

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



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PRESIDENT'S MALARIA INITIATIVE

MALI

Malaria Operational Plan FY 2018

TABLE OF CONTENTS

ABBREVIATIONS and ACRONYMS	3
I. EXECUTIVE SUMMARY	4
II. STRATEGY	9
1. Introduction	9
2. Malaria situation in Mali	10
3. Country health system delivery structure and Ministry of Health (MoH) organization.....	11
4. National malaria control strategy	13
5. Updates in the strategy section	15
6. Integration, collaboration, and coordination.....	15
7. PMI goal, objectives, strategic areas, and key indicators	17
8. Progress on coverage/impact indicators to date.....	18
9. Other relevant evidence on progress	20
III. OPERATIONAL PLAN	21
1. Vector monitoring and control	21
2. Malaria in pregnancy	31
3. Case management	34
4. Health system strengthening and capacity building	45
5. Social and behavior change communication	47
6. Surveillance, monitoring, and evaluation	50
7. Operational research.....	53
8. Staffing and administration	56
Table 1: Budget Breakdown by Mechanism	58
Table 2: Budget Breakdown by Activity	59

ABBREVIATIONS and ACRONYMS

ACT	Artemisinin-based combination therapy
AL	Artemether-lumefantrine
ANC	Antenatal care
AS/AQ	Artesunate-amodiaquine
ASC	<i>Agent de Santé Communautaire</i> (community health worker)
CDC	Centers for Disease Control and Prevention
CSCOM	<i>Centre de Santé Communautaire</i> (community health center)
CSREF	<i>Centre de Santé de Référence</i> (referral health center)
DHIS2	District Health Information System 2
DHS	Demographic and Health Survey
DHSP	Division of Public Health, MoH
FELTP	Field Epidemiology and Laboratory Training Program
FY	Fiscal year
GHSA	Global Health Security Agenda
Global Fund	Global Fund to Fight AIDS, Tuberculosis, and Malaria
GoM	Government of Mali
GPIRM	Global Plan for Insecticide Resistance Management
iCCM	Integrated community case management
IEC	Information, education, communication
IPTp	Intermittent preventive treatment for pregnant women
IRS	Indoor residual spraying
ITN	Insecticide-treated mosquito net
LBMA	Laboratory for Bio-molecular Analysis, University of Bamako
MIP	Malaria in pregnancy
MIS	Malaria indicator survey
MoH	Ministry of Health
MOP	Malaria Operational Plan
MRTC	Malaria Research and Training Center
NGenIRS	Next Generational Indoor Residual Spraying
NMCP	National Malaria Control Program
OSPSANTE	<i>Outil de Suivi des Produits de la Santé</i> (health commodity data platform)
PPM	<i>Pharmacie populaire du Mali</i> (people's pharmacy of Mali)
PPMRm	Procurement planning and monitoring report for malaria
PMI	President's Malaria Initiative
RBM	Roll Back Malaria
RDT	Rapid diagnostic test
SBCC	Social and behavior change communication
SLIS	<i>Système Local d'Information Sanitaire</i> (local health information system)
SM&E	Surveillance, monitoring, and evaluation
SP	Sulfadoxine-pyrimethamine
SP/AQ	Sulfadoxine-pyrimethamine/amodiaquine
UNICEF	United Nations Children's Fund
UNITAID	An EU-based NGO financed by a levy on airline tickets
USAID	United States Agency for International Development
WHO	World Health Organization
WHOPES	World Health Organization Pesticide Evaluation Scheme

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 Roll Back Malaria (RBM) Partnership's second generation global malaria action plan, *Action and Investment to defeat Malaria (AIM) 2016-2030: for a Malaria-Free World* and the World Health Organization's (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.

Mali began implementation as a PMI focus country in fiscal year (FY) 2007.

This FY 2018 Malaria Operational Plan presents a detailed implementation plan for Mali, 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 Mali, describes progress to date, identifies challenges and unmet needs to achieving the targets of the NMCP and PMI, and provides a description of activities that are planned with FY 2018 funding.

The proposed FY 2018 PMI budget for Mali is \$22 million. PMI will support the following intervention areas with these funds:

Entomologic monitoring and insecticide resistance management:

The main objective of the NMCP is to conduct quality entomological monitoring to manage the development of resistance and inform program planning. PMI supports strengthening the MoH's capacity to plan and supervise entomological monitoring activities within the context of its integrated vector management strategy, including insecticide monitoring, insecticide resistance testing, and overall implementation of the entomological monitoring plan.

The results of Mali's entomological monitoring activities have led to rapid changes in the class of insecticide used for IRS activities. From 2008-2013, pyrethroids and later carbamates were used for spraying. As the entomological monitoring data showed failure of carbamates, they were replaced in 2014 with organophosphates. Mali will continue to conduct entomological surveillance in IRS sites and in all the national surveillance sites with FY 2018 funds.

Insecticide-treated nets (ITNs):

Mali's 2013-2017 Malaria Strategic Plan promotes universal ITN coverage for all age groups (defined as one ITN for every two people). The MoH supports the provision of free ITNs distributed to target populations through two main delivery channels: mass distribution to households as part of universal coverage campaigns and routine distribution through antenatal care (ANC) and Expanded Program for Immunization clinics targeting pregnant women and infants. The NMCP has recently made significant progress toward achieving its initial goal of 80% use of ITNs among children under five and pregnant women. According to the 2015 Malaria Indicator Survey (MIS) conducted during the peak transmission season, 93% of households owned an ITN and 71% of children under five years of age and 78% of pregnant women slept under an ITN the previous night.

In 2016, PMI supported the mass campaign in the region of Gao, Tombouctou. Around 1.029 million nets were procured and distributed. PMI contributed 829,000 and the government of Mali (GoM) 200,000 ITNs. The European Union supported distribution costs for 829,000 nets which were used in Gao, Tombouctou. In Kidal Region, the GoM supported the cost of procurement and distribution of 200,000 nets.

With FY 2016 funds, PMI procured 1.25 million nets that arrived in April 2017. These nets are intended for distribution to pregnant women and infants via routine channels in 2017. As per the approved concept note, the Global Fund will fully support the 2017 mass campaign in Kayes and Mopti, procuring and distributing 3.2 million ITNs to replace those distributed in 2013 and 2014, and procuring an additional 500,000 ITNs to contribute to the campaign planned for Koulikoro in 2018.

With FY 2018 funding, PMI will procure 1.4 million nets that will be used for routine distribution to children and pregnant women in 2019. It is anticipated that the Global Fund will procure the needed nets for the mass campaigns to replace nets distributed in 2014 and 2015. PMI will continue to support social and behavior change communication (SBCC) to maintain or increase the level of net use and educate people on net maintenance.

Indoor residual spraying (IRS):

PMI supports the NMCP's strategy to reduce malaria transmission through targeted IRS in select high-risk areas. Starting in 2008, PMI supported three IRS campaigns in the districts of Bla and Koulikoro, adding a third district (Baraoueli) in 2011. In FY 2015, PMI reduced the IRS sites to two districts because of the added cost of moving to a new class of insecticides (organophosphates). In 2016, Mali benefited from the UNITAID-funded Next Generation Indoor Residual Spraying (NGenIRS) project, which includes a short-term co-payment on long-lasting IRS insecticides. This allowed Mali to expand

geographic coverage of IRS back to three districts, targeting 242,684 structures and 778,884 people in total. In 2017, the IRS program will move to four districts in the Mopti Region in order to combat the persistently high level of transmission in the area. Support in 2017 included initial and refresher training of supervisors and spray operators as well as community health volunteers (*relais*); purchase of all commodities and personal protective equipment; and communication, supervision, monitoring, and environmental compliance activities. Mali will continue to support the Mopti Region with FY 2018 funds targeting the maximum number of households possible within the reduced budget envelope.

Malaria in pregnancy (MIP):

Mali's MIP strategy is based on WHO's three-armed strategy, which includes distribution of ITNs to all pregnant women via ANC, the promotion and delivery of at least three doses of sulfadoxine-pyrimethamine (SP) for IPTp, and strengthening malaria case management for pregnant women. Thanks to relatively high rates of ANC utilization (74% had one or more ANC visits, Demographic and Health Survey [DHS] 2012), the proportion of pregnant women receiving two or more doses of SP during routine antenatal care visits continues to increase (38% according to the MIS 2015 survey; an increase from 29% in DHS 2012). However, only 18% of women with a live birth in the last two years received three or more doses (MIS 2015). PMI continues to support the national strategy to achieve universal coverage of at least three doses of SP for IPTp. To this end, FY 2018 funds will support the procurement of an adequate supply of SP and ITNs to cover all eligible pregnant women; training for clinical staff on the importance of and delivery of IPTp, and; SBCC to raise awareness and build demand for IPTp-SP among pregnant women.

Case management:

Mali has scaled up access to diagnosis and treatment over the past decade by expanding access to rapid diagnostic tests (RDTs) and ACTs in the public health system, and by extending services through community case management. In 2010, due to advocacy efforts of PMI and other partners, the MoH adopted significant policy changes including a community case management policy and updated severe malaria treatment and pre-referral guidelines. As a result, according to Mali's routine health information system, 93% of all suspected malaria cases were tested by microscopy or RDT in 2016, a significant improvement from 18% in 2010. PMI continued its support of the integrated community case management strategy in 2016 in four out of ten regions and Bamako District. This support included training and deploying community health workers (*Agents de Santé Communautaire*), procuring RDTs and ACTs for community-based diagnosis and treatment, and ensuring sufficient supplies of RDTs and ACTs for children under five years of age in health facilities. PMI has also procured drugs for the management of severe malaria as well as supported in-service training and supportive supervision of health workers and community health workers.

In the 2013-2017 Malaria Strategic Plan, Mali introduced seasonal malaria chemoprevention (SMC) in selected districts targeting all children under five with four monthly rounds of a preventive treatment with SP and amodiaquine. In 2014, 21 of Mali's 64 districts were covered with SMC, including one in which PMI conducted an OR study to collect data on the feasibility and effectiveness of SMC under routine programmatic conditions. Due to a three-year grant from UNITAID, SMC was implemented in 42 districts during 2015 and, with new funding from the World Bank, the Global Fund, and PMI during the 2016 transmission seasons, SMC was scaled up nationwide. PMI will support the implementation in 12 districts in the focus regions of Kayes, Koulikoro, and Sikasso.

With FY 2018 funding, PMI will continue to support and strengthen efforts to ensure prompt and effective case management of malaria at health facilities and support the scale-up of the integrated

community case management policy nationwide. At the health facility level, PMI will concentrate on strengthening capacity in laboratory diagnostics (including quality assurance and quality control), and supply chain management. PMI will procure 3.5 million RDTs and 1 million ACTs to contribute to filling gaps in annual malaria commodity needs for health facilities, integrated community case management, and SMC sites. PMI will strengthen quality assurance/quality control systems at national and district levels for accurate malaria diagnosis, and will support the NMCP to monitor and reinforce the correct use of ACTs at health facilities and in communities.

Health systems strengthening and capacity building:

Since its first year, PMI has contributed substantially to building capacity of the NMCP and other GoM entities. This support has allowed the government's partners to improve training, supervision, and quality assurance and quality control for diagnostics; to oversee implementation of SBCC activities related to malaria; and to improve partner coordination. With the *coup* in 2012, PMI suspended direct funding for NMCP capacity-building efforts and focused on strengthening the health system at the community level. In 2013, the restrictions were lifted but direct funding to the NMCP is capped. With FY 2018 funding, PMI will support capacity building of the NMCP through training, supervision, and provision of computers and other work-related equipment. Collaboration will continue with other partners to support the NMCP and staff, specifically to increase capacity at all levels for program management, including training, supervision, and facilitating forecasting and quantification for malaria commodities and training in logistic management information systems.

Social and behavior change communication (SBCC):

SBCC interventions in Mali are currently guided by the PMI-supported 2014-2018 SBCC strategy. This strategy encourages partners to focus malaria prevention, treatment and control messages to key populations, including pregnant women and children under five; other family members (e.g., fathers) and caretakers of children; community health workers, and *relais* (community health volunteers). The national strategy supports multiple delivery channels for messages, including mass media and interpersonal communications, however, the majority of SBCC activities supported by PMI focus on interpersonal approaches. In FY 2016, PMI continued to contribute malaria funding to a Mission-managed bilateral agreement that promotes SBCC across the entire health portfolio. PMI support has contributed to the implementation and development and distribution of 300 job aids for healthcare workers and supply chain managers, communication aids for parents; SMC training for nearly 539 community leaders in 10 health districts; and mobilization of 2,446 town criers in 10 districts to convey SMC messages. PMI funding contributed to the development of radio messages to encourage pregnant women to attend ANC early. In addition 3,000 MIP job aids will be printed and distributed nationwide with support from PMI and the Global Fund. PMI supported IPTp by funding radio and TV spots, and posters were designed and broadcast.

PMI will support this integrated approach again with FY 2018 resources. SBCC activities will continue to focus on the promotion of prompt diagnosis and treatment; the correct and consistent use of long-lasting ITNs, especially by vulnerable groups; and the mobilization of pregnant women and a cross-section of healthcare providers (e.g., clinicians, community health workers, traditional healers, midwives) to promote IPTp. Lastly, PMI will continue to support coordination and harmonization among implementing partners, the Malian Ministry of Health, and other donors (e.g., the Global Fund, the World Bank) to ensure that SBCC messages and interventions are based on the national strategy and on current evidence and best practices.

Surveillance, monitoring, and evaluation (SM&E):

The NMCP, with support from PMI and other partners, has developed a comprehensive national malaria monitoring and evaluation plan for 2013-2017, including capacity building, improvement of data collection, and provision of equipment to collect and analyze data. The quality of routine data collection, analysis, and reporting through the health information system is variable and feedback is not delivered in a timely manner for program management.

In FY 2015-16, PMI expanded its work to support the national health information system to strengthen the SLIS (*Système Local d'Information Sanitaire*) through training and supervision, with a focus on the community health center level (*Centres de Santé Communautaire*). Activities focused on broadening the reach of the system to include new health districts, including those districts that implement SMC and IRS, and will expand the use of SMS technology to transfer data. PMI also supported local and regional health system staff to report and utilize surveillance data for epidemic detection and to respond to epidemics in Mopti and the Northern Regions. In late 2015, PMI supported an MIS to collect data on coverage and impact of malaria interventions (data provided in the Strategy Section below). In 2017, the nationwide rollout of the District Health Information System 2 (DHIS2) will be complete and will be reporting back data from every health facility. PMI will continue to support malaria components of the system, and to provide technical assistance to the NMCP to use the data for analysis and decision-making.

Operational research (OR):

Since 2008, OR has been conducted in Mali to answer specific questions regarding the implementation and effectiveness of critical malaria interventions. PMI has funded various studies such as: an evaluation of the expanded program on immunization to monitor bednet usage and treatment of childhood illnesses; the entomological impact of combining larviciding with IRS; and a cost analysis of removing user fees for children under five. With FY 2014 and FY 2015 funds, PMI supported two OR activities: (1) a study to evaluate the impact of ITNs treated with two insecticides to inform PMI about the potential ability of this new ITN variety to affect malaria transmission in areas with high pyrethroid resistance; and (2) an evaluation of the SMC intervention to determine its relative usefulness as part of the malaria control strategy in Mali. Using FY 2016 funding, PMI will evaluate an enhanced intervention package to improve uptake of IPTp. The plans with FY 2017 and FY 2018 funding will again focus on SMC and the potential added benefits of extending SMC services to children up to the age of ten.

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.

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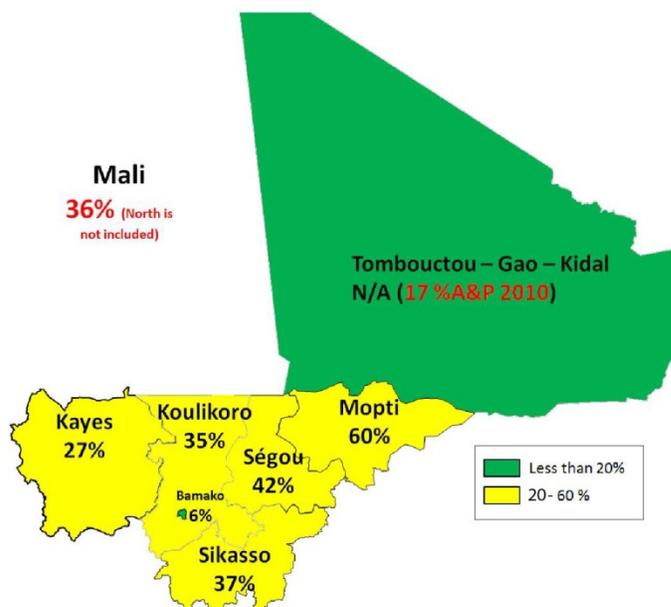
2. Malaria situation in Mali

Malaria is the primary cause of morbidity and mortality in Mali, particularly for children less than five years old. In 2015, the national health information system (*Système Local d'Information Sanitaire* or [SLIS]) reported 2.37 million clinical cases of malaria in health facilities, accounting for 34% of all outpatient visits for all age groups. A total of 1,978 fatal malaria cases were reported. However, SLIS data should be viewed with caution due to their variable quality. According to the 2015 Malaria Indicator Survey (MIS), the prevalence of malaria among children under five years of age was 36% based on microscopy and 32% based on rapid diagnostic tests (RDTs).

Data from the recent MIS 2015 indicates that *Plasmodium falciparum* accounts for 95% of all malaria infections, while *P. malariae*, *P. vivax* and *P. ovale* together account for 5.2%. A 2004 study conducted by the Malaria Research and Training Center (MRTC) in Menaka, an epidemic-prone region in the north, indicated a prevalence of *P. vivax* of 8%, which was confirmed by polymerase chain reaction.

Malaria is endemic to the central and southern regions, where about 90% of Mali's population lives and it is epidemic in the north due to the limited viability of *Anopheles* species in the desert climate. Malaria transmission varies in Mali's five geo-climatic zones. It occurs year-round in the Sudano-Guinean zone in the south, with a seasonal peak between June and November. The transmission season is shorter in the northern Sahelian zone, lasting approximately three to four months (July/August to October). Malaria transmission is endemic in the Niger River Delta and areas around dams with rice cultivation, and is endemic with low transmission in urban areas including Bamako and Mopti. Epidemics occur in the north (Gao, Kidal, and Tombouctou Regions) and in the northern districts of Kayes, Koulikoro, Mopti, and Ségou Regions; recently, there was a recrudescence of malaria cases in Kidal, Northern Mali in October, 2015.

Figure 1. Under-five malaria prevalence with microscopy (MIS 2015)



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

At the national level, Mali's MoH is composed of the cabinet of the Minister of Health and National Directorates reporting directly to the Secretary General of the MoH. The NMCP was established in 1993 under the oversight of the Disease Control Division of the National Health Directorate. In July 2007, the Government of Mali (GoM) elevated the NMCP to a directorate level in the MoH organizational structure. The NMCP is composed of four technical divisions and one administrative and finance division, and the director reports directly to the secretary general of the MoH. Due to its higher profile in the MoH, the NMCP can participate in and influence decision-making about malaria control more effectively, including development of MoH work plans and budgets.

In January 2016, the GoM created two new regions in the north to accompany the peace agreement process and the national reconciliation that was signed in Algeria. Thus the country is divided into ten administrative regions (previously eight) (Gao, Kayes, Kidal, Koulikoro, Menaka Mopti, Sikasso, Ségou, Taoudeni, and Tombouctou) plus the capital, Bamako. Each region represents a regional health directorate except for the new regions. Following the creation of the new regions, eight new "*cercles*" have been created bringing the total to 58 administrative "*cercles*." The regions are made up of 59 health districts, and Bamako is divided into six administrative communes that correspond to six health districts; thus the country has a total of 65 health districts. Governance is decentralized into 703 communes (19 urban and 684 rural), each one administered by an elected local council headed by a mayor. The organization of the health system is based upon the principles of decentralization of health services and community participation to extend health service coverage and to ensure access to essential and effective medicines. PMI supports the NMCP's national strategy, but its support for the regions of the north (including the two new regions) is limited to supplying necessary commodities due to insecurity in that area of the country.

The health delivery system is composed of three levels:

- The local level with 65 referral health centers (*Centres de Santé de Référence* [CSREF]) constitutes the first reference level
- The intermediate level with eight regional hospitals (Gao, Kayes, Kati, Mopti, Sikasso, Ségou, and Tombouctou, and the maternal and child hospital of Bamako) constitutes the second reference level
- The central level with five national reference hospitals constitutes the third reference level

As of December 2015, a total of 1,204 functional community health centers (*Centres de Santé Communautaire* [CSCOM]) as well as parastatal, faith-based, military, and other private health centers, make up the community health services level. The CSCOMs are established and managed by community health associations.

The MoH has a critical staff shortage at all levels of the public health system, especially for service provision below the national level. In addition, health workers are not distributed proportionally to population throughout the country. In 2014, the national ratio of doctors to the population was 1/8,528, (WHO recommends 1/10,000) but rural regions have less than one doctor for every 24,000 inhabitants. Regional directors oversee health teams that implement integrated health interventions; currently all regional teams have malaria focal persons. The CSREF (at the district level) is the first referral structure for CSCOMs; the district health team is headed by a medical chief responsible for technical supervision of CSCOMs and has a malaria focal person as well. The community health associations manage CSCOM staff and operations; collect proceeds from drug sales, consultations, and user fees; and pay

salaries and other expenses. As is the case at the central level, distribution of staff is uneven. Since 2009, the percentage of CSCOMs headed by a certified head nurse was close to the WHO norms and ranged from 100% in five regions to 95% in Kayes. According to the strategic plan for health and social development (2014-2023), in 2014, 32% of CSCOMs were headed by a medical doctor. The number of staff employed depends on the level of community resources to pay them (SLIS 2014). In 2011, the MoH started the “medicalization” of CSCOMs, meaning the appointment of qualified medical doctors in CSCOMs.

In 2010, Mali approved an integrated community case management (iCCM) package offered by community health workers (*Agents de Santé Communautaires* [ASCs]) to provide health services at the village and household levels. The ASCs, who receive a financial incentive or salaries from the local government and different partners for their services, provide free treatment for uncomplicated malaria and malnutrition, with payment for treatment of acute respiratory infections and diarrhea. The ASCs also provide primary care to newborns and some family planning methods for eligible families. Based on national iCCM directives, the iCCM package and ASC model has been introduced in villages located 5 km or more from a health facility and covers 2-3 villages in a radius of 3 km with a catchment area of approximately 1,500 people. This iCCM approach and ASC efforts are supported by an additional cadre of community health volunteers, the *relais*, whose role is to carry out social and behavior change communication activities (SBCC) and health education to promote key health messages to complement iCCM activities. Support for the GoM scale-up plan for nationwide implementation of the iCCM package including supervision, commodity management, RDT confirmation, and quality assurance/quality control (QA/QC) were incorporated into the Global Fund consolidated grant. As of March 2016, a total of 2,377 ASCs had been trained and are fully functional; an estimated 4,876 ASCs are needed to achieve full coverage of iCCM activities. The iCCM *ad hoc* group has developed a plan where each donor partner indicated the number of ASCs to be supported by the partner and in which geographic area – USAID is supporting the implementation of iCCM in the regions of Kayes (275 ASC sites), Koulikoro (576 ASC sites), Sikasso (686 ASC sites) and support to Gao started in 2016 (64 ASC sites).

Mali has a strong cost recovery system that is based on the Bamako Initiative. At the district level, communities can establish CSCOMs based on the following criteria: the establishment of a community health association; raising a minimum of 10% of the cost of construction or renovation of the health facility; and the hiring and support of health personnel. All CSCOMs are required to deliver the national minimum package of services comprising curative, preventive, and promotional health activities. Once authorized by the district medical officer, the MoH provides an initial stock of medicines, consumables, and equipment. In principle, communes are expected to allocate 15% of their budget for social services including water, education, and health.

CSCOMs have three forms of revenue generation that are managed by the community health association: membership fees, sales of essential drugs, and fees for services. Service fees vary by health area and are set by the community health association (“*Association de Santé Communautaire*” - ASACO) after consultation with the population. Membership fees allow for reduced service charges at some CSCOMs. Funds derived from the sale of medications are kept in a separate account to prevent providers from overprescribing to generate revenue and to prevent decapitalization of pharmacy stock. The community health association management committee purchases replacement drugs for the CSCOM through the national pharmacy system or from approved private sector companies based on availability. Selected drugs (e.g., antimalarials for children under five and pregnant women, vitamin A, and immunization services) are provided free by the government or donors. The CSCOMs must finance the transportation of their drugs from CSREFs. However, due to small profit margins and the loss of or

use of revenues for non-pharmaceutical purposes, CSCOM drug stores often lack available funds to cover these costs.

National financial planning for malaria and health/social development

The NMCP receives annual budget support from the National Health and Social Development Program. Its Evaluation Committee manages and approves the annual operating budget plan. Several partners (including the governments of the Netherlands, Sweden, and Canada) provide direct budget support on an annual basis. Other donors, including the U.S. Government, target their funding to sub-sectors and specific programs. The GoM contributes mostly to salaries, office space, and other operating costs in the program's annual budget, but also procures malaria commodities such as ACTs, RDTs, severe malaria drugs, SMC drugs, and ITNs. The GoM, local governments, community health associations, and other donor partners, such as the Global Alliance for Vaccines and Immunizations (GAVI) are supporting the salaries of CSCOM staff, including qualified medical doctors. While the GoM increased its annual investment in malaria control from about \$1 million in FY 2007 to \$6.7 million in FY 2008 and \$9 million in FY 2009, this support decreased to approximately \$4 million in FY 2010 and \$3 million in FY 2011. The GoM budget for malaria remained \$2.5 million per year from 2012 to 2014. In 2015, the GoM invested around \$6 million (3 billion CFA) and most of these funds contributed to procure malaria commodities - mainly SMC drugs and long-lasting ITNs.

4. National malaria control strategy

The NMCP establishes strategies for all malaria interventions; coordinates research; proposes policies, norms, and guidelines; and coordinates partner work plans. The NMCP also supports decentralized regional and district health teams through training and supervision. In 2013, a five-year strategic plan (2013–2017) was developed and published by the NMCP and partners. Its goal is to “reduce the burden of malaria to a level that will not constitute a major cause of morbidity and mortality nor a barrier to economic and social development.”

The NMCP Strategic Plan aims to achieve the following targets by 2017:

- Reduce malaria mortality to near zero
- Reduce malaria morbidity by at least 75% as compared to 2000 levels
- Reinforce/strengthen the NMCP coordination and management capacity

Expected results to be achieved by the 2013-2017 strategic plan are as follows:

- At least 80% of the population at risk of malaria is using ITNs, including pregnant women and children under five years old;
- At least 80% of pregnant women have received three sulfadoxine-pyrimethamine (SP) doses as IPTp during their pregnancy;
- At least 80% of children under five received the four full courses of SMC in selected zones;
- At least 90% of suspected malaria cases are confirmed using microscopy or RDTs before treatment, at all levels of the health system including the ASC level;
- At least 90% of confirmed malaria cases receive appropriate malaria treatment both for severe and uncomplicated cases as indicated in the national guidelines;
- At least 80% of the population is protected by IRS in IRS target zones;
- At least 80% of the general population knows what interventions are recommended to prevent malaria;

- At least 90% of emergency cases and malaria epidemics are detected within two weeks and receive an appropriate response.

Due to the diversity of malaria transmission in Mali (largely endemic in the south and epidemic-prone in the north), the strategic plan emphasizes nationwide universal coverage of key malaria interventions for prevention and control of malaria, as well as specific interventions such as epidemic and entomological surveillance and targeted operational research in areas with unstable malaria transmission. Below are the main intervention areas with their strategic approach:

- Access to and use of ITNs through 1) routine distribution to pregnant women at their first antenatal care (ANC) visit and to children under one year of age at their measles vaccination visit through the expanded program on immunization, and 2) through phased mass distribution campaigns (region-by-region) defined as one net for every two persons;
- IPTp for pregnant women with SP given as directly observed treatment monthly following the first trimester to achieve three doses or more of SP during pregnancy;
- SMC using sulfadoxine-pyrimethamine/amodiaquine (SP/AQ) in children aged 3-59 months during the peak transmission period (August – November);
- IRS in targeted, high burden areas using organophosphate insecticides during the rainy season;
- Case management by diagnosing suspect malaria cases through microscopy or RDT, and treatment of confirmed positive cases using ACTs. The first-line treatment for uncomplicated malaria is artemether-lumefantrine (AL) and artesunate-amodiaquine (AS/AQ) as second-line. Injectable artesunate is used for severe malaria cases. To ensure correct case management, the GoM decided that RDTs should be free for everybody and treatment with ACTs is free for pregnant women and children under five years old at all levels of the health pyramid including the community level;
- Strengthen the sentinel surveillance systems (epidemiological and entomological) in areas with unstable malaria transmission;
- Strengthen the integrated disease surveillance system in all districts and hospitals to collect weekly malaria data for prompt decision making;
- Strengthen SBCC in order to increase the appropriate use of ITNs and promote early care-seeking for patients with fever and encourage early ANC attendance by pregnant women;
- Revitalize monitoring and evaluation (M&E) and surveillance interventions by strengthening the routine surveillance system at all levels of the health system;
- Strengthen operational research through studies and surveys on malaria;
- Revitalize and strengthen the national RBM partnership to leverage sustainable funds for malaria activities;
- Reinforce regional malaria coordination and collaboration; and
- Reinforce managerial capacity of the NMCP and coordination mechanisms at all levels of the health pyramid.

In January 2016, the NMCP, with the support from WHO, PMI, the Global Fund, and other partners, undertook a mid-term review of the 2013-2017 National Strategic Plan to evaluate progress against objectives and targets from 2013 to 2015 and to appropriately update the plan to accelerate control through 2018.

The NMCP also has National Malaria guidance (*“Politique Nationale de Lutte contre le Paludisme”*), a National Malaria Communication Plan 2014-2018, and a National Malaria Monitoring and Evaluation Plan 2013 – 2017.

5. Updates in the strategy section

- As of the 2017 spray season, the IRS program has moved to four districts in the Mopti Region of Mali. The program was moved to help bring down the continued high levels of parasitemia in the region.
- Starting in 2016, SMC was scaled up nationally and is now implemented in all regions of Mali.

6. Integration, collaboration, and coordination

Communications among malaria control partners in Mali are coordinated through the NMCP monthly partners' meetings. Malaria control is part of the national sector-wide approach, based on a strategic ten-year Plan for Social and Health Development and operationalized through the five-year National Health and Social Development Program. The plan is supported by the Financial and Technical Partners' Forum, which meets monthly to share information on ongoing programs, new initiatives, strategies, and policies; to coordinate interventions; and to help leverage resources. The NMCP is responsible for overseeing all malaria control activities conducted in Mali, but donor coordination needs to be strengthened.

Funding

Key funding and technical partners to the NCMP include PMI, the Global Fund, WHO, UNICEF, the World Bank, UNITAID, and the U.S. Government. The U.S. National Institutes of Health also supports the MRTC within the Faculty of Medicine at the University of Bamako. At the implementation level, partners include numerous non-governmental and private voluntary organizations including, the National Federation of Community Health Associations (*Fédération Nationale des Associations de Santé Communautaire*), and Doctors without Borders (*Médecins Sans Frontières*). Partner funding activities include the following:

- In 2017, UNICEF will support \$1 million worth of SMC medications, implement SMC in 10 districts, and fund iCCM in 30 health districts.
- WHO will provide technical assistance for the malaria therapeutic efficacy study.
- The World Bank will support the NMCP to implement SMC in 19 districts and procure 1 million RDTs and 2,237,400 ACTs.

The approved Global Fund Round 10 malaria grant and the Round 6 Phase 2 grant have been consolidated into one malaria grant, which was signed in May 2013. The consolidated malaria grant supported scaling up iCCM implementation, procurement of ACTs and RDTs, and support for a universal ITN coverage campaign in 2015 in Bamako. The total budget amount under this grant is approximately \$60 million for three years. In April 2015, Mali submitted a malaria concept note to the Global Fund which was approved and signed in February 2016. This grant of approximately \$70 million will cover malaria prevention interventions from January 2016 to December 2018. Activities outlined in this grant will continue the scale-up of SMC, iCCM, procurement of ACTs and RDTs, and more than 3 million ITNs will be procured and distributed to support a universal ITN coverage campaign in Mopti and Kayes Regions in 2017.

Other U.S. Government programs

Malaria prevention and control is a major foreign assistance objective of the U.S. Government. The U.S. Agency for International Development (USAID)/Mali supports a number of programs of the MoH including family planning, maternal and child health, nutrition, and water/sanitation programs. Through this diverse array of programs, USAID has contributed considerably to the strengthening of the Malian health system.

As a U.S. Government Feed the Future country, Mali is implementing a coordinated government strategy to address food security and nutrition issues. Anemia, due to iron deficiency, malaria, and helminth infections, affects over 80% of children under five nationwide and exceeds 90% in some regions (e.g., Sikasso). The GoM is committed to developing multi-sectoral programs that address access to health care to improve overall dietary intake and disease status of Malians. PMI is working in collaboration with Feed the Future and the global health programs to improve maternal and child health services and coordinate on relevant malaria and nutrition SBCC messages.

The Ebola epidemic in West Africa highlighted the urgency for immediate action to establish global capacity to prevent, detect, and rapidly respond to biological threats like Ebola. The Global Health Security Agenda (GHSA) was launched in February 2014 to advance a world safe and secure from infectious disease threats and to bring together nations from all over the world to make new, concrete commitments, and to elevate global health security as a national leaders-level priority. The U.S. Government committed to assist at least 30 countries, including Mali, over five years to strengthen the health system to prevent outbreaks, detect threats in real time, and rapidly respond to infectious diseases.

PMI and GHSA remain in constant contact in coordinating efforts towards health system strengthening. PMI/Mali has participated in GHSA planning to ensure complementary activities, and to share PMI practices, lessons learned, and strengths in prevention, detection, and response efforts. Specifically, there are currently three priority areas that PMI continues to support. The first priority is to develop a plan to incrementally strengthen capacity from national to regional to district levels on policies and strategies related to HMIS, rapid response, surveillance, and laboratory systems. The second priority is to strengthen workforce development through training cohorts of health district staff in basic and intermediate epidemiology short courses through the Field Epidemiology and Laboratory Training Program (FELTP). The third priority is to use the Hajj pilgrimage infrastructure, and expand the Ebola incident management system to implement and evaluate surveillance and laboratory capacity, and data management systems to address global health security activities related to the three selected syndromes (AHF, SARS, watery diarrhea, and dehydration). PMI is investing in HMIS and surveillance, and will continue to leverage GHSA for additional funding. PMI will also benefit from a well-trained workforce such as FELTP staff to conduct some malaria surveillance activities.

CDC Mali will use the \$20 million funds for GHSA (4 year level funding, 2016-2019) to strengthen surveillance, the Emergency Operation Center, FELTP, and laboratory services.

USAID has provided funding for health systems strengthening, immunization, HMIS, the Emergency Operation Center Zoonotic diseases, and anti-microbial resistance activities at a total cost of \$16 million (4 year level funding, 2016-2019).

Private sector partnerships

The NMCP and PMI maintain working relationships with several members of the private sector, including the Association of Employers and Business Owners (*Patronat du Mali*) and the banking sector. With the country's well-established net culture, mosquito net vendors in Mali enjoy a large market in both urban and rural areas. The NMCP has a long-established collaboration with mosquito net

vendors in Mali. To date, the NMCP, with support from PMI and the Global Fund, have provided training to private sector personnel on malaria case management using country guidelines as well as supervision to ensure that national directives related to malaria diagnosis and treatment are understood and applied. The mining industry is growing in Mali. Currently, at least five mining companies are supporting IRS activities in their employees' residence sites and neighboring villages. PMI will continue to facilitate a dialogue between the NMCP and the mining companies to ensure that they adhere to national and international IRS standards and to promote best practices.

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 (WHO) criteria for national or sub-national pre-elimination.¹

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

¹ http://whqlibdoc.who.int/publications/2007/9789241596084_eng.pdf

8. Progress on coverage/impact indicators to date

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

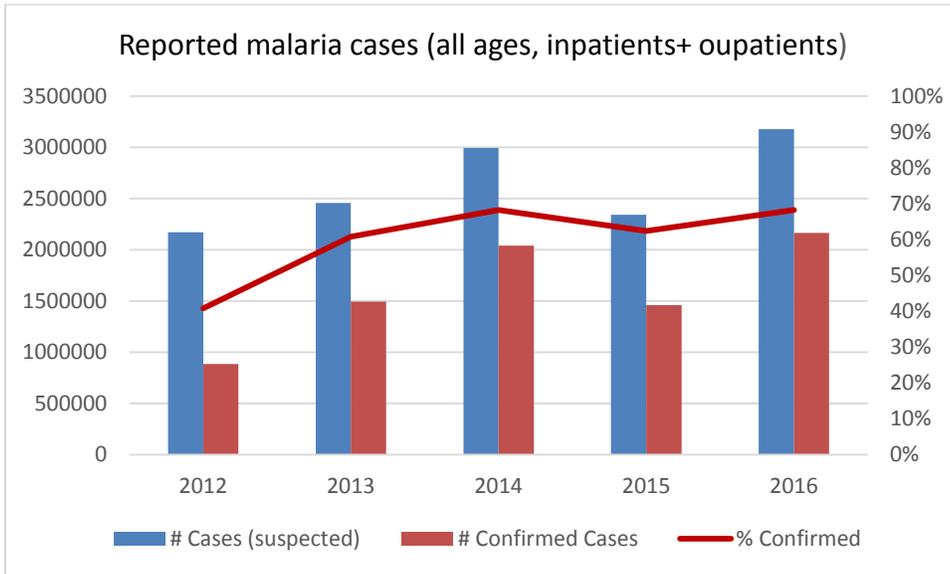
Indicator	2006 DHS	2010 AP Survey	2012-2013 DHS	2015 MIS	Other data sources
% Households with at least one ITN	50%	85%	84%	93%	N/A
% Households with at least one ITN for every two people	N/A	N/A	42%	39%	N/A
% Children under five who slept under an ITN the previous night	27%	70%	69%	71%	N/A
% Pregnant women who slept under an ITN the previous night	29%	N/A	73%	78%	55% (MICS 2010)
% Households in targeted districts protected by IRS	N/A	N/A	N/A	N/A	98% (2015 Abt EOSR)
% Children under five years old with fever in the last two weeks for whom advice or treatment was sought	N/A	8%	32%	49%	N/A
% Children under five with fever in the last two weeks who had a finger or heel stick	N/A	N/A	12%	14%	N/A
% Children receiving an ACT among children under five years old with fever in the last two weeks who received any antimalarial drugs	N/A	8%	19%	33%	N/A
% Women who received two or more doses of IPTp during their last pregnancy in the last two years	4%	N/A	20%	38%	N/A
Severe anemia (<8g/dL)	10%	26%	20%	20%	N/A
Parasite prevalence (microscopy)	N/A	38%	52%	36%	N/A
Parasite prevalence (RDT)	N/A	43%	47%	32%	N/A

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

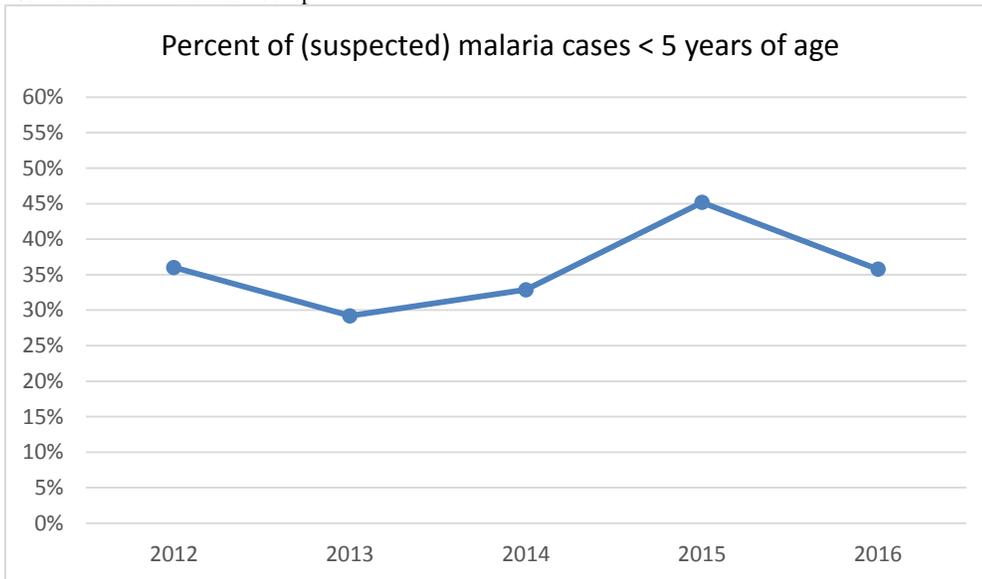
Indicator	2012	2013	2014	2015	2016
Total # cases (suspected)	2,171,739	2,455,429	2,991,746	2,341,203	3,175,776
Total # confirmed cases	886,482	1,492,348	2,039,853	1,460,917	2,165,527
Total # clinical cases	N/A	N/A	N/A	N/A	N/A
Total # <5 cases (suspected)	782,138	717,024	983,206	1,057,620	1,136,044
Total #inpatient malaria deaths (reported malaria deaths)	1,894	1,680	2,309	1,978	1,024
Data completeness* (%)	66%	N/A	76%	N/A	94.7%
Test positivity rate (TPR)	N/A	72%	76%	67%	72%

*Percentage of health facilities reporting each month

Figure 2: Trends in Key Routine Based Malaria Indicators



*% confirmed = confirmed/suspect



9. Other relevant evidence on progress

N/A

III. OPERATIONAL PLAN

PMI will support the NMCP and its key objective of reducing the burden of malaria by filling commodity gaps and ensuring the availability of ITNs, RDTs, ACTs, and SP at the local level and bolstering the supply chain system to avoid future stockouts. PMI will continue to support the implementation of IRS in three districts and iCCM and SMC in USAID/Mali's four intervention regions (Kayes, Koulikoro, Sikasso, and the district of Bamako). PMI funds will be used to update and develop skills in diagnostics and case management among providers, principally at the community levels, but also throughout the health system. The overall health system will be strengthened through improved approaches to monitoring and evaluation, including enhancements to the routine HMIS and training of health care providers and managers on use of data for decision-making. Operational research activities will be undertaken to fine tune program implementation for the Malian context. Finally, all the service provision improvements will be supported through a strong SBCC program to improve knowledge about malaria control in the communities.

1. Vector monitoring and control

NMCP/PMI objectives

The current Malaria Strategic Plan promotes universal ITN coverage and blanket IRS coverage in targeted high-risk districts. With PMI support, the NMCP developed a national vector control strategy in 2015 to guide the use of entomological monitoring data for strategic decisions regarding the deployment of IRS and other vector control interventions. The vector control plan includes entomological monitoring at 13 sites throughout the country including IRS and non-IRS areas. PMI also supports the NMCP to build national capacity to plan and supervise vector control activities within the context of the WHO integrated vector management strategy.

a. Entomologic monitoring and insecticide resistance management

Progress since PMI was launched

Mali has a long history of entomological monitoring and the use of monitoring data to guide its vector control strategy. The methods and timeframe for collection of entomological data were codified in the National Vector Control Strategy, completed in 2015. Historically, Mali relied on the pyrethroid class of insecticides. However, evidence of resistance was first detected in 2010, causing the country to shift to carbamate insecticides for IRS. When the half-life for carbamates (following IRS) was monitored, it was shown to be insufficient to protect treated households for the duration of the transmission season and the IRS insecticide was changed to organophosphates beginning in 2014. A PMI Mali vector control workplan (updated annually since 2012), includes the indicators, methodologies, and mosquito collection schedules to operationalize monitoring of IRS. Insecticide resistance management decisions, such as rotation to a new IRS insecticide class, are based on vector-insecticide resistance data. PMI continues to collect data at the 15 sites.

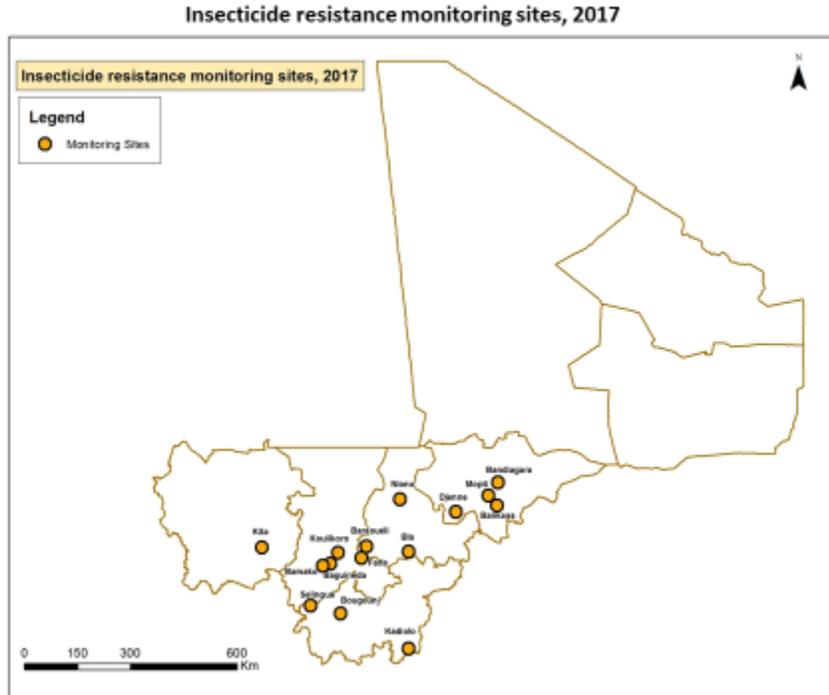
Progress during the last 12-18 months

IRS entomological impact data is collected at five of the same sites in current and former IRS areas (four sites plus one non-IRS comparison area). Table 3 provides a summary of the entomological monitoring sites and the relevant data that are collected at each site.

Table 3. Vector monitoring and evaluation sites (2017) and their relevant characteristics

Region	Site (District)	Reason for selection	Entomological monitoring activity
Kayes	1. Kita	-Agricultural insecticide use (pyrethroids) - ITN	All sites: vector-insecticide susceptibility profile as described in PMI Guidance 4 IRS sites (*) IRS/entomology monitoring - Density - Behavior - Longevity - Infection rate - Blood meal origin
Koulikoro	2. Koulikoro	- <i>Former IRS</i> -ITN	
	3. Kati	-ITN -Black fly control -Irrigation	
Ségou	4. Niono	- Irrigation	
	5. Bla	-Traditional agriculture (limited use of herbicides only) - <i>Former IRS</i>	
	6. Barouéli	- <i>Former IRS</i> -ITN distribution	
	7. Fana	- <i>Former IRS</i> -ITN distribution	
Sikasso	8. Bougouni	-Agricultural insecticide use (pyrethroids) -ITN distribution	
	9. Selingue	-Irrigation -ITN distribution	
	10. Kadiolo	-Agricultural insecticide use (pyrethroids) -ITN distribution	
Mopti	11. Badiangara	-New IRS sites (2017)	
	12. Bankass		
	13. Djenne		
	14. Mopti		
Bamako	Bamako	-Non-IRS comparison	

Figure 3. Entomological Monitoring Sites (2017)



Entomological monitoring data collected during 2016 continue to show (i) widespread pyrethroid and DDT resistance; (ii) carbamate susceptibility, which unfortunately does not persist long enough on walls after IRS; and (iii) organophosphate susceptibility. Elevated levels of mixed-function oxidases, detected by resistance intensity bio-assay methods, are thought to be the physiological mechanism underlying pyrethroid resistance. Additionally, there is now good evidence of high levels of pyrethroid resistance (10 times the diagnostic dose). The intensity and geographical spread of pyrethroid resistance are priority concerns since ITNs rely exclusively on pyrethroids. While full susceptibility to carbamates continues, its short residual activity (2 months) impairs its properties as an IRS insecticide since it does not provide long-enough activity throughout the transmission season. Mali has participated in the UNTAID-funded Next Generation IRS (NGenIRS) program since 2016. This market intervention project includes a short-term insecticide co-payment to accelerate the reduction of price for long-lasting IRS insecticides.

Selected 2016 monitoring and evaluation results are presented below (and available in a report published on the PMI website²):

- IRS impact on measures of vector density in IRS- and non-IRS-supported regions can be seen on Figure 4.
- As shown in Figure 5, the organophosphate insecticide used for IRS in Mali results in two months of complete effectiveness (with 100% mortality of susceptible vectors exposed to sprayed walls) followed by three months of partial effectiveness (with <80% mortality). This is somewhat less than manufacturer's specifications, but nonetheless is long enough to cover the transmission season in Mali. The rainy season and peak vector season in IRS-targeted areas is relatively brief, with the highest vector densities and biting rates occurring in August-September

² www.pmi.gov. March 2017. *Mali: Entomological Monitoring of 2016 IRS Activities. Final Report*. Bamako, Mali .

(2-3 months post IRS). One hypothesis explaining the abbreviated impact of IRS, that houses typically have mud walls, which are often plastered with kaolin after IRS, is being evaluated.

- Members of the species complex *Anopheles gambiae s.l.* predominate based on conventional taxonomic analysis. Molecular taxonomic analysis was used to further identify the most common members of this complex in Mali: *An. coluzzii*, followed by *An. gambiae s.s. / coluzzii* (hybrids), and *An. arabiensis*. Overall indoor resting densities were lower following IRS (in Figure 4, compare green - former IRS and control comparison sites, Bla and Ségou, versus red line – IRS site, Barouéli), where the mean density of *An. gambiae s.l./ house/day* was probably 10x lower during the transmission period.
- Insecticide susceptibility monitoring confirmed widespread resistance to permethrin and deltamethrin (see Table 4). High intensity pyrethroid resistance is an expression of elevated levels of mixed-function oxidases (p450s), confirmed by exposure to a synergist and insecticide in CDC bottle bioassay, and possibly other physiological resistance mechanisms. Mortality rates of populations of *An. gambiae s.l.* exposed to permethrin 10X ranged from 28% to 93% in all sites. With deltamethrin 10X, *An. gambiae s.l.* showed a mortality rate varying from 53% to 91%. Overall, resistance to pyrethroids is quite intense at all sites with some slight differences according to insecticides and sites. The intensity of resistance has remained stable between 2014 and 2016. Data also indicated full susceptibility to the organophosphate pirimiphos-methyl in all IRS sites. Spraying in 2017 is due to take place in the Mopti Region where there is full susceptibility to this insecticide, which is to be used for IRS. The detection of a few homozygous resistant (RR) and heterozygous genotypes (RS) for the *Ace1^R* mutation was detected, suggesting that this mutation also plays a role in the resistance threat.

Figure 4: Impact of IRS on vector density, current vs. former IRS and non-IRS sites, 2016

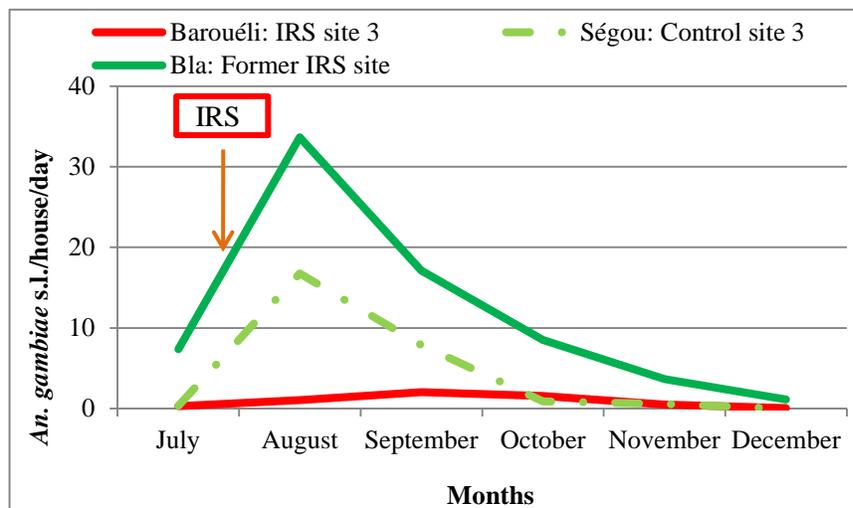
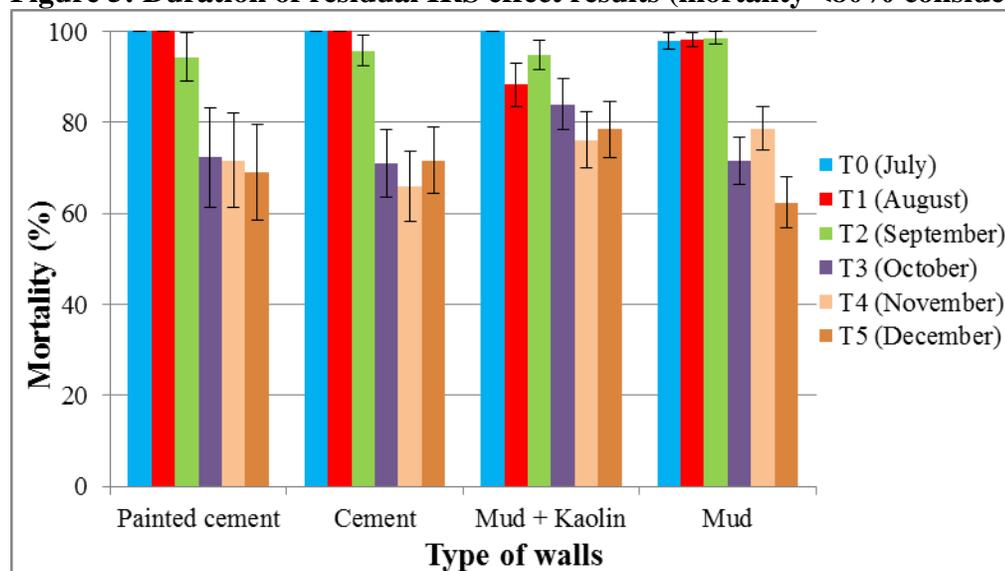


Figure 5: Duration of residual IRS effect results (mortality <80% considered suboptimal)



**Table 4: WHO vector-insecticide susceptibility test results (% mortality)
(Scores <90% indicate resistant phenotypes present in test population)**

District (site)	Permethrin 0.75%			Deltamethrin 0.05%		
	2014	2015	2016	2014	2015	2016
	% Mortality	% Mortality	% Mortality	% Mortality	% Mortality	% Mortality
Kita	19%	65%	74%	64%	98%	95%
Koulikoro	6%	14%	19%	15%	49%	85%
Kati	25%	7%	6%	18%	38%	65%
Bamako	1%	63%	50%	6%	79%	50%
Bla	47%	83%	41%	14%	64%	64%
Baroueli	25%	21%	11%	31%	66%	81%
Niono	11%	49%	n/a	42%	58%	20%
Selingue	72%	57%	33%	42%	56%	40%
Bougouni	61%	85%	67%	77%	79%	76%
Kadiolo	13%	54%	21%	43%	63%	47%
Djenne	21%	19%	14%	40%	41%	28%
Bandiagara	32%	22%	58%	30%	45%	89%
Bankass	54%	87%	64%	37%	90%	93%
Fana	N/A	N/A	41%	N/A	N/A	52%
Mean	30%	48%	38%	35%	64%	64%

N/A: no data

Plans and justification

Based on MIS 2015 data which indicate that the highest malaria burden occurs in the Mopti Region, IRS will rotate from its 2016 district-level sites in Segou and Koulikoro Regions to new districts / health areas in Mopti. Existing monitoring data, some of which already come from Mopti are available and indicate that the use of organophosphate-based IRS will be effective. A full package of entomological monitoring activities will continue in the former IRS areas in order to document the impact of IRS withdrawal with associated scale-up of alternative interventions to counter the threat of resurgence.

Proposed activities with FY 2018 funding: (\$329,000)

- **Entomological monitoring:** Routine entomological monitoring activities at seven sites (four sites in Mopti and three sites in the former (2016) IRS areas, to assess the impact of withdrawal). Indicators include: vector density, behavior, longevity, and infection rate. In addition, insecticide susceptibility testing (full panel of IRS insecticides) will be carried out at 15 sites across the country (including the seven sites where routine monitoring is conducted). (\$300,000)
- **Two CDC TDYs:** Technical assistance from CDC entomologist for supervision of monitoring activities (\$29,000).

b. Insecticide-treated nets

Progress since PMI was launched

In Mali, the MoH supports the provision of free ITNs distributed to target populations through two main delivery channels: mass distribution to households as part of universal coverage campaigns and routine distribution through antenatal care (ANC) and child immunization clinics. Mali defines achievement of universal coverage as one ITN for every two people. Since 2007, the MoH has provided free ITNs to children under five years of age via routine distributions and through a phased national universal coverage campaign for all vulnerable populations. To sustain coverage, the MoH provides free nets to pregnant women at their first ANC visit and to infants when they complete their national immunization series.

Progress during the last 12-18 months

Traditionally Mali has had a strong culture of net ownership and use as shown by the 2013 “Culture of Net Use Survey”; both ownership of at least one net per household and the use of nets among vulnerable populations are even higher. According to the 2015 MIS conducted during the peak transmission season, 93% of households owned at least one ITN; currently Mali is among PMI focus countries with the highest level of ITN ownership. Seventy-one percent (71%) of children under five and 78% of pregnant women slept under an ITN the night before the survey. These findings suggest that Mali has not only maintained high net ownership since December 2007, but has increased coverage and use among vulnerable populations. Beginning in April 2011, following its adoption of universal coverage, Mali launched a rolling, phased campaign to achieve 100% ownership and 80% use of ITNs in the general population. The NMCP and partners opted for a phased approach to the campaign, starting with the region of Sikasso in 2011, and then covering the regions of Ségou, Mopti, Kayes, and Koulikoro between 2012 and 2014. In 2015, three regions were covered with nets by mass distribution campaigns: the district of Bamako in the first round and the regions of Sikasso and Ségou in second mass campaigns. To date, more than 12.8 million ITNs have been distributed, of which PMI has contributed around 9.3 million nets.

During the last 12 to 18 months, PMI supported the mass campaign in the region of Gao, Tombouctou. Around 1.029 million nets were procured and distributed, of which PMI purchased and distributed

829,000 and the GoM 200,000 ITNs. The European Union supported distribution costs for 829,000 nets. In Kidal Region, the GoM supported the cost of procurement and distribution of 200,000 nets.

With FY 2016 funds, PMI procured 1.25 million nets that arrived in April 2017. These nets are intended for distribution to pregnant women and infants via routine channels in 2017. As per the approved concept note, the Global Fund will fully support the 2017 mass campaign in Kayes and Mopti, procuring and distributing 3.2 million ITNs to replace those distributed in 2013 and 2014, and procuring an additional 500,000 ITNs to contribute to the campaign planned for Koulikoro in 2018.

Table 5. ITN Gap Analysis

Calendar Year	2017	2018	2019
Total targeted population ¹	18,874,286	19,553,760	20,257,695
Continuous Distribution Needs			
Channel #1: ANC ²	420,000	450,000	480,000
Channel #2: EPI ²	300,000	350,000	375,000
<i>Estimated Total Need for Continuous</i>	720,000	800,000	855,000
Mass Distribution Needs			
2017/2018/2019 mass distribution campaign	3,297,000	1,800,000	1,263,498
<i>Estimated Total Need for Campaigns</i>	3,297,000	1,800,000	1,263,498
Total Calculated Need: Continuous and Campaign	4,017,000	2,600,000	2,118,498
Partner Contributions			
ITNs carried over from previous year	-	633,000	33,000
ITNs from Government	200,000	200,000	200,000
ITNs from Global Fund	3,200,000	500,000	TBD
ITNs from other donors	0	0	0
ITNs planned with PMI funding	1,250,000	1,300,000	1,400,000
Total ITNs Available	4,650,000	2,633,000	1,633,000
Total ITN Surplus (Gap)	633,000	33,000	(485,498)

1. Population estimates are obtained based on the 2009 census with an estimated 3.6% population growth.

2. Routine nets are given at the first ANC visit for pregnant women and at EPI visits for infants receiving the first dose of the pentavalent measles-containing vaccine.

3. About 400,000 nets of the PMI planned contribution will be used to fill the campaign gap for Bamako. Once Global Fund contributions are known further adjustments may be made.

Plans and justification

PMI will continue to support the nationwide routine distribution of ITNs through ANC and EPI services while the Global Fund will support the implementation of the phased rolling campaign nationwide. As part of this campaign, PMI will conduct the second year bed net durability study following the recommendations of the PMI Vector Control Working Group. PMI will support routine SBCC activities to reinforce the correct and consistent use of ITNs throughout the year. Specific contributions will include support for messaging on correct hanging, use, and maintenance of nets, as well as information

about how individuals' use of ITNs year-round contributes to local and national malaria control objectives (see SBCC section for full description and budget).

Proposed activities with FY 2018 funding: (\$5,022,000)

- **ITN procurement:** PMI will procure approximately 1,00,000 ITNs, of which the majority (approximately 1 million) will support routine distribution to children under one year of age and pregnant women, and approximately 400,000 nets will support the mass campaign. The routine distribution channels, which represent 40% of the overall need in country in calendar year 2019, will be covered through PMI's procurement. (\$4,032,000)
- **Distribution of ITNs:** PMI will support the distribution of free ITNs through routine ANC and immunization services at the CSCOM level for infants and pregnant women. PMI will also support steps to ensure that ITNs reach the targeted populations (ensure that health workers are distributing ITNs according to national guidance, verifying stocks, and comparing data for nets distributed versus physical stock). (\$840,000)
- **ITN durability study:** PMI will support a second-year ITN durability study as part of the mass campaign in 2017, following the recommendations of the PMI Vector Control Working Group. (\$150,000)

c. Indoor residual spraying

Progress since PMI was launched

The class of insecticides used for spraying has changed three times in response to problems, related to vector insecticide resistance as well as short duration of insecticidal effect. In 2008, the program began spraying pyrethroid class insecticides in Bla and Koulikoro Districts. One year later, Barouéli District was added. By 2012, pyrethroid resistance was intensifying, prompting rotation to carbamates. However, use of this insecticide class was halted in 2014 due to the short duration of insecticidal effect following IRS, which was too short to cover the peak transmission season, prompting a shift to organophosphate class insecticides. Unfortunately, the increased cost of these products necessitated a reduction from three to two target districts in 2015. The NGenIRS project enabled Mali to expand the IRS target area back to three districts (Barouéli, Fana, and Koulikoro) in 2016. The history of PMI-supported IRS activities in Mali is summarized in Table 6.

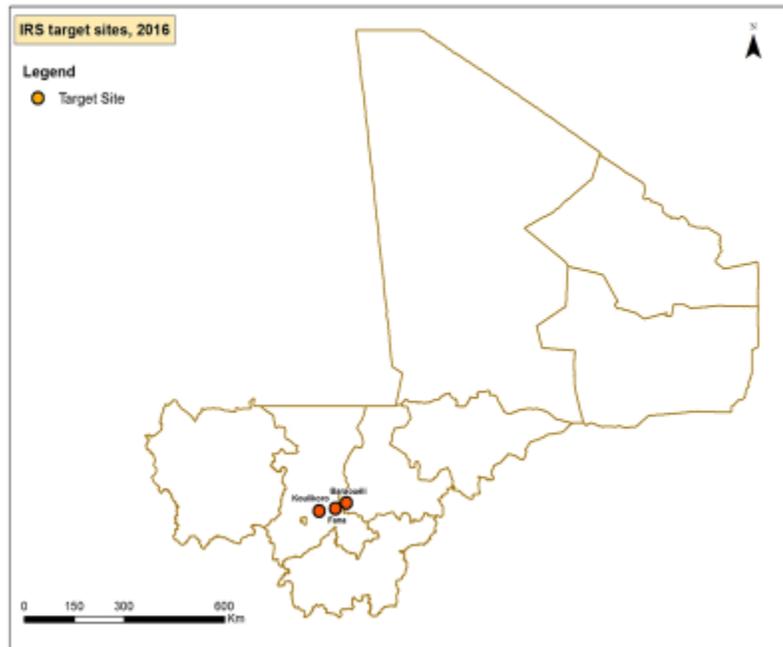
Table 6: PMI-supported IRS activities 2015-2019

Calendar Year	Number of Districts ¹ Sprayed	Insecticide Used	Number of Structures Sprayed	Coverage Rate	Population Protected
2015	2	organophosphate	133,527	98%	494,205
2016	3	organophosphate	228,672	97%	788,922
2017*	4 partial	organophosphate	257,503	TBD	901,263
2018*	4	TBD	~150,000	TBD	~650,000
2019*	4	TBD	~150,000	TBD	~650,000

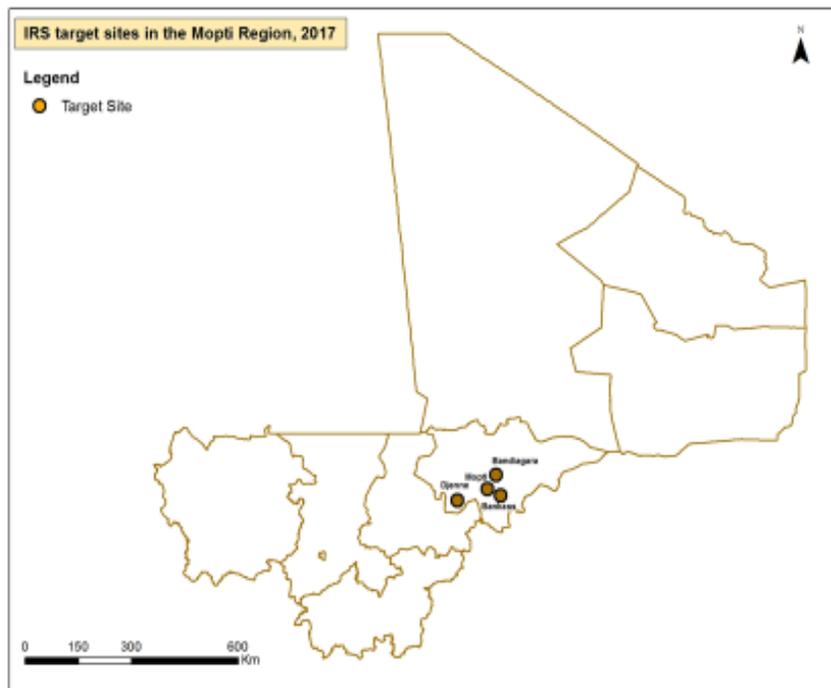
*Represents targets based on the 2017 IRS work plan, and/or projected targets based on national strategic plan and/or discussions with the NMCP.

Figure 6: IRS sites in 2016 and 2017

IRS target sites in 2016-Koulikoro and Segou Regions



IRS Target sites in the Mopti region, 2017



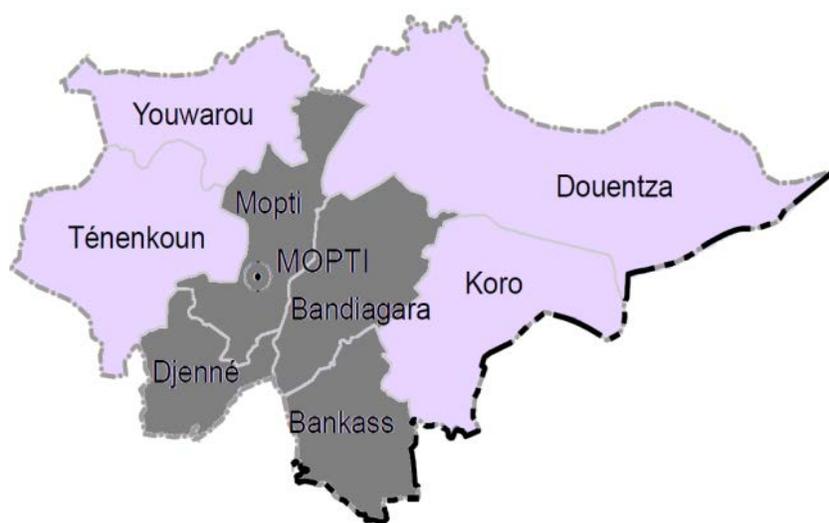
In 2017, with subsidies from the NGenIRS project, IRS will be rotated to Mopti Region following three consecutive rounds (2014, 2015, 2016) of organophosphate IRS in target districts of Koulikoro and Ségou Regions. The shift reflects (1) the priority given by PMI to areas with the highest malaria burden as identified by the 2015 MIS and (2) the fact that three IRS rounds have been completed in the

withdrawal districts. The goal of IRS, as planned by the NMCP in conjunction with PMI, will be to spray all eligible structures in four target districts: Badiagara, Bankass, Djenne, and Mopti. As part of the implementation, PMI will work with the NMCP to closely monitor surveillance data in the Mopti Region to track the impact of the campaign. In the previous IRS districts, PMI will ensure universal coverage of ITNs and SMC through its existing partners. PMI will also work with the NMCP to review surveillance data at quarterly intervals to detect and respond to any post-IRS rebound effect.

Progress during the last 12-18 months

By the end of the 2016 spray campaign, PMI achieved 97% coverage (228,672 structures), which protected 788,922 people in the three districts: Baroueli, Fana, and Koulikoro. PMI worked closely with government counterparts in the three districts and at the national level, to plan and supervise IRS activities. To ensure that communities were aware of IRS prior to the campaign, PMI used radio broadcasts, community mobilizers, and printed materials to reach households. New approaches to IRS, included in this spray round, included a village/neighborhood approach to reduce transportation costs and increase the participation of women in the IRS activity. An assessment of IRS quality showed that nearly 100% mortality among susceptible vectors exposed to sprayed walls was achieved.

Figure 7: 2017 IRS Target Districts (highlighted in grey) in Mopti Region



Plans and justification

With FY 2018 funds, PMI proposes the continuation of IRS in Mopti Region. Current projections estimate that, at current funding levels, 151,093 structures can be sprayed and 648,820 people protected; however it may be necessary to adjust coverage to reflect budgetary constraints. Targeting at the health area level (versus the district level) may be possible given the availability of high quality epidemiological surveillance data as a result of the enhanced surveillance capability, which has been built up in Mopti. Final decisions on the FY 2018 IRS budget envelope will be made in collaboration with the NMCP and the PMI Vector Control Team.

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

- **IRS operations:** Procurement of IRS equipment and insecticides, annual training, implementation of operations, data collection, protocol development, guidelines, SBCC, logistical and technical assistance (\$3,965,000)

- **External environmental compliance assessment:** Support for an external environmental compliance assessment of Mali's IRS activities. Insecticide distribution, use, storage, and disposal as well as insecticide tracking systems and/or tools will be monitored. (\$35,000)

2. Malaria in pregnancy

NMCP/PMI objectives

Mali's malaria in pregnancy (MIP) strategy is based on WHO's three-pronged recommendation: Three doses of IPTp with SP, free distribution of ITNs during the first ANC visit and the promotion of their correct and consistent use, and effective case management of malarial illness. Current national guidelines (updated in 2014) and the National Strategic Plan call for 100% of pregnant women living in stable transmission zones to receive at least three doses of SP for IPTp at ANC services. IPTp should be given at every ANC visit starting at 13 weeks gestation, with at least one month between visits, and may be given up to delivery. In addition to ITN distribution via ANC, the NMCP complements free ITN distribution via ANC with supplementary ITN distribution to mothers and children at immunization clinics and via mass distribution campaigns. ITN distribution channels are further supported by SBCC activities to encourage pregnant women, mothers, and other family members to access ANC and immunization clinics. SP for IPTp has been provided free-of-charge since 2006 (women still pay a small service fee for an ANC card), however financial barriers to access remain an issue in some rural districts. Mali has updated its guidelines for iron and folic acid supplementation. These guidelines require 0.4 mg or 400 µg (daily) and 60 mg of iron (daily). For treatment of a case of anemia, 120 mg of iron need to be given until recovery.

For case management of MIP, the national policy is to use quinine in the first trimester and the first-line ACT (artemether-lumefantrine) (AL) in the second and third trimesters. Treatment of severe malaria follows the same protocols as with non-pregnant adults: injectable artesunate (preferred) and if not available, quinine. Mali is reviewing the recently revised WHO guidelines on case management of MIP and will likely be revising the national policy; however that process has not yet begun. Details on PMI's support to the overall case management program, including drug procurement and supply chain management, are available in the case management section.

Integration and coordination between the NMCP and the MoH's Reproductive Health Division is a core component of PMI's contributions to USAID bilateral projects in the health sector. The NMCP and the Reproductive Health Division jointly support the dissemination and use of a revised in-service training module for focused antenatal care (FANC), which includes MIP and IPTp. A MIP working group co-chaired by the NMCP and the Reproductive Health Division meets regularly to coordinate activities among all stakeholders, including participation by PMI Resident Advisors and USAID Health Team staff.

The National Center for Information, Education, and Communication for Health (*Centre National d'Information Education et Communication pour la Santé* - CНИЕCS), which is tasked with creating SBCC materials and strategies, works with PMI-funded implementing partners to identify barriers to ANC access and IPTp delivery, and to develop relevant SBCC materials to address these barriers. In addition to community-based communications, CНИЕCS and PMI partners also work to develop SBCC tools and messages to improve healthcare providers' use of IPTp during ANC visits.

Progress since PMI was launched

IPTp coverage in Mali is closely linked to ANC utilization, which is aligned with WHO's recommendation that SP doses be directly observed by a healthcare worker. At the launch of PMI in Mali, approximately 70% of pregnant women used ANC services at least once during their pregnancy, and this increased to 74% by 2012, with 41% making four or more visits. Still, nearly a quarter of all pregnant women do not attend ANC at all (2012/13 DHS), and women who do attend ANC generally start seeking care later in their pregnancies (first ANC visit at 4.2 months on average). According to the 2015 MIS, the proportion of women who reported receiving two or more SP treatments during ANC was 38%. The national HMIS was recently updated in order to capture three or more doses of IPTp administered through ANC. As of 2016, approximately 30% of pregnant women in PMI-supported zones had received three or more doses of IPTp according to the routine data. The use of bed nets in general is very high in Mali. Data from the 2015 MIS indicate that 78% of women interviewed reported sleeping under an ITN the night before the survey – an increase from 73% reported in the 2012/13 DHS.

PMI has supported in-service training and supervision of health providers, in collaboration with the Reproductive Health Division, NMCP, and Midwives Association to facilitate the implementation of the MIP guidelines. This training has been conducted alongside SBCC campaigns aimed at reminding healthcare workers to follow national IPTp guidelines. Technical training based on current IPTp recommendations has accelerated in recent years to ensure that all new providers are trained, and that existing providers receive refresher training every two years. The addition of an IPTp3 variable in the DHIS2 system has contributed to improvements in routine program monitoring.

Other PMI-supported partners have promoted the provision of free ITNs to pregnant women at their first ANC visit; in practice, ITNs are often not given until the third or fourth month of pregnancy due to late initiation of ANC. As noted above, PMI has and continues to support a multi-channel SBCC strategy targeting pregnant women, women of childbearing age, and men. The SBCC campaigns (also described in the SBCC section) focus on women's knowledge and awareness of the risks of malaria during pregnancy, the importance of early and frequent ANC attendance and the associated demand for and use of at least three SP treatments for IPTp and ITNs.

Progress during the last 12-18 months

Mali has aggressively worked to improve the implementation of MIP services over the past year. In 2015, they completed the training of all health care workers on the new MIP guidelines (recommending three or more ANC visits) and will continue to conduct rolling refresher trainings nationwide. The results of these trainings will be tracked through a health facility survey planned for 2018. In 2016, PMI provided support through its partners to revise the national protocols and guidance documents and for coordination of the MIP Technical Working Group in Mali. A total of 5,670 providers and community volunteers were trained in the new national malaria guidelines (across all areas of malaria, including MIP). In addition, 529 health care providers (nurses, doctors, midwives) received specific training in MIP implementation in the PMI focus regions. In the past, Mali had a history of SP stockouts, which negatively affected the program's ability to deliver services. The GoM stepped in to procure limited quantities of SP for the national program, with PMI providing the remaining quantities necessary to meet national needs. A major thrust of the MIP program this year was SBCC activities aimed to encourage early and regular uses of antenatal care. PMI provided support to develop posters, TV, and radio spots, and interpersonal communication activities that focused on MIP (see SBCC section for more details). PMI has also developed an operational research (OR) activity aimed at testing an enhanced package of provider training, coupled with community level messaging, to improve both delivery and use of services. Primary results from this study are expected in 2019 and will be used to improve provider training and supervision and SBCC activities.

Table 7. Status of IPTp policy in Mali

Status of training on updated IPTp policy		Number and proportion of HCW trained on new policy in the last year if training on new policy is not yet completed	Are the revised guidelines available at the facility level?	ANC register updated to capture 3 doses of IPTp-SP	HMIS/ DHIS updated to capture 3 doses of IPTp-SP
Completed/Not Completed	Date (If completed, when, if not completed, when expected)				
Completed	2015	529 (100% of providers in PMI-supported regions)	Yes	Yes	Yes

Commodity gap analysis

PMI remains committed to supporting the procurement of an adequate stock of SP to achieve the NMCP's objective of 100% IPTp3 coverage for pregnant women. PMI remains the primary provider of SP, complementing the quantities procured by the GoM to ensure all needs are met. There are currently no stockouts of SP at the central level in country. There are some distribution issues that result in some health facilities being stocked out occasionally, however PMI is working with the NMCP to utilize data from OSPSANTE (*Outil de Suivi des Produits de la Santé*, a health commodity data platform) to redistribute central stocks to facilities in need and to avoid these situations in the future.

Table 8. SP Gap Analysis for Malaria in Pregnancy

Calendar Year	2017	2018	2019
Total population	18,874,286	19,553,760	20,257,696
SP Needs			
Total number of pregnant women attending ANC	707,786	723,489	749,535
Total SP Need (in treatments)*	1,503,337	1,536,691	1,592,012
Partner Contributions			
SP carried over from previous year	168,032	896,117	504,512
SP from Government	231,422	145,086	0
SP from Global Fund	0	0	0
SP from other donors	0	0	0
SP planned with PMI funding	2,000,000	1,000,000	1,000,000
Total SP Available	2,399,454	2,041,203	1,504,512
Total SP Surplus (Gap)	896,117	504,512	(87,500)

*MoH data indicates 90% of pregnant women come for a first ANC visit, 80% of those who had a first visit, come for a second visit; and 70% of those who came twice, come for a third consultation.

NB: The country team will monitor actual ANC/IPTp-SP consumption data and match to these assumptions over the course of the next year. Reprogramming will be used if these rationalized estimates prove too low.

Plans and justification

With FY 2018 funding, PMI will continue to support activities aimed at reinforcing the provision of effective MIP services on the platform of antenatal care. Direct support will continue for monitoring and

supportive supervision of MIP service delivery, improving data collection including IPTp data, and training new staff on MIP. PMI will continue its work in the four USAID focus regions, and will use additional mechanisms to ensure services to the regions of Mopti and Sikasso. Complementing this work, PMI will support SBCC activities (see SBCC section) that encourage pregnant women and their partners to seek early and regular antenatal care. PMI will also continue to encourage collaboration between the NMCP and the Division of Reproductive Health and Child Survival to strengthen and streamline MIP activities.

Proposed activities with FY 2018 funding: (\$830,000)

- **SP procurement:** Procurement of 1,000,000 doses of SP for IPTp treatments. (\$130,000)
- **Strengthen antenatal care and MIP services in USAID focus regions:** Strengthen services delivered to pregnant women during antenatal care visits in the USAID focus regions of Bamako, Kayes, Koulikoro, and Sikasso (Gao will also be covered if/as security allows). (\$450,000)
- **Provide antenatal care and MIP services in Mopti and Ségou:** Provide ANC and MIP services to women in the regions of Mopti and Ségou (non-USAID focus regions). Together with the above allocation, ANC and MIP strengthening will occur in regions covering >90% of Mali's population. (\$250,000)

3. Case management

a. Diagnosis and treatment

NMCP/PMI objectives

Mali's case management policy is in line with WHO guidelines requiring that every malaria case should be laboratory confirmed before administering ACTs and that RDTs should be used to confirm the diagnosis where microscopy is not available. Microscopic diagnosis is performed in 4 national, 6 regional and 65 district hospitals at a cost ranging \$0.75–\$5 per blood smear. In addition to hospitals providing microscopy, some privately operated CSCOMs staffed with physicians and/or laboratory technicians also perform malaria microscopy. However, most CSCOMs do not have the capacity to do microscopy and rely on RDTs for malaria diagnosis. The RDTs initially were free for children under five years of age and pregnant women and highly subsidized for other groups. However, following PMI-supported advocacy by the NMCP, the MoH signed a new policy in mid-2014 to make RDTs free for patients of all ages to encourage RDT use.

The National Institute of Public Health Research (*Institut National de Recherche en Santé Publique* [INRSP]) is responsible for quality control (QC) of all diagnostic services. With PMI funding, the institute has developed and finalized a quality assurance/quality control (QA/QC) plan for malaria microscopy and RDTs. Implementation of the plan was suspended after the military *coup* in March 2012, but restarted in 2015 with technical assistance from PMI.

In 2010, the MoH revised the national policy for the treatment of uncomplicated malaria to make artemether-lumefantrine (AL) the first-line drug and artesunate-amodiaquine (AS/AQ) an alternative. As per national directive, ACTs are free to children under five years of age and pregnant women in the second and third trimester. Mali's malaria case management guidelines were recently updated to specify injectable artesunate as the first-line treatment for severe malaria, with intravenous quinine and injectable artemether as alternatives. Severe cases identified in the community are referred to the CSCOM, where they can receive appropriate treatment. In practice, health centers typically use whatever severe malaria medication is available in a severe malaria emergency. In addition, the People's

Pharmacy of Mali (PPM) has a significant stock of injectable quinine, so a plan is in place to gradually draw down the stock of quinine, while simultaneously scaling up the availability and use of injectable artesunate through 2017 and 2018.

Table 9. Status of Case Management Policy in Mali, 2017

Status of Case Management Policy in Mali (NMCP Case Management Guideline 2016)	
What is the first-line treatment for uncomplicated <i>P. falciparum</i> malaria?	Artemether-lumefantrine
What is the second-line treatment for uncomplicated <i>P. falciparum</i> malaria?	Artesunate-amodiaquine
What is the first-line treatment for severe malaria?	Injectable artesunate
In pregnancy, what is the first-line treatment for uncomplicated <i>P. falciparum</i> malaria in the first trimester?	Oral quinine
In pregnancy, what is the first-line treatment for uncomplicated <i>P. falciparum</i> malaria in the second and third trimesters?	Artemether-lumefantrine
In pregnancy, what is the first-line treatment for severe malaria?	Injectable artesunate; injectable artemether
Is pre-referral treatment of severe disease recommended at peripheral health facilities? If so, with what drug(s)?	Rectal capsule of artesunate, injectable artemether or injectable quinine
Is pre-referral treatment of severe disease recommended for community health workers? If so, with what drug(s)?	Rectal capsule of artesunate
If pre-referral rectal artesunate is recommended, for what age group? (note: current international guidelines do not recommend administering to those ≥ 6 years)	0-5 years old

Progress since PMI was launched

Since 2008, PMI has contributed to the improvement of malaria diagnosis and clinical case management in Mali by providing support to local NGOs and partners to conduct a combination of various strengthening activities for health workers, laboratory technicians, and community health workers. These activities include trainings of trainers, refresher training courses, and supervision of malaria microscopy and RDTs, adherence to test results when prescribing ACTs and improvement of care for patients with severe febrile disease.

The NMCP and MRTC initiated supervision of diagnosis and treatment for malaria cases in 2010 starting with Bamako and transitioning to other regions. These visits covered district referral health centers (CSREFs), where the team provided training of trainers to district health leads to provide supervisory support in their specific district. The team used supervisory tools developed in collaboration with NMCP, PMI, MRTC, and malaria partners to focus on the proportion of suspected malaria cases tested, adherence to malaria diagnostic test results, and improving case management of severe febrile disease. Malaria supervision guidelines were updated in 2015 and include supervision of outpatient consultations at health facilities, antenatal consultations, and ASC visits.

Diagnostic confirmation of all suspected malaria cases has increased substantially in the last five years: routine data show that 18% of suspected malaria cases were tested by microscopy or RDT in 2010, increasing to 32% in 2011, 52% in 2012, and 80% in 2013. According to the 2016 annual NMCP report, health workers diagnostically tested 93% of suspected malaria cases prior to treatment.

Poor access to care due to geographic and economic constraints is a major challenge for malaria treatment in Mali. With approximately 1,252 CSCOMs in the country in 2016, about 90% of the population has geographic access to public health services according to WHO standards (living within 15 km of a first-line health facility) but only 57% live within 5 km of a health facility. All patients must pay consultation fees, however diagnosis by RDT is free for all as of 2014, injectable artesunate and ACTs are free for children under five and pregnant women. Older patients must pay fees for malaria drugs, though these are subsidized. A health financing task force has been set up to examine issues related to user fees for primary care in Mali, a complex issue with a long history dating back to the Bamako Initiative in 1987 that set up revolving drug funds at CSCOMs. An updated national health financing policy and strategy was adopted in February 2014, which outlines a strategy to increase the proportion of the population covered by insurance from 6% in 2011 to 45% in 2018, primarily through expanding *mutuelle* insurance for the informal sector. The Malian government plans a review of this strategy and identification of revised longer term goals.

To overcome geographic barriers to health services, the MoH adopted an integrated community case management (iCCM) package in February 2010 that includes treatment for malaria, diarrhea, pneumonia, and malnutrition; essential newborn care; and family planning. Free malaria treatment for children under-five is provided by trained ASCs (though patients must pay a consultation fee) and includes malaria diagnosis with RDTs and treatment with ACTs, although diarrhea and pneumonia medications are not free. Severe cases are referred to CSCOMs, which are equipped to provide appropriate treatment. ASCs receive refresher training every three months and supportive supervision on a regular basis. ASCs are paid a salary of approximately \$100 per month, with various donors currently supporting ASC salaries in different regions. One of the NMCP's major concerns is securing continued funding for ASC salaries. From 2016 to 2018, the Global Fund committed to pay salary of 1,500 ASCs out of 2,337 currently trained. In addition, the GoM is also revising its community strategy (called 'SEC' locally), to reduce donor costs and to incorporate cost recovery into the program with a goal of sustainability over the long term. PMI and other USAID health funds (MCH, Nutrition/WASH, FP) will support the implementation of iCCM in all 20 districts of the regions of Kayes and Sikasso. The Global Fund, UNICEF, World Vision, and other partners will support iCCM activities in the regions of Koulikoro, Mopti, and Ségou, where an iCCM technical group coordinates all partners' interventions.

Mali currently has 2,337 trained ASCs who are functional in five of the eight regions of the country in the south, where more than 90% of the population lives. However, there is a need for additional ASCs and roughly 2,600 ASC posts are currently unfilled. According to the MoH minutes of the ASC review meeting, which took place in Koulikoro in February 2016, where ASC malaria activities from 2015 were presented, ASCs provided diagnosis (with RDTs) and treatment for 165,168 malaria cases while health workers in the same six regions provided diagnosis and treatment for 992,426 malaria cases. This shows that 17% of all malaria cases in these six regions were diagnosed and treated by ASCs. The ASCs work in collaboration with volunteer *relais*, community members who assist in community mobilization and behavior change communication. An external evaluation completed in May 2014 found that iCCM was well integrated into the health system of Mali and effectively coordinated by partners, although utilization was still low, due in part to financial barriers and health worker attrition.

PMI is working with other stakeholders to coordinate and expand iCCM/SEC activities. These activities are under discussion at a high level with the GoM to identify sustainable financing options for the ASC program.

The total population of PMI's target regions for iCCM (Bamako, Kayes, Koulikoro, and Sikasso) in 2018 is projected to be 6,526,298, of which 2,055,493 will be children under five (the targeted group for iCCM). In 2017, PMI will contribute to the scale-up to cover all districts in USAID-targeted regions through the Mission's integrated program with financial support from other health programs including Maternal and Child Health, Family Planning, and Nutrition/Water, Sanitation, and Hygiene. However, due to security concerns, the three regions of the North are still not accessible.

In the 2013–2018 Malaria Strategic Plan, Mali introduced SMC (providing four rounds of SP and AQ for children under five years of age) as a key malaria control intervention. SMC is implemented by the district health team, which distributes the medications at a fixed point (often near the CSCOM each month). Participation of the ASCs varies by district including conducting SBCC activities, and going door-to-door to recruit families who do not come to the central distribution point. ASCs and health center teams receive refresher training at the start of each SMC season. Following a successful pilot of SMC in Koutiala District (in the Sikasso Region) by MSF in 2012, which showed a 42% reduction in malaria cases, the NMCP developed a plan to implement SMC in all districts of Mali, with scale-up dependent upon donor funds. In 2013, five of Mali's 65 districts were covered by SMC and this increased to 21 districts during the 2014 transmission season, including one supported by PMI. Due to a three-year grant awarded to CRS from UNITAID, SMC was implemented in at least 42 districts during the 2015 transmission season and in 2016 SMC was implemented in all 65 districts including the north of Mali. PMI currently supports the implementation of SMC in 12 districts in the regions of Kayes and Sikasso.

Progress during the last 12-18 months

PMI has contributed to the improvement of the quality of malaria diagnostics and clinical case management and works in partnership with the *Institut National de Recherche en Santé Publique* (INRSP) to build and strengthen capacity of a cohort of staff with known competencies to train, supervise, and mentor laboratory technicians in accurate diagnosis of malaria. The primary goal is to have the cohort of INRSP staff support the NMCP to train, supervise, and mentor diagnostics experts in all regions, creating synergies with Global Fund interventions. With the widespread use of RDTs in both health facilities and the community, PMI continued support of training and supervision of health facility providers and ASCs on RDT use and interpretation. Additionally, through its case management partner, PMI has implemented Outreach Training and Support Supervision (OTSS), which is a quality assurance mechanism proven to be effective, to ensure that training directly contributes to improved quality of malaria diagnostics in the field.

With FY 2016 funding, PMI procured 3,000,000 RDTs for use at health facilities and for ASCs who test febrile children under five in the community. PMI supported 400 health workers to receive training in malaria diagnosis refresher training and outreach training and support supervision (OTSS). The most recent end-use verification (EUV) survey conducted at 86 facilities in five regions throughout Mali in August 2016 found that 96% of health workers had been trained in RDTs and 100% of laboratory technicians in microscopy. At the time of the survey, 95% of health facilities had RDTs in stock. With the removal of fees for RDTs in 2014 for all age groups, the percent of malaria cases that are diagnostically confirmed has improved from 10% in 2008 to 93% in 2016 according to an NMCP report.

During the last 12–18 months, PMI procured 2.3 million AL treatments for health facilities, iCCM, and pregnant women. PMI procured 96,000 treatments of injectable artesunate. PMI has been supporting

iCCM implementation, including initial and refresher trainings and regular supervision, in all districts of Bamako, Kayes, Koulikoro, and Sikasso Regions. In 2014 and 2015, PMI funded the implementation and evaluation of the effectiveness of SMC (which included coverage, adherence, cost implications, and impact on parasitemia, morbidity, and drug resistance) in the district of Kita in the Kayes Region, in approximately 100,000 eligible children aged 3–59 months. Preliminary results for year one are outlined in the operational research section. In 2018, PMI will support SMC in 12 districts in the regions of Kayes, Koulikoro, and Sikasso.

During the 2015 and 2016 transmission seasons, PMI supported a therapeutic efficacy study (TES) of first (AL) and second-line (AS/AQ) ACTs in the high-burden malaria rural communes of Kolokani (region of Koulikoro) and Sélingué (region of Sikasso). This study ended in early 2017. Children six months to five years of age with uncomplicated *P. falciparum* malaria have been randomized to receive one of the two treatments. A total of 120 children have been selected for each study arm. In addition to RDT confirmation and randomized ACT treatment, thick and thin blood smears will be prepared for each participant on days 0, 2, 3, 7, 14, 21, 28, 35, and 42 to assess asexual parasitemia and response to treatment. Parasite-positive samples were preserved on filter paper for subsequent genotyping to discriminate between reinfection from recrudescence, and for molecular testing for K13 markers at CDC. Among the 309 Day 0 samples successfully sequenced for the K13 gene, only one had a non-synonymous mutation. This mutation was A578S, which is not associated with artemisinin resistance. Among the 309 Day 0 samples successfully sequenced for the Pfmdr1 gene, 68 (27.1%) possessed a non-synonymous mutation: 6 with N86Y, 61 with Y184F, and 1 with D1246Y. For the recrudescence patients, all three had the NFD haplotype in the Day 0 samples. In the recrudescence samples, two of these had the NFD and one had the NYD haplotype. In summary, we observed no K13 mutations associated with artemisinin resistance and high efficacy of AL and ASAQ treatment in Sélingué, Mali. In this same study, recrudescence was observed in 3 of 309 subjects for a rate of 0.97%. Continued monitoring for molecular markers of resistance to ACTs is critical in complementing therapeutic efficacy studies and in providing timely evidence-based malaria treatment policies.

Table 10. PMI-supported Therapeutic Efficacy Studies

Completed TESs		
2016	Site name: Sélingué, Missira	Treatment arms: AL and ASAQ
	Sélingué: 449 Missira: 31	AL: 240 ASAQ: 240
Ongoing TESs		
2017	Site name: Sélingué and Missira	Treatment arms: AL, ASAQ, SP/ASAQ
	Sélingué: 240 (120 under AL and 120 under ASAQ) Missira: 240 (120 under AL and 120 under ASAQ) SP/ASAQ: Prospective monitoring	AL: 240 ASAQ: 240 SP/ASAQ: Molecular testing of parasitemic children during SMC
Planned TESs FY 2018		
2018	Site name: Sélingué, Missira,	Treatment arms: AL, ASAQ and SP/ASAQ
	Sélingué: 240 (120 under AL and 120 under ASAQ) Missira: 240 (120 under AL and 120 under ASAQ) SP/ASAQ: Prospective monitoring	AL: 240 ASAQ: 240 SP/ASAQ: Molecular testing of parasitemic children during SMC

Commodity gap analysis

All procurement activities, quantification, and consumption data were reviewed to determine PMI's commodity contribution for FY 2018. As part of the MOP writing process, quantification data for FY 2017 were re-examined to address immediate gaps. PMI and World Bank have committed to procuring all RDT needs, while the Global Fund will contribute ITNs for the mass campaign in Mopti and Kayes. The Global Fund, PMI and Global fund will contribute to fill the gap of ACTs. PMI will monitor donor contributions throughout the year, factoring in consumption data, and make necessary adjustments to ensure commodity gaps are filled.

Table 11: RDT Gap Analysis

Calendar Year	2017	2018	2019
RDT Needs			
Total country population	18,874,286	19,553,760	20,257,696
Population at risk for malaria ¹	18,874,286	19,553,760	20,257,696
PMI-targeted at risk population	18,874,286	19,553,760	20,257,696
Total number projected fever cases ²	5,056,984	5,338,017	5,629,590
Percent of fever cases confirmed with RDT	80%	80%	80%
Total RDT Needs³	4,045,587	4,270,414	4,503,672
Partner Contributions			
RDTs carried over from previous year	605,100	576,513	378,099
RDTs from MoH	0	0	0
RDTs from Global Fund	0	0	TBD
RDTs from other donors (World Bank and UNICEF)	1,017,000	572,000	552,750
RDTs planned with PMI funding	3,000,000	3,500,000	3,690,000
Total RDTs Available	4,622,100	4,648,513	4,620,849
Total RDT Surplus (Gap)⁴	576,513	378,099	117,177

¹100% of the population is the target population at risk for malaria. ²Total number of projected fever cases at the health facility and community level according to the number of fever cases per person, per year. These figures are derived from the March 2017 SIAPS quantification exercise. ³Total RDT needs for health facilities and iCCM are based on the gap analysis exercise led by NMCP for the development of the Global Fund concept note. ⁴Surplus or gap will vary depending on usage in SMC sites. Procurements may be modified as actual usage figures are known.

Table 12: ACT Gap Analysis

Calendar Year	2017	2018	2019
ACT Needs			
Total country population	18,874,286	19,553,760	20,257,696
Population at risk for malaria ¹	18,874,286	19,553,760	20,257,696
PMI-targeted at risk population	18,874,286	19,553,760	20,257,696
Total number projected malaria cases ²	3,206,651	3,320,228	3,391,315
Total ACT Needs³	3,206,651	3,320,228	3,391,315
Partner Contributions			
ACTs carried over from previous year	0	1,007,532	1,063,376
ACTs from MoH	0	0	0
ACTs from Global Fund	564,253	1,200,000	TBD
ACTs from other donors (World Bank and UNICEF) ³	1,349,930	1,176,072	0
ACTs planned with PMI funding	2,300,000	1,000,000	2,327,939
Total ACTs Available	4,214,183	4,383,604	3,391,315
Total ACTs Surplus (Gap)⁴	1,007,532	1,063,376	0

¹100% of the population is the target population at risk for malaria. ²Total number of projected fever cases at the health facility and community level according to the number of fever cases per person, per year. These figures are derived from the March 2017 SIAPS quantification exercise. ³Total ACT needs for health facilities and iCCM are based on the gap analysis exercise led by NMCP for the development of the Global Fund concept note. ⁴Surplus or gap will vary depending on usage in SMC sites. Procurements may be modified as actual usage figures are known.

Plans and justification

To support the NMCP and sustain the trend of increasing malaria diagnostic confirmation, PMI will procure nearly 3.7 million RDTs, complementing procurements from UNICEF and from the World Bank. RDTs will contribute to the needs at the health facility level and iCCM during the 2018–2019 calendar year periods. PMI also plans to procure 1.1 million treatments of ACTs to meet national needs. Other donors such as UNICEF and the World Bank have committed to procure ACTs, but PMI will monitor timely delivery of these commodities. If needed, PMI will address unexpected ACTs and RDTs needs.

It is important to note that USAID/Mali has identified four priority regions (Bamako, Kayes, Koulikoro, and Sikasso) for interventions; however, PMI has a national scope, so commodities procured by PMI can be used in any region of Mali. PMI will also contribute to the procurement of 3,200,000 treatments of the SP/AQ co-blister to meet the needs of the SMC campaign to cover 650,000 children under five for four rounds in ten districts.

Mali is transitioning from using injectable quinine to injectable artesunate for severe malaria. For 2018, there are estimated to be 3,320,228 million malaria cases, of which approximately 10% can be severe. Given the existing large supply of injectable artesunate currently at the central medical warehouse, and the concurrent use of existing injectable quinine until supplies are used up, PMI will cover roughly 48% of the national need and procure enough to cover 160,000 treatments of severe malaria. In addition, the GoM will procure a sizeable (though as yet unspecified) quantity of injectable artesunate. PMI will continue to provide support for refresher training and supervision on malaria case management at the health facility level, continuing support initiated with FY 2015 funds.

PMI will continue to support implementation of SMC in 12 districts in four focus regions, covering an estimated 650,000 children with four rounds of treatment with SP/AQ during the high-transmission season. PMI funding will cover the purchase of SMC drugs as well as implementation costs. PMI will continue to support implementation of the full package of iCCM in the four focus regions of Bamako, Kayes, Koulikoro, and Sikasso.

PMI will continue to support the dissemination of SBCC messages related to the importance of early diagnosis and treatment (for the general public), as well as appropriate clinical case management for healthcare providers. SBCC targeting community health workers will focus on prompt identification of severe malaria and referral for appropriate treatment.

Proposed activities with FY 2018 funding: (\$8,432,145)

- **Procurement of RDTs:** PMI will procure 3,690,000 RDTs to contribute to the RDT needs at CSCOMs and to supply ASCs as part of the national iCCM strategy. (\$2,055,000)
- **Procurement of ACTs:** PMI will procure 1,000,000 treatments of AL for the public sector. (\$1,100,000)
- **Treatment for severe malaria:** PMI will procure 160,000 treatments of injectable artesunate for treatment of patients with severe malaria at CSREF (and selected CSCOM) levels. The estimated annual need is more than 700,000 cases, according to routine reporting, but this is likely a large overestimate given over-diagnosis of severe malaria in Mali. (\$400,000)
- **Procurement of SMC treatments:** PMI will support the cost of covering 650,000 children under five years of age with four rounds of the SP/AQ co-blister for SMC. (\$1,317,145)
- **Implementation of SMC:** PMI will support the implementation of SMC in 12 districts. Implementation will include the costs of training, supervision, community mobilization, and distribution of drugs. (\$1,700,000)
- **Implementation of iCCM:** PMI will support iCCM implementation in the regions of Bamako, Kayes, Koulikoro, and Sikasso, while other donors, including UNICEF, the Global Fund, World Bank and the GoM will provide support for iCCM activities in the other target regions. PMI support for iCCM includes continued support to the malaria/fever component of the iCCM package, with new and refresher trainings at district levels, supportive supervision, training in appropriate RDT use, evaluating ASC performance with RDTs, monitoring and evaluation, and provision of ASC materials and supplies. PMI will support ASCs to provide appropriate health communications and SBCC messages to encourage understanding and adherence to current treatment algorithms. PMI will continue to support the NMCP to coordinate all community health implementing partners to ensure that community health materials (e.g., training modules, job aids, supervision protocols, and key messages) are reviewed and standardized across partners. (\$500,000)
- **Procurement of microscopes:** Procurement of microscopes and consumables to fill gaps in basic microscopy supplies (\$50,000)
- **Nationwide training and supervision for malaria case management:** After training health personnel at all levels in case management, PMI will continue to support the NMCP to conduct quarterly supervisory visits in order to maintain and strengthen the quality of services at multiple levels of the health delivery system. Particular emphasis will be placed on training and supervision for severe malaria case management. PMI will support improved and increased malaria diagnosis and case management in collaboration with the NMCP at national, regional, district, and community levels. (\$1,200,000)
- **Routine monitoring of the therapeutic efficacy of the first- and second-line malaria drug.** This study will be done in Kolokani (region of Koulikoro) and Sélingué (region of Sikasso). A total of 120 children have been selected for each study arm (AL and AS/AQ) (\$100,000)

- **CDC technical visit focused on case management, particularly severe malaria (\$10,000)**

b. Pharmaceutical management

The Mali supply chain system is a combination of push and pull as the central level pushes down to the regions, the community health center staff pulls health commodities from the district pharmacies, and ASCs obtain their health commodities from the community health centers (CSCOMs). Although the districts are responsible for collecting commodities from the regional level, PPM, with PMI support, delivers directly to the districts for immediate supply at lower levels. The regions order monthly from the central level, whereas hospitals are on an automatic system of quarterly ordering. The district pharmacies purchase drugs from regional depots based upon monthly orders from health facilities (CSREFs and CSCOMs) and the average number of drugs expected to be distributed within the district's catchment area. The PPM distributes malaria commodities per the distribution plan developed by the NMCP with the assistance of partners.

If a drug is unavailable in the regional PPM stores, private pharmaceutical warehouses can fill orders. Ideally, the CSCOMs keep at least one month of stock and the district drug depot (*dépôt répartiteur des cercles*) keeps a minimum of two months and maximum four months of stock. However, there are problems with drug storage at district depots related to storage capacity, temperature control, humidity, security, and drug classification in warehouses. While CSCOMs must collect all required drugs from the district pharmaceutical depots, there is no central funding to support the transportation and logistics at the lower levels and often the districts are stocked out or waiting for their request to be filled. The pull portion of the system still proves to be a hurdle, and commodities often do not reach the lowest levels of the health system. However, there have been noticeable improvements around following proper warehousing standard operating procedures and more timely distribution from the central level.

Although there is progress, some problems still hamper the Malian supply chain system and the ability to maintain adequate supply. Interaction among the different levels (national, region, district, and community) has improved, yet there is still a need for improved data and use, forecasting and communication. There are still some gaps around donor coordination and communication, which impacts building a smooth flow of commodities. At the CSCOM level, there is limited funding to pay and capacity for transportation to pick up needed commodities, leading to stockouts, even when there is available stock in country. A health commodity data platform (OSPSANTE) is now up and running and is bringing greater visibility to commodity needs while generating data for decision-making. The general reporting rate by facilities and warehouses has now reached 98%. Per this database, there has been a reduction in stockouts in 135 warehouses from 50% (2013) to 28% (2016) as the central, district, and facility level staff use OSPSANTE to manage and relocate stock to prevent stockouts and use commodities before they expire. OSPSANTE, the PPMRm, and EUV tools are all used together to complement each other and triangulate stock status information, particularly at the various levels. Although OSPSANTE is working well, it is still new and all tools will remain functioning while it continues to scale up. The three tools will be reviewed going forward to ensure usefulness and prevent duplication. Although data visibility and stock status have improved, stockouts remain, particularly at the facility level. Efforts need to continue to improve forecasting, order coordination, distribution of commodities and use of stock level data for possible re-distribution.

Finally, understanding the various effects of the Bamako Initiative such as potential disincentives around free commodities (pregnant women and children under five receive ACTs for free, now all populations receive free RDTs) needs to be further understood.

Regulation and drug quality: Several ministerial decrees provide guidelines for the management of pharmaceuticals in Mali. These include the formation of a national committee to oversee pharmacy retailers responsible for QC, inspection, and licensure and ensuring a basic package of pharmaceutical products. Adherence to standard operating procedures for pharmaceutical management is still a weakness, particularly at the lower levels of the health system. The National Essential Drug List is reviewed biannually. Laws are in place to ensure QC for imported drugs. The Directorate of Drugs and Pharmacies (*Direction de la Pharmacie et du Médicament [DPM]*) issues visas and import licenses only after the exporter meets certification and other requirements. The National Health Laboratory (*Laboratoire National de la Santé [LNS]*) samples drugs, verifies quality, and has regulatory authority to monitor pre- and post-market quality of drugs and other products, including insecticides and bed nets. The LNS checks the quality of all commodities that arrive at the PPM. Expired or poor quality medicines are destroyed at the national level, however there is no adequate incinerator and medicines are still burned out in the open, but far from populations. The DPM, the National Health Laboratory, and customs officials meet quarterly to discuss regulations and importation or donation of medicines.

Pharmacovigilance: Pharmacovigilance remains a priority of the NMCP and the MoH. The Pharmacovigilance Department at the DPM continues to work to implement their action plan and report adverse events, however there are still challenges to enforcing the plan.

NMCP/PMI objectives

A main component of the National Malaria Strategy (2013-2017) is to reach universal coverage of key malaria commodities, which cannot be achieved without consistent access and availability of essential malaria commodities through a functioning supply chain system. The NMCP and PMI plan to increase the availability of malaria commodities through a strengthened supply chain system and improved understanding and implementation of logistics and pharmaceutical management tools.

Progress since PMI was launched

The PPM manages, procures, and distributes medicines for Mali's primary health care system. The PPM stores and distributes commodities procured by the GoM and key donors such as PMI and the Global Fund. PPM delivers all commodities from the central level to the regional level, but lacks the capacity to ensure reliable transportation of commodities to the community level. The PPM has five regional warehouses in the regions of Kayes, Koulikoro, Mopti, Sikasso, and Ségou, and three offices in Gao, Koutiala, and Tombouctou. Warehousing for the multitude of commodities is inadequate but plans are now underway to move to a new larger warehousing space to improve meeting the countries health commodity needs. The GoM has approved the land for the new warehouse construction. Thanks to collaboration among many partners (U.S. Government, Global Fund, Netherlands Cooperation, and the GoM/PPM) the new pre-fabricated warehouse should be installed in 2017 and hopefully completed by 2018, allowing for the much needed expansion and more efficient management of health commodities, and cost savings to the PPM. In preparation for the move many warehousing operation procedure improvements have been implemented to support a smooth transition.

With USAID's support, the PPM developed its first strategic plan (2015-2019), which has fed into the mentioned PPM relocation, improved operating procedures, and resulted in smoother functioning of the PPM. Despite a *coup* and disruptions in funding availability from the Global Fund the pharmaceutical management, logistics and quality assurance system has shown improvement since PMI began supporting Mali in 2008. Due to an agreement with the PPM and increased trainings and supervision, commodities now flow past the regional level. Reporting systems have also improved allowing for more visibility and decision-making. The national laboratory is able to test and report on the quality of

malaria pharmaceuticals. Regular coordination meetings now occur among malaria partners regarding commodities and policies in order to make informed commodity and supply chain decisions.

Progress during the last 12-18 months

During the past year PMI continued to provide a significant portion of malaria commodities in concert with some Global Fund commodities (*please refer to quantities listed above in case management section*). PMI, along with multiple partners, continues to support the expansion and development of a larger and improved central medical store. The national technical coordination committee continues to meet quarterly to make supply chain decisions. Efforts to improve logistics reporting, commodity management, data analysis, and pharmaceutical management continues at the regional and district level through quarterly visits, supervision, and trainings. Over the past year USAID supported capacity building through training national coordination committee members and technical working groups on supply planning, OSPSANTE, quantification, and its relevant tools. The active engagement of civil society organizations grew to 26 which enhanced inclusiveness, transparency and accountability. Committee members are now able to use appropriate tools to collect and analyze information for decision making, coordination, and planning. As of August 2016, working groups updated 17 malaria supply plans and developed 23 malaria commodity distribution plans.

USAID continued to support the national laboratory and implementation of the national strategy and developed new laboratory quality management standard operating procedures. The program was able to conduct a laboratory capacity analysis, test report evaluation, sample review, and testing for the DPM and PPM. Six technical staff were trained in areas such as laboratory safety, proper documentation, WHO laboratory quality control and practices, and HLPC testing. A sampling plan was developed for the lab with a risk-based approach. In collaboration with LNS, DPM, and the NMCP, PMI supported the development of a sampling plan for post-marketing surveillance of antimalarial medicines available in the Malian market. The plan includes the District of Bamako, Koulikoro, Mopti, Segou, and Sikasso. Delays in funding led to delays in monitoring from the drug quality monitoring sentinel sites, however samples from the sentinel sites were being collected at the time of writing and results of the sample screenings will be available late spring 2017.

Plans and justification

PMI will continue to strengthen supply chain, logistics, and pharmaceutical management including forecasting, quantification, training, supervision, and monitoring stocks and malaria commodity needs/gaps. PMI will work with the NMCP, the MoH, the PPM, and appropriate partners to continue to implement the new strategic plans of the PPM and the Laboratory for Bio-molecular Analysis at the University of Bamako (LBMA). PMI will continue to support the coordinating committee led by the DPM with the participation of the NMCP, the PPM, and supply chain partners to improve the quantification and distribution of malaria commodities. PMI will also contribute to strengthening the LMIS system for better data availability and use for decision-making and finalization of the new central warehouse.

PMI will continue support to the national laboratory in concert with the DPM to implement drug quality assurance and improve capacity at the national laboratory. PMI will continue to support the sentinel sites and the pre- and post- market surveillance analysis.

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

- **Supply chain and logistics strengthening:** PMI will continue to provide technical assistance for pharmaceutical management, including forecasting commodity needs; and improved

coordination between the NMCP, PPM, and relevant partners such as the Global Fund, through organizations such as the national medicines body. Pharmaceutical and supply chain strengthening activities will include training and supervision in pharmaceutical management, national guidelines, standard operating procedures, quantification and monitoring availability of key antimalarial commodities at the national, district, facility, and community levels. PMI will also continue to support the OSPSANTE tool, the procurement planning and monitoring report for malaria (PPMRm) and two end-use verification exercises annually in order to track the availability of essential malaria commodities at the health facility level. (\$600,000)

- **Quality assurance and quality control of antimalarials:** Strengthen capacity in quality assurance and quality control of antimalarials via increased training at the National Laboratory of Health, support for the finalization, validation, and implementation of the five-year strategic plan, repairing of equipment, and continued supervision of MQM sites. The Drug Regulatory Direction of the MoH will continue to receive support to improve the alert and response system around counterfeit and substandard medicines. (budgeted under HSS section)

4. Health system strengthening and capacity building

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

NMCP/PMI objectives

The NMCP objectives for health system strengthening include expanding their ability to train and supervise providers in the field, improving the quality of information available to the NMCP for program management and reporting, and improving the physical working conditions at the NMCP office in Bamako.

Progress since PMI was launched

Through its partners, PMI has worked to strengthen the health surveillance system, the supply chain and pharmaceutical management system, and the capacity of the national laboratory. PMI and partners have also worked to improve the ability of health workers to manage and treat malaria at all levels with a particular focus at the community level. The coordination of malaria program activities across multiple partners continues to improve as evidenced by the successful and now national implementation of the complex SMC intervention, improved warehousing and distribution procedures at the central medical store, growing laboratory capacity, and improved data use.

PMI supported the evaluation of the HMIS at the national and community levels in 2015 which identified the need for a formal revision of the system and implementation of the DHIS2 platform. Since then, PMI has continued to work with the HMIS Division of the MoH and other donors to implement the new DHIS2 platform. Since its launch in Mali, PMI is working with the MoH and partners to improve the coverage of health interventions through the development and implementation of new strategies including iCCM and SMC. Mali is now regularly using the USAID-developed health commodity dashboard to support evidence-based decision-making.

Progress during the last 12-18 months

During the past 12-18 months, PMI has been working on strengthening capacity and management at the national laboratory. Current surveillance activities involve collecting samples from seven sentinel sites, two times per year, and rely entirely on local capacity with no external technical assistance. These collections were delayed this year due to funding delays.

The national laboratory still faces challenges such as limited resources and trained staff, high staff turnover, and minimal capacity in the quality assurance unit. Through support from PMI, the NMCP continues to participate in supervision visits and leads the quarterly malaria commodity quantification and forecasting meetings.

PMI supported the strengthening of the supply chain system and case management through continued training and supervision of staff and use of tools such as the EUV and the PPMRm and support of the OSPSANTE dashboard. The dashboard can capture, track, aggregate, and disseminate information about malaria, family planning, and maternal and child health commodities to support evidence-based decision-making. Additional training of decision makers and data managers at national, regional, and district levels on the tool continues.

PMI has been supporting the roll-out of the DHIS2 platform for routine information and the inclusion of a malaria module in that system. This system was first deployed in early 2016 at the regional and provincial levels (except Kidal for security reasons) and later extended to all districts. As of April 2017, the DHIS2 was deployed in 100% of the districts in Mali, and 75% of the health facilities. A malaria-specific dashboard was created which incorporates key indicators for reporting at the national level. An analysis at the provincial level showed that six provinces had data completeness rates between 90-100%. Several staff from the NMCP were trained as administrators of the system and since October 2016, the NMCP has been producing monthly malaria bulletins which track key reporting indicators.

Plans and justification

PMI will focus on building technical and managerial capacity at all levels of the health care system, both through implementing partners and support to the NMCP. Most inputs in training, supervision, and operational support are described elsewhere in the MOP.

Proposed activities with FY 2018 funding: (\$300,000)

- **Quality assurance and quality control of antimalarials:** Strengthen capacity in quality assurance and quality control of antimalarials via increased training at the National Laboratory of Health, supporting the implementation of the five-year strategic plan, repairs of equipment, and continued supervision of the drug quality sentinel sites including the training and fieldwork for sample collection. *(\$250,000)*
- **NMCP capacity building:** Assist the NMCP for operations and strengthen functions. Assist NMCP's day-to-day operations and ability to work closely with PMI and implementing partners by funding travel for supervision visits, attendance at conferences, and participation in trainings. Also support functionality of the new NMCP office, (construction is almost complete), such as providing needed office equipment, internet connection, a power generator, computers, and other office supplies. *(\$50,000)*

Table 13: Health Systems Strengthening Activities

HSS Building Block	Technical Area	Description of Activity
Health Services	Case Management	Through training and supervision, PMI improves QA/QC systems to monitor the quality of laboratory and diagnostic services.
Health Workforce	Health Systems Strengthening	PMI strengthens knowledge and capacity of the health workforce in the areas of pharmaceutical management, laboratories and diagnostics, treatment, communications, and monitoring and evaluation through the various activities implemented by PMI and USAID partners. PMI continues to support the functioning of the pharmaceutical coordination committee meetings, the MIP working group, and the national RBM meetings.
Health Information	Monitoring and Evaluation	PMI strengthens disease surveillance systems to improve decision-making, planning, forecasting, and program management.
Essential Medical Products, Vaccines, and Technologies	Case Management	PMI supports improved forecasting, procurement, quality control, storage and distribution of malaria commodities, such as ITNs, ACTs, and RDTs.
Leadership and Governance	Health Systems Strengthening	PMI builds NMCP technical and managerial capacity through training and technical assistance, as well through supervision and support from implementing partners. PMI will also provide support, through the NMCP and partners, to strengthen coordination of malaria interventions, pharmaceutical regulation, development of guidelines and policies, and improve quality of services.

5. Social and behavior change communication

NMCP/PMI objectives

PMI supports the development, dissemination, and practical implementation of Mali’s national SBCC strategy (published with PMI support in 2015). The current strategy, which expires in 2018, focuses on expanding public and healthcare provider awareness of key malaria control interventions, with a specific focus on IPTp and ITN use for pregnant women, SMC for children aged 0-59 months, early diagnosis and treatment, year-round ITN use, and quality control for diagnostics. The strategy is divided into five communication approaches: interpersonal/counseling, community mobilization, media outlets, advocacy, and social mobilization. Different channels such as radio and television, brochures/pamphlets, job aids, skits/songs, and “champions” are used to promote desired behaviors, skills, and practices. Donor-supported SBCC activities are coordinated (with PMI support) by the NMCP and the National Center for Information, Education, and Communication for Health. Looking ahead to the implementation period for this FY 2018 MOP, PMI’s implementing partner will begin to prepare the groundwork for a revised national strategy in addition to continuing to support routine SBCC activities.

Other donors with whom PMI will continue to collaborate on SBCC issues include the Global Fund's principal recipient (Population Services International [PSI]).

Progress since PMI was launched

There is now a malaria-specific line item in the GoM's health budget. A policy dialogue tool on malaria, pregnancy, and Islam, developed with PMI support, has been used with the Islamic Network for Child Survival, the Islamic Network for Population Development, and the National Union of Muslim Women. The tool is based on passages from the Koran that encourage dialogue among couples about malaria and pregnancy. Through advocacy efforts, PMI supported the development of messages on malaria-specific topics to be used by imams during Friday prayers.

PMI SBCC efforts have contributed to maintaining high ITN use among the general population, increasing IPTp2 use from 4% in 2006 to 38% in 2015, and increasing RDT use from 47% in 2012 to 93% in 2016. It remains important to note that more SBCC work is needed to increase the proportion of women who receive three or more doses of SP for IPTp.

Progress during the last 12-18 months

PMI supports SBCC activities in five regions (Bamako, Gao, Kayes, Koulikoro, and Sikasso). These five regions represent approximately 78% of Mali's national population. All SBCC activities are implemented through an integrated USAID health promotion mechanism. SBCC activities have focused on four primary technical areas: malaria in pregnancy, malaria case management, SMC, and IPTp. Specific SBCC activities have focused on promoting the distribution and use of ITNs (especially among pregnant women); expanding demand for and use of SP for IPTp; mobilizing families to enroll children aged 0-59 months in SMC, and strengthening health care providers' capacity to diagnose malaria and correctly prescribe treatments. Additional assistance is provided at the national level to support the development and revision of national guidelines and policies and to support the coordination and harmonization of SBCC activities by various donors and implementing partners.

Over the last 12-18 months, PMI support has contributed to the implementation of the following activities:

- Seasonal malaria chemoprevention (SMC): Development and distribution of 300 job aids for healthcare workers, parents, and supply chain managers; SMC training for nearly 539 community leaders in 10 health districts (Bafoulabé, Kayes, Kita, Ouassoubidiagna, and Yelimané in Kayes Region; and Kignan, Kolondieba, Niéna, Selingué, and Sikasso in Sikasso Region); and mobilization of 2,446 town criers in 10 districts to convey SMC messages.
- Malaria in pregnancy (MIP): Development of radio messages to encourage pregnant women to attend ANC early. In addition 3,000 job aids will be printed and distributed nationwide with support from PMI and the Global Fund.
- Case management: Six algorithms on malaria case management were pre-tested with health workers.
- Intermittent preventive treatment of malaria in pregnancy (IPTp): Radio and TV spots, and posters were designed and broadcast. A total of 412 traditional healers, including 351 men and 61 women, were trained on early referral for pregnant women.
- M&E: A survey to collect baseline data for the project evaluation was conducted, and plans were begun for a mid-term evaluation in 2017. The M&E activities focus on assessing campaign reach (for interpersonal, small group, and mass media channels), how messages are received by the audience (e.g., understanding, clarity, perception of messages), and changes in knowledge, attitudes, and behaviors resulting from the SBCC activities. The project also coordinates with the M&E partner to triangulate health care utilization data from the HMIS before, during, and after the campaigns.

A memorandum of understanding with a large consortium of public radio stations was signed in 2016 to develop, test, and broadcast public service announcements for radio and television. At the national level, PMI's implementing partner also provided direct technical assistance to the NMCP's SBCC team. This included support for routine operations (e.g., revision and dissemination of national guidelines) and specialized assistance to expose NMCP staff to international SBCC meetings.

Plans and justification

PMI's SBCC strategy in Mali will continue the integrated approach to SBCC with other health interventions with messages tailored to specific issues and audiences (e.g., pregnant women or caregivers of children less than five years old). Proven approaches (e.g., job aids and supportive supervision) and channels (e.g., radio) will continue to anchor PMI-supported SBCC activities. Specific activities for SBCC by intervention area include:

- **SBCC for ITNs:** Support for routine SBCC activities will continue to reinforce the correct and consistent use of ITNs throughout the year. These activities will contribute to addressing reduced ITN use during low transmission seasons. Specific contributions will include support for messaging on correct hanging, use, and maintenance of nets, as well as information about how individuals' use of ITNs year-round contributes to local and national malaria control objectives. Messages will continue to be disseminated via a variety of validated channels, including door-to-door messages disseminated by ASCs and *relais* in their communities, radio, professional job aids, and community theater. PMI will also maintain support for SBCC activities before, during and after rolling ITN distribution campaigns to increase the use of newly distributed nets by all age groups.
- **SBCC for MIP:** PMI will continue to support a multichannel strategy targeting pregnant women, women of child-bearing age, and men, to increase the uptake of three or more doses of SP for IPTp, one at each ANC visit after the first trimester. Additional SBCC interventions will focus on raising awareness among women about the risks of malaria during pregnancy, the importance of early and frequent ANC attendance, the benefits of three or more doses of IPTp at every ANC visit, and the role of ITNs in the prevention of malaria. Other SBCC messages will focus on ensuring that healthcare workers understand the importance of completing the recommended course of SP for IPTp (including direct observation of each dose), and do not charge pregnant women for ITNs or SP for IPTp (both of which are free under the national policy). Demand-creation activities will also be continued to increase ANC attendance and other health-seeking behaviors. PMI will continue to link SBCC activities with other health sector messaging, where appropriate.
- **SBCC for case management:** PMI will continue to support the dissemination of SBCC messages related to the importance of early diagnosis and treatment (for the general public), as well as appropriate clinical case management for healthcare providers. Mass media and interpersonal communication, and community mobilization strategies will be applied as appropriate. Community health workers (ASCs and *relais*) will also continue to receive capacity-building support to educate caregivers on signs of severe malaria that require prompt referral.
- **SBCC for SMC:** PMI will support messages and communications for SMC, focusing on attendance, drug adherence, and returning for all rounds. These activities will include message boxes for community dialogues and orientation days for community leaders/traditional healers.

Lastly, PMI will continue to support and participate in World Malaria Day activities.

Proposed activities with FY 2018 funding: (\$300,000)

The following activities will be continued with FY 2018 funding:

- **SBCC for ITNs:** Support for messaging on correct hanging, use, and maintenance of nets, as well as information about how individuals' use of ITNs year-round contributes to local and national malaria control objectives. (\$75,000)
- **SBCC for MIP:** PMI will continue to support a multichannel strategy targeting pregnant women, women of child-bearing age, and men, to increase the uptake of three or more doses of SP for IPTp and raising awareness among women about the risks of malaria during pregnancy, the importance of early and frequent ANC attendance, the benefits of three or more doses of IPTp at every ANC visit, and the role of ITNs in the prevention of malaria. PMI will continue to link SBCC activities with other health sector messaging, where appropriate. (\$75,000)
- **SBCC for case management:** PMI will continue to support the dissemination of SBCC messages related to the importance of early diagnosis and treatment (for the general public), as well as appropriate clinical case management for healthcare providers. (\$75,000)
- **SBCC for seasonal malaria chemoprevention (SMC):** PMI will support messages and communications for seasonal malaria chemoprevention, focusing on attendance, drug adherence and returning for all rounds. (\$75,000)

At the national level (funds will be drawn for this activity from all three technical areas broken out above), PMI will support the implementation of the revised national SBCC strategic plan, which will be finalized in 2018. PMI will also continue to support the NMCP to coordinate SBCC activities and ensure harmonization of activities by all external and domestic stakeholders.

6. Surveillance, monitoring, and evaluation

NMCP/PMI objectives

Monitoring and evaluation is a key component of Mali's national malaria strategy, and the NMCP is focused on ensuring there is a coordinated plan for malaria data capture to inform programmatic interventions and measure outcomes and impact. A national malaria M&E plan covering the years 2007-2011 was developed, costed, and adopted in 2008, and an updated M&E plan for 2013-2017 was later put into place. The current plan includes routine data collection and analysis through the national health information system, or SLIS; a system for epidemic surveillance and response (ESR) in the North, and periodic national surveys to evaluate malaria prevention and treatment activities. PMI supports the NMCP's M&E strategy through its continued support for routine system strengthening, ESR, cross-sectional surveys, and internal M&E capacity building. As the NMCP begins the process of developing a revised strategy for 2018-23, PMI will provide support through the Resident Advisors and HQ staff as necessary.

Progress since PMI was launched

Routine system strengthening: PMI has supported enhancements to the malaria portion of the routine information system for several years to increase the timeliness and quality of the malaria component of the SLIS. These enhancements included revisions to the reporting forms for the malaria sections, conducting training and supervisory activities, improving the technology infrastructure, and implementing an SMS reporting system in selected districts. The system started in 2011 with Ségou and Bamako Districts (Commune 1V), expanded to the Mopti District in 2013 (26 CSCOMs/1 CSREF) and to the rest of Mopti Region in 2014 (142 CSCOMs/CSREFs). A mobile data transmission system (using SMS) was implemented in selected districts. The system allows the NMCP to have access, via a website, to monthly data on epidemiologic indicators for each of the implementation districts covering around 6 million people. In FY 2015, the Ministry of Health took the decision to implement a DHIS2 system for their national routine data. USAID, and other donors, have supported the work, and PMI has provided support for the integration of the 'stand-alone'

malaria system into the national DHIS2. The integration and expansion of the DHIS2 has been ongoing since January 2016.

Household surveys: Population-based surveys currently provide the most accurate data on malaria intervention coverage and malaria biomarkers (i.e., anemia and parasitemia). Following a DHS in 2006, a PMI-supported national anemia and parasitemia (A&P) survey conducted in 2010 provided the first parasitemia measures in Mali (see below for national estimates of anemia and parasitemia). Another DHS, including parasitemia, was conducted in 2012 which showed increased levels of coverage for key interventions, and a corresponding decline in child mortality rates. However, the survey results also indicated continued high malaria prevalence. Results reflect high transmission season estimates and showed that 52% of children 6-59 months of age were parasitemic by microscopy. These high levels of parasitemia were likely due in part to the population displacements during the 2012 crisis, when large numbers of people from the low-transmission areas of the North migrated to the endemic regions of the South. An MIS conducted in 2015 showed that 36% of children under five were parasitemic, confirming that malaria prevalence has substantially decreased in the intervening years (data shown in Strategy section, under *Progress on coverage/impact indicators to date*).

Progress during the last 12-18 months

Over the past two years, PMI has supported the integration of the malaria-specific routine information system into the new DHIS2 system. The GoM launched a project to implement a new DHIS2 system in December 2015. The project began at the regional level with a training of trainers and used a cascade approach to train additional staff as the system rolled out at lower levels of the health system. In early 2016, the system was deployed at the regional and provincial levels (except Kidal for security reasons). Through this training, two members of the M&E team at the NMCP were trained as DHIS2 administrators. In late 2016 and early 2017, the system was extended to all districts. As of April 2017, the DHIS2 was deployed in 100% of Mali's districts, and 75% of health facilities. Throughout this process, a series of six customization workshops were held, to ensure that the system captured critical data across all health areas, including malaria. A malaria-specific dashboard was created which incorporates key indicators for reporting at the national level. An analysis at the provincial level showed that 6 of 8 provinces had completeness rates between 90-100%. Bamako had lower completeness rates due to some issues in equipping some facilities with computers. Gao and Kidal had lower completeness rates due to the insecurity of region. Since October 2016, the NMCP has produced monthly malaria bulletins tracking key reporting indicators. PMI has also supported an epidemic surveillance system in the North, which was slow to start due to funding issues, but began in 2017.

PMI also supported the establishment of a malaria M&E technical working group to provide further advice and direction to M&E activities in the country. The group is led by the NMCP, with participation from PMI, Global Fund, and other malaria stakeholders. The group was formally established in January 2017 and held its first meeting in March 2017, with plans for quarterly meetings thereafter.

PMI is also supporting capacity development in M&E for NMCP staff. One staff member was supported for a malaria-specific DHS data analysis workshop, and 3 staffers (1 PMI supported, 2 Global Fund supported) were selected to attend a Malaria M&E workshop in the summer of 2017.

The table below shows the main sources of data and sequence of surveys for malaria program monitoring and impact evaluations.

Table 14. Surveillance, Monitoring, and Evaluation Data Sources

Data Source	Survey Activities	Year										
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
Household surveys	Demographic Health Survey (DHS)			X							X	
	Malaria Indicator Survey (MIS)						X					
	MICS*	X										
	Anemia & Parasitemia Survey	X										
Health facility and other surveys	Health Facility Survey			X								
	EUV survey			X	X	X	X	X	X	X	X	X
Malaria surveillance and routine system support	Epidemic malaria surveillance system in Northern Mali					X	X	X	X	X		
	Enhanced malaria reporting system	X	X	X	X	X	X					
	Support to HMIS						X	X	X	X	X	
Therapeutic efficacy monitoring	<i>In vivo</i> efficacy testing of first/second line drugs								X			X
	SP resistance monitoring										X	
Entomology	Entomological surveillance and resistance monitoring	X	X	X	X	X	X	X	X	X	X	X
Other data sources	Malaria Impact Evaluation							X				

*Not funded by PMI

Plans and justification

With FY 2018 funding, PMI will continue to support the malaria components of the DHIS2 especially at the CSCOM and CSREF levels in Mali to improve malaria data quality and use. This activity will support training and quality control/timeliness for completion of routine SLIS reporting forms, assist in analysis and feedback on malaria indicators and promote use of findings at all levels to improve program performance. PMI funds will also support M&E capacity development at the NMCP, including the development of a national-level M&E workshop in Mali. The workshop will be developed in conjunction with the NMCP and will focus on district-level use of data from the newly rolled out DHIS2.

Proposed activities with FY 2018 funding: (\$700,000)

- Routine system strengthening:** Continue support for the DHIS2 to improve malaria data quality and use. This activity will support training, DQA activities, analysis and production of malaria bulletins, and use of the data for program improvement. These funds will also support M&E training for NMCP/MOH staff at both national and subnational levels. (\$700,000)

7. Operational research

NMCP/PMI objectives

The NMCP and PMI share a common goal of conducting operational research to answer specific questions regarding the implementation and effectiveness of critical interventions. The OR studies proposed for support by PMI are identified jointly and designed to respond to key information needs in the NMCP's National Strategic Plan.

Progress since PMI was launched

Since the launch of PMI in Mali in 2008, multiple studies have been conducted in Mali that have helped inform malaria control and prevention activities. In October 2008, a mixed-method evaluation was conducted to: (1) evaluate the validity of the expanded program on immunization contact method as a tool for monitoring bed net usage and treatment of common childhood illnesses by comparing data collected using the EPI contact method to that collected during baseline and follow-up representative cross-sectional household surveys; and (2) evaluate the effectiveness of the EPI contact method as an intervention to improve bed net use and the appropriate treatment of common childhood illnesses. One intervention district (EPI-contact method) and one comparison district were selected in the Ségou Region, and both qualitative (key informant interviews, exit interviews, and focus groups) and quantitative methods (baseline and follow-up surveys) were used. The primary outcome measures were determinants of ITN use and appropriate treatment of fever in children. Results showed that the EPI contact method did not produce consistent measures of ITN utilization on a monthly basis. Health workers felt the EPI contact method lengthened the waiting time for vaccination. Observations and focus groups identified poor ITN durability as a concern and mothers' impressions that ITNs last approximately six months³. Results of the validity comparison of the EPI contact method and household survey data showed that the EPI contact method did not produce reliable estimates of health behaviors⁴.

From 2009 to 2010, a study was conducted to develop a dry season malaria vector control strategy in the Sudan savannah areas of Mali. A pre-test/post-test design was implemented to assess the impact of the IRS performed in eight Niger River bank hamlets on malaria transmission parameters of two larger villages located 2-3 kilometers from the river. Monthly entomological monitoring through the rainy season was conducted following the IRS campaign to measure entomological indicators of malaria transmission. Results from 2009 showed some reductions in *Anopheles* densities per house in two of the three IRS river hamlets (Dangassa-Somonosso and Bozokin) but little difference in a third (Fourda). Similarly, *Anopheles* biting rates were reduced in Dangassa-Somonosso but not in the other two IRS river hamlets. No reductions in *Anopheles* densities or biting rates were seen in inland villages. Results in 2010 were more positive but also mixed. The IRS-treated hamlets showed significant reductions in resting densities, biting rates, and entomological inoculation rates during the first three months; clearly demonstrating the effectiveness of IRS. After three months however, mosquito densities, biting rates, and entomological inoculation rates quickly returned to pre-intervention levels. Cone assays performed on sprayed walls showed that ICON 10 CS (lambda-cyhalothrin) lasted only 3-4 months before activity fell well below 80% mortality thresholds; the different microclimates and interior household characteristics may explain results that diverge from the IRS districts where lambda-cyhalothrin remained active for 6 - 8 months. In addition, resistance to pyrethroids was detected at high levels in the

³ Wei SC, Vanden Eng JL, Patterson AE, *et. al.* 2012. Effect of the expanded program on immunization contact method of data collection on health behaviors in Mali. *JID*, 205: S103-11.

⁴ Wei SC, Vanden Eng JL, Patterson AE, *et. al.* 2012. Validity of expanded program on immunization contact method health behavior estimates in Mali. *JID*, 205: S112-19.

study area (only 50% and 56% mortality in WHO assays for permethrin and lambda-cyhalothrin, respectively).

Another vector control intervention was conducted in 2009 to determine the added benefit of larviciding water sources surrounding houses that received IRS compared to houses that received only IRS. Larval control, mosquito densities, sporozoite rates, and entomological inoculation rates were assessed before and after the intervention in 2-3 villages in each arm (IRS only and IRS+larviciding) in 2009 and 2010. In both years, there was a highly significant reduction in larval breeding activity in the villages with larviciding compared to IRS only villages; in 2009 entomological measurements varied widely by location so overall there was no difference seen between intervention arms; however, in 2010 significant differences were seen in resting densities, biting rates, sporozoite rates, and entomological inoculation rates between intervention arms. Investigators concluded that some benefit was seen with larviciding combined with IRS compared to IRS alone.

A USAID centrally-funded study was conducted to estimate the financial implications of removing malaria user fees (consultation, laboratory diagnosis, drugs) for children under five in primary care level/private nonprofit facilities (CSCOM) and first level public facilities (CSREF) in Mali and on third party payers. Facility and patient exit surveys, in-depth interviews, and a costing model were conducted in 40 health facilities. There was consensus among providers and stakeholders that the removal of fees was important to increase access to care, especially among the poor and the majority rural population, and decrease infant mortality. However, several concerns/challenges included potential substantial financial losses to facilities, increase in demand for services and abusive increase in utilization, which risk overcrowding health facilities, decreased quality of care, and the absence of a coherent framework that identifies real costs and proper financing mechanisms and sources. There were also strong practical objections to the removal of only malaria user fees such as being a non-feasible option, and a desire to remove all under-five user fees. According to the costing model, total estimated losses to primary care and first level reference health facilities in Mali ranged between 0.34 billion CFA and 0.45 billion CFA (approximately \$0.72 million and \$0.95 million), depending on utilization changes. Total estimated costs to a third-party range between 1.1 billion CFA and 1.6 billion CFA (approximately \$2.33 million and \$3.4 million). The higher figures equal 2.4% of the Ministry of Health's 2009 approved budget.

Table 15. PMI-funded Operational Research Studies

Completed OR Studies			
Title	Start date	End date	Budget
A mixed-methods evaluation of the expanded program on immunization contact method as both a monitoring tool and intervention for malaria control and prevention in Mali.	10/2008	10/2009	\$185,000
Development of a pilot dry season vector control strategy in Mali.	06/2009	06/2010	\$80,000
Integrated vector management: Interaction of larval control and IRS on <i>Anopheles gambiae</i> density and vectorial capacity for human malaria.	06/2009	12/2010	\$110,000
The financial implications of removing user fees for malaria treatment for under-five children in Mali.	09/2010	06/2011	\$150,000
Evaluation of seasonal malaria chemoprevention (SMC) pilot in Kita District, Mali.	07/2014	04/2016	\$314,000
Ongoing OR Studies			
Title	Start date	End date	Budget
A field study comparing the impact of new ‘combination’ long-lasting insecticidal (mosquito) net products on entomological measures of malaria transmission: Olyset Plus® and PermaNet 3.0® versus their conventional ITN analogues: Olyset® and PermaNet 2.0®.	06/2013	12/2016	\$433,000
Planned OR Studies FY 2016			
Title	Start date (est.)	End date (est.)	Budget
Increasing IPTp uptake through enhanced antenatal clinic service delivery to improve maternal and child health.	7/2017	7/2019	\$400,000

Progress during the last 12-18 months

During the last 12-18 months, two OR studies have made significant progress:

Combination ITNs: The field study examining the effects of new ‘combination’ ITN products on entomological measures of malaria transmission and ITN integrity began in June 2013. Vector populations from candidate study villages were screened to confirm the presence of elevated mixed function oxidases (the resistance mechanism targeted by the ‘combination’ nets). Starting in October 2013, monthly vector collections were conducted to establish baselines. ITNs were distributed in February–March of 2014 and data collection is ongoing (see Other relevant evidence on progress, Vector Control).

SMC: The baseline survey to measure prevalence of anemia and parasitemia in children ages 3-59 months in the intervention (SMC) and comparison districts was conducted July 23 – August 2, 2014. Prevalence of fever and parasitemia were similar in intervention (23.4%) and control (29.5%) districts prior to SMC (p=0.34). After SMC, parasitemia prevalence fell to 18% in the intervention district and increased to 46% in the control district (Difference-in-differences (DD) OR=0.35; 95% CI: 0.20-0.60). SMC also significantly reduced the odds of malaria disease (DD OR=0.20; 95% CI: 0.04-0.94) and moderate anemia (Hb<8 g/dL) (DD OR=0.26, 95% CI: 0.11-0.65). Rounds 1 – 4 of SMC adherence

surveys were completed in November 2014. Results showed that the proportion of children who received SMC drugs at least on day one, dropped from 82% in Round 1 to 68% in Round 4. The proportion of children who received SMC drugs on days two and three at home remained high (>90%) between rounds one to four. The results of this study have been presented at ASTMH and a manuscript is currently under review at the British Medical Journal.

IPTp: Despite ongoing PMI support of malaria in pregnancy activities, IPTp uptake has been low. Utilization of ANC services is moderate, but the 2012-2013 DHS reported the proportion of women who received two or more doses of IPTp during their last pregnancy at 20%, well below the PMI targets for IPTp. The NMCP is committed to the new WHO policy on providing pregnant women with a minimum of three doses of IPTp. Preparedness for national level implementation is underway, however in order to effectively implement this new policy the barriers identified in empirical studies in the country must be addressed. These multi-faceted barriers suggest a significant missed opportunity to deliver effective ANC services and IPTp. Given the logistical, practical, and financial challenges together with the context of Mali just emerging from a profound socio-political crisis, sound evidence is needed to provide the best opportunity for the successful implementation of the new IPTp policy. Specifically, PMI will test an enhanced intervention package which combines intensive training (including simulated ANC consultations) and job aids, with regular and specific supervision to improve provider behaviors around IPTp dispensing. This enhanced package will be tested on its own, and with a program of community mobilization, and compared against districts receiving routine ANC activities. This study was delayed due to administrative difficulties in transferring the funding, but is slated to start in mid-2017.

Plans and justification

Mali is currently one of two countries (together with Senegal) where PMI is actively supporting SMC interventions. In both countries, the SMC program has shown great success, contributing to major declines in incidence and prevalence of malaria in children under five. However, examination of routine surveillance data has shown that malaria cases continue to be a major issue in children aged 5-10 years old. Senegal has had some success extending their program to age 10, however the body of evidence for the feasibility, cost-effectiveness, and impact of adding these additional age groups is very limited. The GoM is interested in this extension as a way of tackling the persistently high parasitemia rates in the country. However, the PMI team feels such an extension merits an OR pilot before making final decisions on national policy. This study will also add to the global body of evidence around effective implementation of SMC in the Sahel. The study was approved by the PMI OR committee in early 2017 (as part of the FY 2017 MOP) and will begin implementation in July 2017 with the start of SMC administration.

Proposed activities with FY 2018 funding: (\$250,000)

- **Evaluation of the value-added of extending SMC to age 10:** This funding will support the second year of a two-year OR activity to evaluate the feasibility and impact, including cost implications, of extending SMC interventions to children up to age 10. (\$250,000)

8. Staffing and administration

Two health professionals serve as Resident Advisors (RAs) to oversee PMI in Mali, one representing CDC and one representing USAID. In addition, one or more Foreign Service Nationals (FSNs) work as part of the PMI team. All PMI staff members are part of a single interagency team led by the USAID Mission Director or his/her designee in country. The PMI team shares responsibility for development and implementation of PMI strategies and work plans, coordination with national authorities, managing

collaborating agencies and supervising day-to-day activities. Candidates for RA positions (whether initial hires or replacements) will be evaluated and/or interviewed jointly by USAID and CDC, and both agencies will be involved in hiring decisions, with the final decision made by the individual agency.

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

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

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

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

Proposed activities with FY 2018 funding: (\$1,236,855)

- CDC technical and administrative support (\$310,855)
- USAID technical and administrative support (\$926,000)

Table 1: Budget Breakdown by Mechanism**President's Malaria Initiative – MALI
Planned Malaria Obligations for FY 2018**

Mechanism	Geographic Area	Activity	Budget (\$)	%
GHSC-PSM	National	Commodity procurement	\$9,924,145	45%
SSGI	4 regions	Service delivery	\$2,950,000	13%
TBD-IRS	4 districts	IRS activities	\$4,265,000	19%
CDC-IAA	National	CDC Resident Advisor and technical assistance	\$349,855	2%
TBD-Supply chain partner	National	Supply chain strengthening	\$600,000	3%
TBD-New Service Delivery Award	National	Case management technical assistance	\$1,450,000	7%
TBD- Environmental Management	1 region	External environmental compliance assessment	\$35,000	0%
GHSC-PSM USP/PQM (LBMA)	National	Laboratory quality assurance/quality control	\$500,000	2%
KJK (BCC bilateral)	4 regions	SBCC activities	\$300,000	1%
Measure Evaluation	National	M&E activities	\$700,000	3%
USAID	National	Staffing and administration	\$926,000	4%
Total			\$22,000,000	100%

Table 2: Budget Breakdown by Activity

**President’s Malaria Initiative – MALI
Planned Malaria Obligations for FY 2018**

Proposed Activity	Mechanism	Budget (\$)		Geographic Area	Description
		Total	Commodity		
PREVENTIVE ACTIVITIES					
VECTOR MONITORING AND CONTROL					
Entomologic monitoring and insecticide resistance management					
Entomological monitoring	TBD-IRS	300,000		15 sites	Conduct routine entomological monitoring activities including former IRS areas (7 sites). Insecticide susceptibility testing will be carried out at 15 sites nationally. Support the NMCP entomologist in conducting IRS-related entomological monitoring. Support to DHPS to participate in the monitoring of IRS operations.
CDC entomological TDY	CDC-IAA	29,000		Nationwide	Technical assistance from CDC entomologist for entomological monitoring activities and analysis.
Subtotal Entomology		329,000			
Insecticide-treated Nets					
Procurement of ITNs	GHSC-PSM	4,032,000	4,032,000	Nationwide	Procure up to 1.4 million ITNs for routine coverage through ANC and EPI.
Distribution of ITNs	GHSC-PSM	840,000	-	Nationwide	Distribute up to 1.4 million routine ITNs through ANC and EPI.

Net durability monitoring	GHSC-PSM PQM/LBMA	150,000	-	Nationwide	Conduct the second year of net durability monitoring as per PMI requirements.
Subtotal ITNs		5,022,000	4,032,000		
Indoor Residual Spraying					
Indoor residual spraying	TBD-IRS	3,965,000	1,247,056	Mopti Region	Procure IRS equipment (insecticide, sprayers, etc.), training, implementation, data collection, protocols, guidelines, SBCC, logistic assessment for IRS operations.
External environmental compliance assessment	TBD-Environmental Management	35,000		Mopti Region	External IRS environmental compliance monitoring as per PMI guidance.
Subtotal IRS		4,000,000	1,247,056		
SUBTOTAL VECTOR MONITORING AND CONTROL		9,351,000	5,279,056		
Malaria in Pregnancy					
Procurement of SP	GHSC-PSM	130,000	130,000	Nationwide	Procure 1 million treatments of SP.
Strengthen FANC and MIP services	SSGI	450,000		4 regions (Koulikoro, Sikasso, Bamako, Kayes, Gao when security allows)	Continue to strengthen use of FANC and MIP services.

Strengthen FANC and MIP services	TBD-New Service Delivery Award	250,000		2 regions (Mopti and Segou)	Support strengthening MIP services in Mopti and Segou in order to increase coverage.
Subtotal Malaria in Pregnancy		830,000	130,000		
SUBTOTAL PREVENTIVE		10,181,000	5,409,056		
CASE MANAGEMENT					
Diagnosis and Treatment					
Procurement of RDTs	GHSC-PSM	2,055,000	2,055,000	Nationwide	Procure approximately 3,690,000 RDTs.
Procurement of ACTs	GHSC-PSM	1,100,000	1,100,000	Nationwide	Procure approximately 1,000,000 ACTs (AL).
Procurement of injectable artesunate for treatment of severe malaria	GHSC-PSM	400,000	400,000	Nationwide	Procure approximately 160,000 vials of injectable artesunate for severe malaria.
Procurement of medications for SMC	GHSC-PSM	1,317,145	1,317,145	12 districts in the 4 USAID focus regions (Koulikoro, Sikasso, Bamako, Kayes)	Cover approximately 650,000 children < 5 years with four rounds of SP/AQ co-blister for SMC. Plus up to 10 in 1 district. Assumes cost of \$0.49 per treatment per child (x 4 rounds).
Implementation of SMC (training, supervision, distribution)	SSGI	1,700,000	-	10 districts in the 4 USAID focus regions	Implementation of SMC in 4 USAID focus regions.

Implementation of iCCM	SSGI	500,000	-	4 USAID focus regions (Koulikoro, Sikasso, Bamako, Kayes)	Implementation of SMC in 12 districts. Implementation will include the costs of training, supervision, community mobilization, and distribution of drugs.
Procure microscopes	GHSC-PSM	50,000	50,000		Procure microscopes and kits.
Training and supervision for case management	TBD-New Service Delivery Award	1,200,000		Nationwide	Training includes OTSS, diagnostics, case management for simple and severe malaria, and supervision on all aspects of case management nationwide. Will cover additional CSCOMs and continue severe malaria module of OTSS.
Therapeutic efficacy study (TES)	PQM/LBMA	100,000		Nationwide	Routine monitoring of therapeutic efficacy of first- and second-line drugs.
CDC case management TDY	CDC-IAA	10,000			CDC technical visit focused on case management, particularly severe disease.
Subtotal Diagnosis and Treatment		8,432,145	4,922,145		
Pharmaceutical Management					
Supply chain strengthening	TBD-Supply chain partner	600,000		Nationwide	Strengthen pharmaceutical management and the supply chain system at national, district, and community levels, emphasizing continued improved quantification, forecasting, and distribution. Conduct at least two end-use verification surveys, tracking commodities down to community level and case management practices with an emphasis on follow-up of findings.
Subtotal Pharmaceutical Management		600,000			

SUBTOTAL CASE MANAGEMENT		9,032,145			
HEALTH SYSTEM STRENGTHENING / CAPACITY BUILDING					
Quality assurance and quality control of antimalarials	USP/PQM	250,000		Nationwide	Strengthen national laboratory. Strengthen quality assurance and quality control of antimalarials. Continue sentinel sites and sample review.
Support day-to-day operations of NMCP	SSGI	50,000		Nationwide	Assist with the NMCP's day-to-day operations and ability to work closely with PMI and implementing partners.
SUBTOTAL HSS & CAPACITY BUILDING		300,000			
SOCIAL AND BEHAVIOR CHANGE COMMUNICATION					
SBCC for ITNs	KJK Project (BCC bilateral)	75,000		Nationwide	Continued support to SBCC activities to correct hanging, use, and maintenance of nets, as well as information about how individuals' use of ITNs year-round contributes to local and national malaria control objectives. Support for the revision of national BCC plan.
SBCC for MIP	KJK Project (BCC bilateral)	75,000		Nationwide	Continue to promote SP IPTp uptake and MIP targeting pregnant women. Continuing focus on second and third ANC visits. Support to the revision of the national SBCC plan.

SBCC for case management	KJK Project (BCC bilateral)	75,000		Nationwide	Continued support of messages and communications approaches for case management; implement through relais, train on referral systems at the community level with a focus on early care-seeking behaviors. Support the National Center for Information, Education, and Communication for Health (CNECS) capacity to develop and implement communications approaches and messaging for case management. Support to the revision of the national SBCC plan.
SBCC for seasonal malaria chemoprevention	KJK Project (BCC bilateral)	75,000			Support messages and communications for seasonal malaria chemoprevention, with a focus on attendance at all rounds.
SUBTOTAL SBCC		300,000			
SURVEILLANCE, MONITORING, AND EVALUATION					
Routine systems strengthening	MEASURE Evaluation	700,000		Nationwide	Continue support for the DHIS2 to improve malaria data quality and use and finalize the integration of OSPSANTE into DHIS2. This activity will support training, DQA activities, analysis and production of malaria bulletins, and use of the data for program improvement. These funds will also support M&E training for NMCP/MOH staff at both national and subnational levels. Funds will also support coordination around routine data for IRS and SMC epidemiological monitoring and malaria in pregnancy activities.
SUBTOTAL SM&E		700,000			
OPERATIONAL RESEARCH					
Transmission reduction effects of SMC (year 2)	SSGI	250,000			Second year of a two-year OR activity to evaluate the feasibility and impact, including cost implications, of extending SMC interventions to children up to age 10.

SUBTOTAL OR		250,000			
IN-COUNTRY STAFFING AND ADMINISTRATION					
CDC	CDC-IAA	310,855			Support for CDC PMI Resident Advisor (1) with salary, benefits and relocation support
USAID	USAID	926,000			Support for USAID PMI staff (1 PSC/1 FSN) with salaries, benefits, contribution to salaries and benefits of Mission support staff, IT support costs, office space, vehicles, other Mission program support costs, local costs for CDC PMI Resident Advisor.
SUBTOTAL IN-COUNTRY STAFFING		1,236,855			
GRAND TOTAL		22,000,000			