria control and prevention interventions in Ghana. With baseline and follow-up estimates of all-cause under-five mortality, these nationally representative surveys will serve as the key data sources for the 2016 Impact Evaluation.

Progress during the last 12-18 months

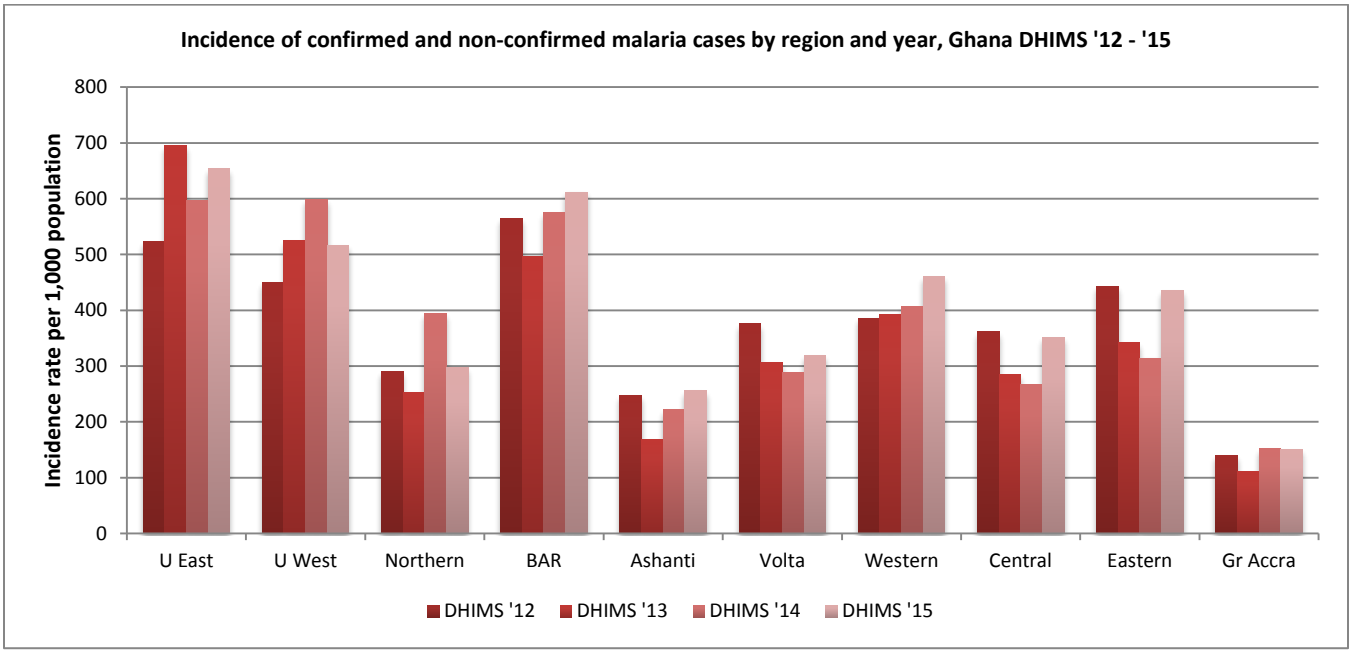
Improving the overall quality of HMIS malaria data is one of the NMCP's most immediate challenges. Table L, below, summarizes key routine surveillance indicators collected through the DHIMS2 system in 2015. Figure 6 provides a depiction of trends in malaria incidence by region, from 2012 to 2015, as generated by DHIMS2. 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. Support was at the national, regional and district and health facility levels and included:

- Data coaching visits conducted in 42 districts across five regions (Northern, Volta, Greater Accra, Central and Western). A total of 754 facilities received coaching on data collection and reporting from a team comprised of five 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).
- Trained 686 OTSS supervisors on malaria data management (including accurate completion of the consulting room register). Supervisor competency scores rose from 50% pre-test to 78% post-test.

Table L: Routine Surveillance Indicators

Indicators	Value	Comments
1. Total number of reported malaria cases (outpatient and inpatient) (Data source: DHIMS2)	10,596,457	Suspected malaria cases (fever and other clinical signs and symptoms)
Total diagnostically confirmed cases	4,319,919	Suspected malaria cases tested positive using either RDT or Microscopy
Total clinical/presumed/unconfirmed cases	1,526,079	Number of suspected cases, not tested and tested negative but treated
Outpatient number of reported malaria cases	10,596,457	Suspected malaria cases (fever and other clinical signs and symptoms). Includes malaria cases admitted.
Diagnostically confirmed	4,319,919	Suspected malaria cases tested positive using either RDT or Microscopy
Clinical/presumed/unconfirmed	1,526,079	Number of suspected cases, not tested and tested negative but treated
Inpatient number of reported malaria cases	409,947	
Diagnostically confirmed	Not available	
Clinical/presumed/unconfirmed	Not available	
2. Total number of reported malaria deaths (Data source: DHIMS2)	2,137	
Diagnostically confirmed	Not available	
Clinical/presumed/unconfirmed	Not available	
3. Malaria test positivity rate (outpatients) (Data source: Sentinel Sites and DHIMS2)	30.3%	Testing positivity rate using both RDT and Microscopy
Numerator: Number of outpatient confirmed malaria cases	82,901	Number of OPD malaria cases tested positive using Microscopy. (RDT, 57,611; Microscopy, 25,290)
Denominator: Number of outpatients receiving a diagnostic test for malaria (RDT or microscopy)	273,326	Number of OPD malaria cases tested using microscopy or RDT (RDT, 174,499; Microscopy, 98,827)
4. Completeness of monthly health facility reporting (Data source: DHIMS2)	90%	
Numerator: Number of monthly reports received from health facilities	45,910	
Denominator: Number of health facility reports expected (i.e., number of facilities expected to report multiplied by the number of months considered)	51,648	

Figure 6. Malaria Incidence (Confirmed & non-Confirmed Cases), by year and region in Ghana, DHIMS2 data 2012 - 2015



- All regions and districts completed two rounds of supportive supervision as of March 2016:
  - 1,961 facilities visited and 8,990 staff supervised in Round One
  - 1,337 facilities visited and 6,402 staff supervised in Round Two (Northern and Volta data were still pending at time of writing).
- Supported five regional health directors to conduct data quality assessments of key malaria DHIMS2 indicators in 18 target districts in 125 facilities.
  - 85.8% of facilities correctly assessed fever
  - 69.6% of facilities correctly tested for malaria
  - 78.4% of facilities correctly managed malaria
  - 59.5% of facilities correctly recorded data
- Supported M&E technical working group activities and regional level review meetings.

Plans and justification

PMI is committed to working with the NMCP to support the implementation of the national malaria M&E plan. 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. Therefore, PMI will support monitoring data quality collected through DHIMS2, starting with data validation at the facility level, to ensure the programmatic and technical needs of 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 (which will also focus on the private sector); 2) continuing to support regional malaria data review workshops (which will include the private sector) 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.

With the introduction of integrated health programs, PMI will support a national-level, malaria-specific SM&E expert to work alongside the NMCP to ensure program objectives contribute to the national malaria SM&E targets. The malaria SM&E expert will facilitate coordination among all PMI-funded partners and the NMCP engaging in malaria-specific SM&E activities.

Proposed activities with FY 2017 funding: ($750,000)

- *Strengthen and support routine M&E systems at peripheral levels in five focus regions:* Support GHS/NMCP to strengthen routine systems at the health facility and district levels for malaria M&E in the Northern, Volta, Greater Accra, Central, and Western Regions. Strengthening activities in each of the five regions will include: providing integrated data coaching visits for health facility data management staff to validate and audit data collection, analysis and reporting to improve data quality (target of 2,514 health facilities); 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 meetings to routinely assess and discuss malaria data – these meetings will reinforce ownership, use and feedback of the data; integrated supported supervision by GHS in 109 districts to improve collection and reporting of data from the health facility up to the district level; and limited computer hardware and software to fill gaps. *($645,000)*

- *Provide M&E technical assistance for malaria-specific activities at the national level:* Provide national-level, malaria-specific M&E advisor to support the NMCP to: a) ensure coordination among all PMI-funded partners engaging in malaria-specific M&E activities; b) provide direct malaria-specific technical assistance to the NMCP; c) actively participate on the national malaria M&E technical working group; d) operate as a malaria liaison for the health – sector wide M&E collaborations; and e) conduct malaria specific data analyses as requested. *($95,000)*

- *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 M, below, summarizes the three OR studies supported by PMI in the past five 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 the 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 five, 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 nighttime 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.[9] 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 nighttime 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 nighttime event with participants reporting that they attended funerals up to once a week.

Table M: Operational Research Studies

Completed OR 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**
No PMI-supported OR is ongoing			
Planned OR Studies FY 2016			
Title	**Start date (est.)**	**End date (est.)**	**Budget**
Effect of indoor residual praying on *Anopheles* vector behaviors and their impact on malaria transmission in the northern region of Ghana (Vector Behavior Study)	June 2016	October 2017	$225,000

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

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 nighttime 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 human and vector behavior play 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 the northern region of Ghana (Vector Behavior Study)". The aim of this study is to better understand malaria vector outdoor behavior (feeding and resting), 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 the 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 human behavior and 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 three 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 2017 funding.

Proposed activities with FY 2017 funding: ($0)
No operational research is planned with FY 2017 funding.

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 USAID Mission Director will approve the number of locally-hired staff and necessary qualifications needed to successfully support PMI activities either in Ministries or within USAID. 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 2017funding: ($1,485,000)

- *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. *($1,485,000)*

Table 1: Budget Breakdown by Mechanism

President's Malaria Initiative – GHANA
Planned Malaria Obligations for FY 2017

Mechanism	Geographic Area	Activity	Budget ($)		%
TBD IRS Project	6 Districts	Support for IRS program implementation	$4,814,500	**$5,050,000**	18.04%
	National	Support for IRS program implementation	$235,500		
Communicate for Health	National	Support mass media communication efforts to promote ITN ownership and use, IPTp uptake, and improved care seeking behavior	$650,000	**$650,000**	2.32%
CDC IAA	National	Technical assistance to support entomologic monitoring for IRS	$29,000	**$769,000**	2.75%
		Technical assistance for diagnostics	$10,000		
		Support long-term field epidemiology and laboratory training	$120,000		
		Provide M&E technical assistance	$10,000		
		In-country staff and administrative expenses	$600,000		
Evaluate for Health, Task Order 1	National	Provide M&E technical assistance for malaria-specific activities	$95,000	**$95,000**	0.34%
TBD (G2G GHS/CLU)	National	Strengthen the quality of malaria microscopy capacity of lab supervisors	$300,000	**$300,000**	1.07%
G2G NHIA - Clinical	National	Support NHIA to implement clinical audits	$325,000	**$325,000**	1.16%
G2G NHIA Communications	Sub-national	Support targeted communication efforts related to NHIA capitation rollout	$350,000	**$350,000**	1.25%

TBD (vice HFG)	National	Ensure sustainability of NHIA	$300,000	**$300,000**	1.07%
TBD – Case management	5 non-USAID focus regions	Strengthen the quality of malaria microscopy capacity of lab supervisors	$100,000	**$1,000,000**	3.57%
		Provide technical assistance to support GHS and NMCP	$650,000		
	National	Provide technical assistance to support GHS and NMCP	$250,000		
MCSP	National	Support pre-service training for health care workers and physicians to improve malaria case management capacity	$400,000	**$400,000**	1.43%
Peace Corps SPA	National	Support Peace Corps Malaria Program	$30,000	**$30,000**	0.11%
SHOPS (Bilateral Associate Award)	National	Strengthen the malaria case management capacity of OTCMS and pharmacies	$300,000	**$300,000**	1.07%
Systems for Health	5 USAID focus regions	Strengthen provision of malaria prevention tools through ANC clinics	$550,000	**$3,845,000**	13.73%
		Strengthen the community-based management of fever via CHPS compounds	$600,000		
		Strengthen the provision and quality of malaria case management at health facilities	$850,000		
		Strengthen the district-level supply chain system	$550,000		
		Implement facility-based and community-based interpersonal communication activities	$550,000		
		Strengthen and support routine M&E systems at peripheral levels	$645,000		
		Build management capacity at NMCP, GHS and other GOG partners	$100,000		

GHSC-PSM	National	Procure and transport long-lasting ITNs	$5,302,000	**$11,051,000**	39.47%
		Procurement of RDTs	$2,120,000		
		Procurement of ACTs	$2,000,000		
		Procurement of severe malaria treatment	$429,000		
		Support national and regional supply chain system strengthening	$1,200,000		
People for Health	Sub-national	Strengthen the role of civil society in malaria advocacy	$300,000	**$300,000**	1.07%
TBD (G2G ICD)	National	Provide technical assistance to improve malaria case management at the national and regional levels	$300,000	**$300,000**	1.07%
USAID/Ghana	National	In-country staff and administrative expenses	$885,000	**$885,000**	3.16%
USP-PQM	National	Strengthen drug quality monitoring capacity	$150,000	**$150,000**	0.54%
VectorWorks	National	Support, technical assistance for ITN distribution and supply chain	$1,600,000	**$1,900,000**	6.79%
		Support correct and consistent use of ITNs through school-based communication and education program	$300,000		
			Total	**$28,000,000**	**100.00%**

Table 2: Budget Breakdown by Activity

President's Malaria Initiative – GHANA
Planned Malaria Obligations for FY 2017

Proposed Activity		Mechanism	Budget		Geographic Area	Description
			Total $	Commodity $		
PREVENTIVE ACTIVITIES						
Vector Monitoring and Control						
Entomologic monitoring and insecticide resistance management						
Support nationwide entomological and insecticide resistance monitoring	TBD IRS Project	$50,000	$0	National		In collaboration with other partners and national research institutions, continue to support entomological and insecticide resistance monitoring at a network of sites nationwide. PMI will provide technical assistance, equipment, training, and funding for routine data collection. These resources will leverage other vector-control partner resources for entomological and insecticide resistance monitoring activities and will help fill gaps to ensure national coverage.
		$185,500	$0	IRS districts		IRS routine entomological monitoring will continue at existing 14 entomological monitoring sites in Northern Region and include: WHO bottle assay insecticide susceptibility testing (with molecular and genetic resistance testing being subcontracted to Noguchi), cone bio-assays (for spray quality and durability of insecticide), and the determination of EIRs and parity rates from indoor and outdoor human landing catches and pyrethroid spray catches.
Subtotal: Entomologic Monitoring		**$235,500**	**$0**			
Insecticide Treated Nets						

Procure and transport long-lasting ITNs	GHSC-PSM	$5,302,000	$5,302,000	National	Procure approximately 1,360,000 long-lasting ITNs to support continuous distribution channels (ANC and CWC clinics) and/or mass distribution efforts to ensure Ghana maintains universal coverage of ITNs. The budget includes transportation of ITNs to regional distribution points.
Support, technical assistance for ITN distribution and supply chain	VectorWorks	$1,600,000	$0	National	Support the continuous distribution of ITNs through health facilities (ANCs and CWCs) with support to the GHS/NMCP. Funds will support the costs of training, planning, supervision, operations, and M&E. Additional support will be provided for mass distribution, as needed.
	Subtotal: ITNs	**$6,902,000**	**$5,302,000**		
Indoor Residual Spraying					
Support for IRS program implementation	TBD IRS Project	$4,814,500	$1,588,785	6 Districts	Support IRS implementation and programmatic evaluation in six districts in the Northern Region. Funding will support entomological monitoring, spray operations, data collection, environmental assessment and compliance monitoring, SBCC activities including community mobilization, and logistics. Proposed activities include continued support for procurement of insecticide and equipment; support for supervision by GHS, Environmental Protection Agency, and Noguchi Institute personnel; and collaboration with the NMCP, MaVCOC, the Global Fund/AGAMal IRS program, and other partners. Programmatic evaluation includes the M&E activities that measure the performance of IRS, particularly those relating to monitoring coverage levels, spray quality assessment, and mosquito susceptibility levels.
Technical assistance to support entomologic monitoring for IRS	CDC IAA	$29,000	$0	National	Provide technical assistance and quality assurance, through two visits by a CDC entomologist, for ongoing entomologic monitoring of the PMI-funded IRS program.
	Subtotal: IRS	**$4,843,500**	**$1,588,785**		

SUBTOTAL: VECTOR MONITORING & CONTROL	**$11,981,000**	**$6,890,785**		

Malaria in Pregnancy					
Strengthen provision of malaria prevention tools through ANC clinics	Systems for Health	$550,000	$0	5 USAID focus regions	Support ANC clinics at health centers and, where available, at CHPS compounds to effectively deliver a package of malaria prevention services to pregnant women. PMI support will focus on supportive supervision, on-site training as needed, quality improvement to increase provision of IPTp at every ANC visit, in accordance with national guidelines. Ensure distribution of an ITN to every pregnant woman at first ANC visit.
	Subtotal: MIP	**$550,000**	**$0**		
SUBTOTAL PREVENTIVE ACTIVITES:		**$12,531,000**	**$6,890,785**		
CASE MANAGEMENT					
Diagnosis and Treatment					
Procurement of RDTs	GHSC-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	GHSC-PSM	$2,000,000	$2,000,000	National	Procure approximately 2 million ACTs, to meet the estimated infant, toddler and adolescent treatments (estimated at 40% of total annual ACT needs) for 2018.
Procurement of severe malaria treatment	GHSC-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 200mg/1ml), which is 100% of the annual need.
Strengthen the quality of malaria microscopy capacity of lab supervisors	TBD – Case management	$100,000	$0	National	Provide technical support to successfully conduct quarterly malaria diagnostic refresher training nationwide.
	TBD (G2G GHS/CLU)	$300,000	$0	National	Conduct quarterly national malaria diagnostic refresher training and laboratory OTSS to support continued quality improvements to malaria microscopy and RDT use and scale up, including improvement of coordination between laboratory staff and prescribers.

Strengthen the community-based management of fever via CHPS compounds	Systems for Health	$600,000	$0	5 USAID focus regions	Support in-service training of community health nurses to improve integrated management of childhood illness (IMCI) to strengthen community-based management of fever; support supportive supervision of community health volunteers by community health nurses; support referral system to CHPS compounds, health center, and district hospitals.
Strengthen the provision and quality of malaria case management at health facilities	Systems for Health	$850,000	$0	5 USAID focus regions	Support in-service training of health facility staff on malaria case management; Engage the regional health management team and regional OTSS teams to conduct quarterly clinical OTSS visits at district hospitals to improve malaria case management; support district health management teams and district OTSS teams to conduct quarterly clinical OTSS at health centers and CHPS compounds; conduct quarterly data coaching for district health information officers.
Provide technical assistance to support GHS and NMCP	TBD – Case management	$250,000	$0	National	At the national level, provide critical national-level technical assistance to the GHS and the NMCP to strengthen national oversight of malaria case management, including activities such as: support for case management technical workings groups, revision of guidelines (as needed)
		$650,000	$0	5 non-USAID focus regions	In the five non-USAID focus regions, support the regional health management teams to strengthen capacity of facilities to provide high quality malaria case management. This support will be provided through malaria-focused quarterly clinical OTSS visits and data coaching. Support national-level case management work with GHS and NMCP.
Provide technical assistance to improve malaria case management at the national and regional levels	TBD (G2G ICD)	$300,000	$0	National	Support GHS Institutional Care Division to provide oversight for regional clinical OTSS; support regional OTSS teams with improved management, leadership, data management, and supervision; facilitate regional-level planning to ensure that malaria activities are properly documented and captured.
Support pre-service training for health care workers and physicians to improve malaria case management capacity	MCSP	$400,000	$0	National	Support pre-service training and skills lab-based practical application of training for general nurses, midwives, and medical assistants to improve competencies in knowledge, skills, and practices for malaria diagnosis and case management and malaria in pregnancy, in compliance with GHS guidelines and protocols.

Strengthen the malaria case management capacity of OTCMS and pharmacies	SHOPS (Bilateral Associate Award)	$300,000	$0	National	Support activities to build the capacity of licensed over the counter medicine sellers (OTCMS) and pharmacists to comply with GHS malaria diagnosis, treatment, and referral guidelines. Address issues related to for-profit, business motivations to comply with GHS guidelines.
Support NHIA to implement clinical audits	G2G NHIA - Clinical	$325,000	$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.
Technical assistance for diagnostics	CDC IAA	$10,000	$0	National	Provide technical assistance for lab OTSS, proficiency testing, microscopy quality assurance, and RDT proficiency and scale-up.
Subtotal: Diagnosis and Treatment		**$8,634,000**	**$4,549,000**		
Pharmaceutical Management					
Support national and regional supply chain system strengthening	GHSC-PSM	$1,200,000	$0	National	Provide technical assistance for strengthening logistics, warehousing, and distribution to improve availability of malaria commodities, in accordance with the national Supply Chain Master Plan and interim working group. Activities will focus on addressing weaknesses in supply management, forecasting, transportation and reporting systems. Support quarterly end user verification surveys to monitor the status of facility-level commodity stock levels and identify ongoing programmatic successes and challenges.
Strengthen the district-level supply chain system	Systems for Health	$550,000	$0	5 USAID focus regions	Strengthen the overall supply chain management capacity nationally and down to the district and facility levels within the five priority regions, including support of scheduled delivery to certain regions. Facilities in the districts will receive supportive supervision on supply chain management which will focus on ensuring the use of logistics records (stock cards, logistic management information system), commodity management training integrated into capacity building activities and assessing the storage conditions. Continuous on-the-job training will be provided and action plans will be developed to improve supply chain management.

Strengthen drug quality monitoring capacity	USP-PQM	$150,000	$0	National	Provide support for the strengthening of a country-owned sustainable anti-malaria drug quality monitoring with the GH-FDA. Support to GH-FDA for increased enforcement capacity and education to heighten responsiveness to counterfeit and substandard medicines will continue.
Subtotal: Pharmaceutical Management		**$1,900,000**	**$0**		
SUBTOTAL: CASE MANAGEMENT		**$10,534,000**	**$4,549,000**		
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	TBD (vice HFG)	$300,000	$0	National	Support NHIA to increase efficiency and sustainability to improve access to health services in general and quality malaria treatment by: a) providing technical assistance to facilitate a successful scale-up of a primary health care capitated package of services ; b) ensuring the continued sustainability of the NHIS; c) improving use of claims data and analytics to provide routine information on malaria service utilization and quality; d) identifying factors that drive the variability in malaria treatments costs across providers; and e) supporting the Presidential Commission on the Technical Review of the NHIS.

Support targeted communication efforts related to NHIA capitation rollout	G2G NHIA Communications	$350,000	$0	Sub-national	Continue to support targeted communication activities at both the provider and patient levels to facilitate NHIA capitation roll-out. Promote an increase in patient enrollment in NHIS and inform the public about how to access NHIS-accredited facilities. Activities will also include developing communication materials including print, radio and television messaging; procuring radio, air and TV time and local community engagement activities to promote active enrollment in NHIS and access to NHIS-accredited facilities among the general population, with a focus on high burden rural areas.
Strengthen the role of civil society in malaria advocacy	People for Health	$300,000	$0	Sub-national	Build the capacity of local 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. Empower civil society organizations to engage citizens to demand and participate in health service delivery and advocate for their interest. Activity will also strengthen the health sector monitoring of government institutions, officials and policy processes.
Support Peace Corps Malaria Program	Peace Corps SPA	$30,000	$0	National	Support two third-year Peace Corps Volunteers through the "Stomping out Malaria in Africa" initiative. All Peace Corps Volunteers based in Ghana will also be able to apply for small grants from PMI to engage in malaria control and prevention activities such as community mobilization for BCC, ITN distribution
Support 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		**$1,200,000**	**$0**		

SOCIAL AND BEHAVIOR CHANGE COMMUNICATION					
Support mass media communication efforts to promote ITN ownership and use, IPTp uptake, and improved care seeking behavior	Communicate for Health	$650,000	$0	National	Provide national-level mass media communication efforts to disseminate core malaria messages via television, radio and through key events (e.g. World Malaria Day and the 2018 ITN mass distribution campaign). Support includes: a) Determine barriers to and facilitators of ITN use, care seeking, and uptake of IPTp and adherence to national IPTp guidelines to inform SBCC activities; b) Continue support for the "Good Life. Live it Well." campaign; c) Strengthen the capacity of the GHS HPD to increase its institutional capacity to design, implement, and evaluate malaria-specific SBCC activities; d) 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; e) Produce malaria-specific communication materials that will be used and disseminated through other PMI-funded SBCC activities; and, f) Work with the NMCP and Ghana Statistical Service to ensure indicators continue to be included in future national household surveys.
Support correct and consistent use of ITNs through school-based communication and education program	VectorWorks	$300,000	$0	National	Build on the existing school-based interpersonal communication outreach program to promote increased malaria prevention awareness and to promote correct ITN use and correct care practices, as the mass ITN campaign is conducted. This activity will be timed to correspond with the 2018 national mass distribution efforts so that at the community level, there will be an a) increased awareness of the campaign (timing, registration plans, etc.); b) promotion of correct and consistent use of ITNs and ITN care, and c) increased mobilization of the community to participate in the mass campaign activities. Nationwide, teachers, students, parents and community leaders will be engaged through this activity.

Implement facility-based and community-based interpersonal communication activities	Systems for Health	$550,000	$0	5 USAID focus regions	Operating as PMI/Ghana's principle interpersonal communication activity, this work will include supporting facility-based and community-based IPC activities to promote correct and consistent uptake of both preventative and curative malaria interventions. It will also include working with community health nurses and community health workers to improve their skills to engage with communities and promote malaria-related preventive and health seeking behaviors. This activity will also improve health care workers' adherence to national malaria case management and IPTp guidelines and strengthen the capacity of health workers to effectively communicate key preventative and curative malaria messages to patients.
	SUBTOTAL: BCC	**$1,500,000**	**$0**		
MONITORING AND EVALUATION					
Strengthen and support routine M&E systems at peripheral levels	Systems for Health	$645,000	$0	5 USAID focus regions	Support GHS/NMCP to strengthen routine systems at the health facility and district levels for malaria M&E in the Northern, Volta, Greater Accra, Central, and Western Regions. Strengthening activities in each of the five regions will include: providing integrated data coaching visits for 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 meetings to routinely assess and discuss malaria data – these meetings will reinforce ownership, use and feedback of the data; integrated supported supervision by GHS in 109 districts to improve collection and reporting of data from the health facility up to the district level; and limited computer hardware and software to fill gaps.

Provide M&E technical assistance for malaria-specific activities	Evaluate for Health, Task Order 1	$95,000	$0	National	Provide national-level, malaria-specific M&E advisor to support the NMCP to: a) ensure coordination among all PMI-funded partners engaging in malaria-specific M&E activities; b) provide direct malaria-specific technical assistance to the NMCP; c) actively participate on the national malaria M&E technical working group; d) operate as a malaria liaison for the health – sector wide M&E collaborations; and e) conduct malaria specific data analyses as requested.
Provide M&E technical assistance	CDC IAA	$10,000	$0	National	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.
SUBTOTAL M&E		**$750,000**	**$0**		
OPERATIONS RESEARCH					
N/A		$0			
SUBTOTAL OR		**$0**	**$0**		
IN-COUNTRY STAFFING AND ADMINISTRATION					
In-country staff and administrative expenses	USAID/Ghana	$885,000	$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.
	CDC IAA	$600,000	$0	National	
SUBTOTAL: IN-COUNTRY STAFFING		**$1,485,000**	**$0**		
GRAND TOTAL		**$28,000,000**	**$11,439,785**		