This Malaria Operational Plan has been approved by the U.S. Global Malaria Coordinator and reflects collaborative discussions with the national malaria control programs and partners in country. The final funding available to support the plan outlined here is pending final FY 2017 appropriation. If any further changes are made to this plan it will be reflected in a revised posting.

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PRESIDENT'S MALARIA INITIATIVE

SENEGAL

Malaria Operational Plan FY 2017

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ABBREVIATIONS and ACRONYMS

ACT	Artemisinin-based combination therapy
AL	Artemether-lumefantrine
ANC	Antenatal care
AS/AQ	Artesunate-amodiaquine
CBO	Community based organization
CDC	Centers for Disease Control and Prevention
cDHS	Continuous Demographic and Health Survey
CFA	West African Financial Community Franc (USD $1 = F CFA 500)
CHW	Community health worker
CMS	Central Medical Stores
DHS	Demographic and Health Survey
DSDOM	*Dispensateur de soins à domicile* (village malaria worker)
DSISS	*Division du Système d'Information Sanitaire et Sociale*
FARA	Fixed Amount Reimbursement Agreement
FY	Fiscal year
GHI	Global Health Initiative
Global Fund	Global Fund to Fight AIDS, Tuberculosis and Malaria
GHSA	Global Health Security Agenda
G2G	Government to government
HIV/AIDS	Human immunodeficiency virus /acquired immunodeficiency syndrome
IEC	Information, education, communication
IPTp	Intermittent preventive treatment for pregnant women
IRD	*Institut de Recherche pour le Développement*
IRS	Indoor residual spraying
ITN	Insecticide-treated mosquito net
JICA	Japan International Cooperation Agency
LLIN	Long-lasting insecticide-treated bed net
LNCM	*Laboratoire national de contrôle des médicaments* (National Drug Control Laboratory)
MIP	Malaria in pregnancy
MIS	Malaria indicator survey
MoH	Ministry of Health
MOP	Malaria Operational Plan
NMCP	National Malaria Control Program
PBF	Performance-Based Financing
PECADOM	*Prise en charge à domicile* (home-based management of malaria)
PMI	President's Malaria Initiative
RDT	Rapid diagnostic test
SBCC	Social and behavior change communication
SLAP	*Service de Lutte Antiparasitaire*
SM&E	Surveillance, monitoring, and evaluation
SMC	Seasonal malaria chemoprevention
SNEIPS	National Health Education and Information Service
SP	Sulfadoxine-pyrimethamine

SP-AQ	Sulfadoxine-pyrimethamine/amodiaquine
UCAD	*Université Cheikh Anta Diop*
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USG	United States Government
WHO	World Health Organization

I. EXECUTIVE SUMMARY

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

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

Senegal was selected as a PMI focus country in FY 2007. This FY 2017 Malaria Operational Plan presents a detailed implementation plan for Senegal, 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 Senegal, describes progress to date, identifies challenges and unmet needs to achieving the targets of the NMCP and PMI, and provides a description of activities that are planned with FY 2017 funding.

The proposed FY 2017 PMI budget for Senegal is $24 million. PMI will support the following intervention areas with these funds:

Entomologic monitoring and insecticide resistance management: Monitoring entomological parameters (species composition, feeding preferences, densities, etc.) as well as insecticide resistance are important priorities in the NMCP's Strategic Plan for 2016-2020. To support the rollout of vector

control interventions, PMI has funded entomological monitoring and resistance testing, which has been carried out in partnership with in-country institutions such as the *Université Cheikh Anta Diop* (UCAD), the *Service de Lutte Antiparasitaire*, and the *Institut Pasteur Sénégal*. Molecular analyses have confirmed that four members of the *An. gambie* complex are present in Senegal (*An. arabienesis, An. coluzzii, An. gambiae s.s.* and *An. melas*). While anophelines in Senegal feed on a variety of vertebrates, humans are the primary source of blood meals. Resistance testing at 20 sites has revealed widespread resistance to pyrethroids and DDT, while resistance to bendiocarb remains limited to Dakar Region. During FY 2016, in addition to supporting ongoing entomological monitoring and resistance testing, PMI supported the NMCP and UCAD to organize a workshop which resulted in a draft national strategy for insecticide resistance management and the creation of a more user-friendly database to centralize and store all entomological data. In addition, PMI supported an evaluation of Senegal's national entomological capacity with several recommendations that are currently being implemented. PMI FY 2017 funding will be used to continue to conduct entomological monitoring, including insecticide resistance testing.

Insecticide-treated nets (ITNs): During FY 2016, PMI continued to support the NMCP's multiple continuous distribution channels, which distribute free and subsidized long-lasting insecticide-treated mosquito nets (LLINs) nationwide. These include free LLINs to pregnant women attending antenatal care (ANC) clinics and to primary school children, subsidized nets to other health facility clients through community-based organizations, and through social marketing. In March-June of 2016, the NMCP carried out a nationwide universal coverage campaign, with the support of numerous partners including the Global Fund, the Islamic Development Bank, and PMI. More than 8 million nets were distributed, of which 1.9 million were procured with PMI funding. To promote demand for and correct use of LLINs, PMI continued to invest in social and behavior change communication (SBCC) activities using primarily community-based networks. With FY 2017 funding, PMI plans to continue its support for the operational costs associated with the routine distribution system. This will ensure that high coverage is maintained after the 2016 mass campaign and will provide the population with several options to replace nets as they age and become worn out. PMI plans to provide approximately 1.2 million of the needed LLINs in 2017 and 2 million in 2018, which will be distributed primarily through routine channels; any surplus that carries over into 2019 will be used for the campaign that year.

Indoor residual spraying (IRS): PMI has supported the NMCP's spray program since 2007 and the population protected with this intervention has ranged from around 650,000 in 2007 to more than 1 million in 2012, with high coverage rates being achieved in most years. Due to pyrethroid resistance among anopheline mosquito populations, the IRS program gradually transitioned to spraying using non-pyrethroids only and currently only long-lasting organophosphates (pirimiphos-methyl) are used. The NMCP's strategy for IRS has evolved to a more targeted approach and, starting in 2015, spraying has been prioritized to hotspots, defined as areas with malaria incidence above 15-30 per 1,000. During FY 2016, PMI-supported spraying occurred in the same four districts that were sprayed the previous year; this resulted in 124,757 structures sprayed (97% of those targeted) and 496,728 people protected. PMI plans to support spray operations during calendar year 2017 using FY 2016 funding; this will be the third year of IRS using the hotspot approach. At the time of MOP writing, the NMCP's position on IRS was to discontinue IRS given a lack of impact on malaria incidence after one year of implementation of the hotspot approach. With the recent change in NMCP leadership, the role of IRS within Senegal's overall vector control strategy is being reassessed. In August 2016, a consensus meeting was convened by the NMCP in order to discuss the future of IRS with all key institutions involved in vector control. The PMI/Senegal team is actively engaged in these discussions and PMI's FY 2017 support for IRS may

be revised once the findings of these technical working groups are completed and a final evidence-based decision is reached on IRS policy for Senegal.

Malaria in pregnancy (MIP): The NMCP adopted intermittent preventive therapy for pregnant women in 2003 and SP is given free of charge in all ANC sites nationwide. National policy has been revised to include World Health Organization (WHO) recommendations on frequency (at least three doses starting in the second trimester and with at least one month between doses). The NMCP recommends using quinine to treat pregnant women with confirmed malaria in the first trimester and ACTs in the second and third trimesters. During FY 2016, the Government of Senegal continued to procure SP for IPTp while PMI focused its support on training and supervision of health workers in malaria in pregnancy activities. With PMI's assistance, registers have been updated to reflect all three doses of IPTp and these are now being used in health facilities nationwide. While only 12% of pregnant women received two doses of SP in 2005, this percentage increased to 49% in the last cDHS (2015). While IPTp3 coverage remains low (11% in the cDHS 2015), the NMCP credits the introduction of this indicator as one of the driving factors behind the recent uptick in national coverage with IPTp2. PMI's FY 2017 funding will continue to support activities aimed at reinforcing the provision of effective MIP services in health facilities and outreach activities to encourage IPTp uptake. Support will continue for monitoring and supportive supervision of MIP service delivery, improvement of data collection including IPTp data, and training of new staff on IPTp, including topics such as the importance of LLIN use in pregnancy, diagnosis and management of MIP, and counseling and interpersonal communication skills.

Case management: The NMCP adopted ACTs as first-line treatment in 2006 and introduced RDTs in 2007. In addition, pre-referral treatment with rectal artesunate for severe malaria and seasonal malaria chemoprevention (SMC) are WHO recommendations already adopted by Senegal's NMCP. At the community level, PMI supports both health huts and home-based management of malaria (PECADOM), as a means to reach as many people as possible with proper malaria case management. With FY 2017 resources, PMI plans to support training and supervision for microscopic diagnosis of malaria, quality control for microscopy and RDTs, and procurement of microscopy consumables and RDTs. The number of RDTs required is expected to remain high as the revised malaria testing algorithm (universal testing of fever cases in all age groups throughout the year) is put into practice during 2017 and more active case detection activities are carried out in the context of pre-elimination. PMI also plans to procure ACTs, injectable artesunate, and antimalarials needed for SMC in the high-transmission regions of Senegal. In addition, PMI plans to support malaria training and supervision both in the formal health sector and at the community level. Finally, PMI plans to support the implementation of single low-dose primaquine for transmission reduction in elimination districts as well as monitor the efficacy of all three first-line antimalarials (artemether-lumefantrine, artesunate-amodiaquine, and dihydroartemisinin-piperaquine).

Health systems strengthening and capacity building: During the past year, PMI's health systems strengthening activities included continued support to the Central Medical Stores, support for institutional capacity building at the NMCP, and support for ongoing results-based financing activities. Integrated logistics supervision visits were conducted at all regional medical stores and health districts, and PMI also supported the NMCP to supervise case management at hospitals, health centers, and health posts. With FY 2017 funding, PMI plans to support activities to develop capacity at sub-national and central levels to continue working towards the attainment of the NMCP's pre-elimination objective. This will include support for quarterly meetings to foster better coordination between the NMCP and partners as well as state-of-the-art capacity building opportunities for NMCP staff. PMI will complement other Mission health programs to promote local governance by strengthening the capacity of local elected

officials to address malaria as a priority in local development plans and increase participation of communities in decision-making and financing. Also, PMI will encourage the NMCP to empower their staff at the decentralized level to plan, manage, and coordinate activities and allocate resources as appropriate to achieve expected results. In selected districts, PMI FY 2017 funding will be used to support performance-based financing efforts to improve malaria indicators. As in the previous five years, PMI resources will support a malariology course to provide in-country training to health staff at various levels. Given the large Peace Corps program in Senegal and the opportunities to leverage their community presence to further the NMCP's objectives, PMI funds will continue to support malaria-specific Peace Corps projects.

Social and behavior change communication (SBCC): The NMCP is taking a more strategic and evidence-based approach to developing and implementing communications campaigns, as detailed in the NMCP's 2016-2020 Strategic Plan and the new malaria communication strategy. PMI has supported various community mobilization and SBCC activities in Senegal. These include both ongoing malaria communications (mass and interpersonal) and activities promoting specific events, such as IRS or LLIN distribution campaigns. Typical communications activities in Senegal have included community meetings on a specific topic, home visits, theater, community radio, and social mobilization.
With FY 2017 funds, PMI will continue to support a range of communications activities to influence the social and behavior changes needed to improve the adoption of key malaria prevention and care seeking behaviors (e.g., net ownership, proper net use, net care and maintenance, IPTp, when and where to seek care). PMI will also continue to support communication activities to ensure the continued high acceptance rate of the SMC campaign in four regions. PMI resources will also continue to support operational expenses associated with the social marketing of LLINs in the private sector.

Surveillance, monitoring and evaluation (SM&E): In March 2016, with PMI's support, the third phase of the continuous DHS (cDHS) was completed and the final report disseminated. The survey results show continued improvements in intervention coverage as compared with the 2014 cDHS. For example, IPTp2 improved from 40% to 49% and ITN use among children increased from 43% to 55% as well as among pregnant women (from 38% to 52%). Senegal is known for its robust routine malaria information system, providing prompt and complete data to guide and measure scale-up of malaria control activities. The NMCP is working closely with the Division of Social and Health Information Systems (DSISS) to integrate data from the NMCP routine malaria information system into the national HMIS that now uses the District Health Information System (DHIS2) platform. During FY 2016, PMI continued to support 20 epidemic surveillance sites. With the expansion of reactive case detection activities, PMI supported the malaria epidemic surveillance system to expand data collection to all health posts in the districts of Saint-Louis Region. PMI funding also supported a malaria-specific M&E course which was held in May 2016 with participation from the central, regional, and district levels.
Using FY 2017 funds, PMI plans to continue to support data collection through the cDHS to monitor intervention coverage; strengthen the malaria surveillance system; provide training for health staff to conduct case investigations in districts with low malaria incidence; and conduct process monitoring and an end-of-season coverage survey for the SMC campaign.

Operational research (OR): The goal of operational research in Senegal, which is grouped with M&E in the NMCP's Strategic Plan for 2016-2020, is to provide data for decision making and in particular to evaluate issues related to achieving pre-elimination, both in the low transmission North and the high transmission South. In support of the NMCP's objectives, PMI has funded seven operational research studies to date on a variety of topics, namely: a study on the burden of malaria among nomadic pastoralists; an evaluation of the malaria diagnostic algorithm; a qualitative study to asses the

acceptability of SMC; a study to determine which factors could explain continued high transmission in Vélingara, where all interventions had been scaled up; a study of Senegal's home-based malaria care program known as PECADOM Plus; and a Phase III evaluation of long-lasting insecticide-treated nets. No operational research is planned with FY 2017 PMI funding.

II. STRATEGY

1. Introduction

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

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

Senegal was selected as a PMI focus country in fiscal year (FY) 2007. Large-scale implementation of ACTs and rapid diagnostic tests (RDTs) began in 2007 and progressed rapidly with support from PMI and other partners. ACTs and IPTp are now available in all public health facilities nationwide, RDTs are used to confirm malaria cases at all levels of the health system (including the community level) and 18.9 million long-lasting insecticide-treated bed nets (LLINs) have been distributed using a universal coverage approach since 2010. In March 2016, the country launched the first nationwide campaign to distribute almost 8.2 million LLINs to achieve universal coverage. In the meantime, routine distribution using different channels (school-based, community-based, and health facility-based) has been pursued.

This FY 2017 Malaria Operational Plan presents a detailed implementation plan for Senegal, based on the strategies of PMI and the National Malaria Control Program (NMCP) strategy. 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 new National Malaria Control strategy and plan (2016-2020) 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 Senegal, describes progress to date, identifies challenges and unmet needs to achieving the targets of the NMCP and PMI, and provides a description of activities that are planned with FY 2017 funding.

2. Malaria situation in Senegal

Senegal's estimated population in 2017 will be approximately 15.1 million, based on the most recent census conducted in 2013. Although substantial improvements have been achieved since the 1960s, Senegal's indicators of human development remain low, with the country ranked 170 out of 187 countries worldwide on the Human Development Index.[1] The infant mortality rate is 39 deaths per 1,000 live births and the under-five mortality rate is 59 deaths per 1,000 live births.[2] Maternal mortality ratio is estimated to be 320 deaths per 100,000 live births and the life expectancy at birth is 66.5 years.[1] The adult HIV prevalence rate is estimated at 0.5% for adults 15-49 years of age, with 15,000 adults and 5,400 children (aged 0 to 14) estimated to be living with HIV/AIDS.[1]

Malaria is endemic throughout Senegal and 100% of the population is at risk of the disease. The three ecological zones, based on annual rainfall, are the northern Sahelian zone with < 400 mm of rainfall occurring between July and September, the central Sahelian zone with 400 – 1,000 mm of rainfall occurring between July and October, and the southern tropical zone with 1,000 – 1,250 mm of rainfall occurring between June and October. The country can also be divided into two epidemiological zones: the tropical zone, with year-round transmission peaking during the rainy season and lower transmission during the rest of the year; and the Sahelian zone, with high transmission toward the end of and immediately after the rainy season and very low transmission during the rest of the year. Transmission in the Sahelian zone may occur throughout the year, often as small outbreaks, in areas close to rivers or other water sources that persist through the dry season. In peri-urban areas, persistent flooding during and after the rainy season has led to higher peaks in transmission during the rainy season and a longer transmission season. *Plasmodium falciparum* is the major malaria parasite species, accounting for more than 90% of all infections. The main vector species are *Anopheles gambiae sensu strictu*, *An. coluzzii*, *An. arabiensis*, *An. melas, An. funestus*, *An. nili*, and *An. pharoensis*. The species distribution depends on rainfall and the presence of permanent sources of water.

The vulnerable groups in Senegal comprise an estimated 2.9 million children less than five years of age and 608,000 pregnant women. According to routine data collected by the NMCP between 2001 and 2006, malaria was responsible for just over one-third of all outpatient consultations. In October 2007, the case definition of malaria changed from a purely clinical definition to one that relies on parasitological confirmation. From that point on, health workers were directed to test all suspected cases of malaria and to treat and report only those cases with positive results. Suspected cases of malaria were defined as those with fever who do not have signs or symptoms indicative of other illnesses. In 2013, 87% of suspected cases were tested, in 2014, 96% were tested, and in 2015, nearly all suspected cases were tested (99%).[3]

As a result of these changes, the proportion of all outpatient visits due to malaria fell from 36% (clinically diagnosed) in 2001 to 6% (parasitologically confirmed) in 2008. The proportion of all deaths in children under five in health facilities that were attributed to malaria also fell from 30% to 7% over the same timeframe. Although the change in the case definition of malaria obscured assessment of the

[1] 2015 Human Development Index, United Nations Development Programme: http://hdr.undp.org/en
[2] 2015 Continuous DHS Senegal: http://dhsprogram.com/what-we-do/survey/survey-display-457.cfm
[3] Source: NMCP Annual Activity Reports for 2013-2015, available at: www.pnlp.sn

impact of program activities, this reduction continued between 2008 and 2009, with malaria representing only 3% of all outpatient visits and 4% of all deaths in 2009. Morbidity and mortality data were not available between 2010 and 2012 because health worker unions staged a nationwide data retention strike. This data strike ended in March 2013, and data have been backfilled, though data quality for 2010-2012 is not optimal. In 2013, the routine data system was functional once again. Incidence of confirmed malaria per thousand increased from 14 in 2009 to 27 in 2013, fell to 19 in 2014, and rose to 34 in 2015, a year of record rains and in which the definition of a suspect case was broadened (see below). Incidence ranged from 1 per 1,000 in five northern districts to over 200 per 1,000 in two southeastern districts.

In 2015, the NMCP adopted an updated policy of testing all patients under the age of five with fever, regardless of any other signs or symptoms. Given the uncertainty in the true number of patients with fever, the transition to this new algorithm has been gradual to avoid large scale stockouts of commodities. In those over five years of age, all febrile patients will be tested from July to January, with the previous algorithm (those with fever who do not have signs or symptoms indicative of other illnesses) in use from February to June. From 2017 onward, all febrile patients, regardless of age, season, or other symptoms will be tested with an RDT. This broadening of the definition of a suspect case of malaria resulted in a 97% increase in the number of suspect cases and an 85% increase in the number of confirmed cases from 2014 to 2015.

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

Administratively, the country is divided into 14 regions and 46 departments. The health system functions at the level of the regions (each with a Regional Chief Medical Officer) and is further decentralized into 76 health districts that may be all or part of an administrative department. Health districts are led by the District Chief Medical Officer who, together with the District Health Management Team, oversees care and treatment activities at the District Health Center and at peripheral facilities, as well as prevention activities. Health districts have at least one health center and a number of health posts (1,553 in total) that are staffed by chief nurses and sometimes midwives.

Although not a formal part of the health system, Senegal's health care pyramid rests on a foundation of approximately 1,929 functional health huts that are established and managed by local communities and cover approximately 50% of the country's population. A functional health hut is defined as one that has a trained community health worker (literacy is preferred but not required), regular supervision by the chief nurse of the health post, and the basic structure and equipment needed to provide services. Malaria case management with free RDTs and ACTs was rolled out in health huts in 2008. The community health workers (CHWs) offer an integrated package of preventive and curative services or referral for more advanced medical care. Additional community health staff includes *matrones*, who are trained birth attendants, and *relais*, who are health educators and communicators.

Since 2008, a new type of health worker, the village malaria worker (*dispensateur de soins à domicile* (*DSDOM)*), provides testing with RDTs and treatment with ACTs through the home-based management of malaria program (*prise en charge à domicile (PECADOM)*), now active in 2,063 villages in 13 regions where health services are difficult to access. In 2012, 88 DSDOMs were trained in management of pneumonia and diarrhea in addition to malaria, an approach called integrated PECADOM that was scaled up to 492 DSDOMs in the Kédougou and Tambacounda regions in 2013 and to 1,926 villages in 13 regions in 2015. Both health huts and DSDOMs are linked to their supervising health post by the commodity supply chain and the health information system (i.e., they receive supplies from and submit

data to the health post). In 2014, the Ministry of Health adopted a National Strategic Plan for Community Health to improve linkages between the community level and the formal health system, to increase ownership by communities, and to improve coordination of activities to make Senegal a model for community health.

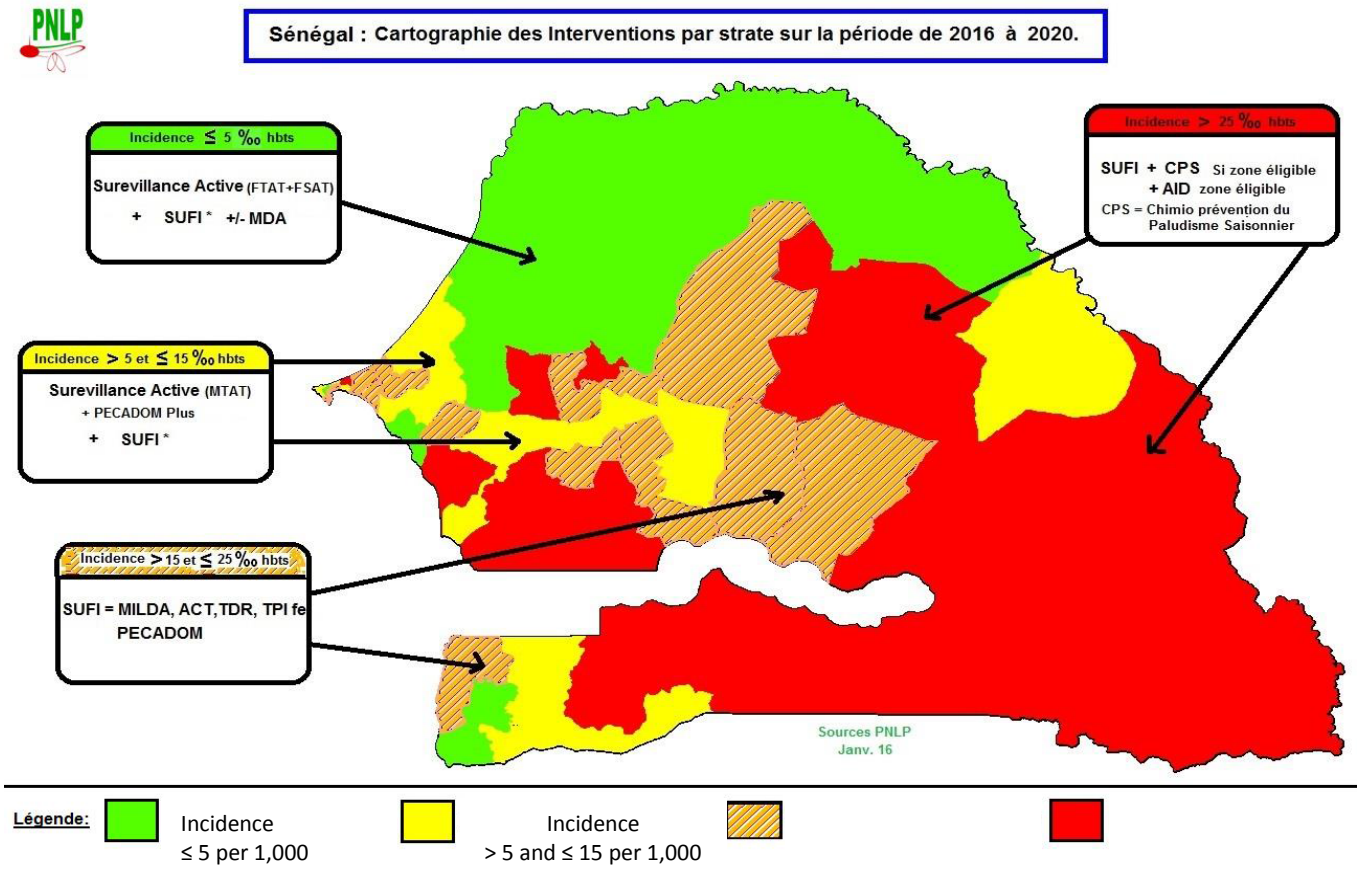
4. National malaria control strategy: Achieve pre-elimination by 2020

In developing the 2016-2020 National Strategic Plan, the NMCP adopted a goal of reaching the threshold for pre-elimination (defined by the NMCP as annual incidence <5 cases per 1,000) by 2020, continuing the use of proven interventions already scaled up nationally, adopting new proven interventions in a targeted manner, and piloting new interventions. In 2013, the NMCP conducted a midterm program review. Key findings included the need for closer collaboration with private health care providers (case management and reporting) and private enterprises (coordination and resource mobilization); weaknesses in stock management at all levels, including providing malaria commodities free of charge; and the need to extend weekly surveillance to all low-transmission districts. The National Strategic Plan was subsequently updated. In early 2014, the decision was made to develop a new Strategic Framework that would guide the development of a concept note for the Global Fund, covering activities expected to be implemented from 2015 through 2017 (the Framework goes through 2018 in alignment with the National Health Development Plan). In 2015, the NMCP and its partners undertook a Malaria Program Review.

The major recommendations of the 2015 Malaria Program Review included: a) implement the recommendations of the NMCP organizational audit conducted in 2014, b) develop plans for malaria control activities at the regional level in order to mobilize resources from partners at the regional and operational levels, c) ensure availability of commodities (ACTs, RDTs, LLINs, SP) at all levels of the health system, d) increase LLIN storage capacity at the central as well at the regional level, e) monitor use of injectable artesunate for severe malaria case management, f) implement social behavior change communication campaigns based on evidence and within an appropriate timeframe, and g) conduct data analysis and use at the operational level.

Based on the above recommendations, the goal of reaching pre-elimination has been extended to 2020 in the new strategic plan, with interventions targeted to the different transmission zones. In addition to the standard interventions, pre-elimination zones are eligible for case investigation and reactive case detection, while the highest transmission regions (control zones) receive seasonal malaria chemoprevention (SMC) and are prioritized for active home-based management (PECADOM Plus) (see map, below).

Figure 1. Interventions targeted to incidence, by district (National Strategic Plan 2016-2020)



MSAT – mass screen and treat; FSAT – focal screen and treat; SUFI – scale up for impact (LLINs, IPTp, RDTs, ACTs, PECADOM Plus); MDA – mass drug administration; SMC – seasonal malaria chemoprevention.
Source: National Malaria Control Strategic Plan (2016-2020)
Note: MSAT and MDA are MACEPA and UCAD research projects.

NMCP strategy by intervention

Senegal has now adopted all the WHO-recommended interventions and remains a leader in piloting and scaling up new recommendations and innovative strategies to increase the reach and effectiveness of interventions. The 2016-2020 National Strategic Plan outlines the following package of activities:

- **LLINs**: Rolling mass distribution campaigns for universal coverage transitioning to a nationwide campaign in 2016, with scale-up of multi-channel routine distribution.
- **IRS**: Focal spraying to target hotspots at the level of the health post in districts with annual incidence above 15-30 per 1,000.
- **Larval source management**: Bio-larvicides applied in areas where larval sources are few, fixed, and findable, such as the suburbs of Dakar or dry areas where water holes are known.

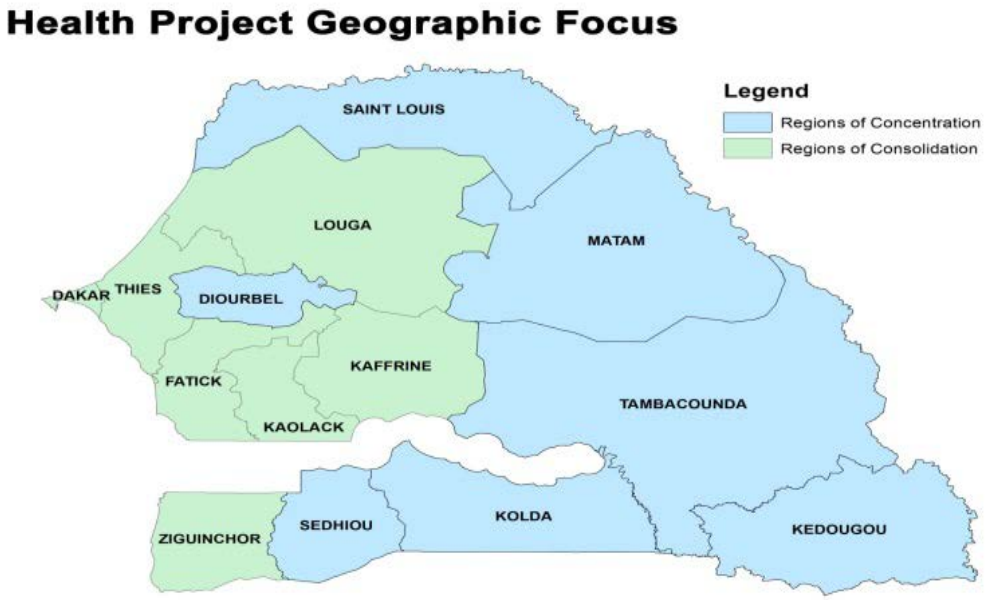
- **Seasonal malaria chemoprevention**: One treatment of sulfadoxine-pyrimethamine (SP) and amodiaquine (AQ) monthly during the transmission season, up to four months, for children 3-120 months in regions that meet WHO criteria.
- **Malaria in pregnancy**: IPTp with SP (at least three doses) under directly observed therapy, beginning during the second trimester, at every contact with the health facility, at intervals of at least one month. Every pregnant woman is to receive a free LLIN during her first antenatal care (ANC) visit. Pregnant women with confirmed malaria are treated with quinine in the first trimester and with ACTs thereafter, unless signs of severe disease, when IV quinine or artesunate is used.
- **Case management**
  - Uncomplicated malaria: All suspected cases are to be confirmed with RDT, and patients with positive tests treated with an ACT. Artemether-lumefantrine, artesunate-amodiaquine, and dihydroartemisinin-piperaquine are co-first line therapies.
  - Severe disease: Pre-referral treatment with rectal artesunate if identified at community or health post level. Definitive treatment at the health center or hospital level with IV quinine or artesunate, to be followed with a course of oral ACT. Hospitalized patients should have malaria confirmed by blood smear.
  - Community level: All patients with fever are tested with an RDT and patients with positive tests receive an ACT. Both health hut and home-based care programs are integrated with diarrhea and pneumonia.
- **Health promotion**: Evidence-based behavior change campaigns and activities accompanied by M&E to measure impact, increasing role of communities and private sector.
- **Epidemic surveillance and response**: Epidemic surveillance sites report all data weekly and data are analyzed to identify hotspots. Case notification and reactive case investigation in pre-elimination zones.
- **Monitoring and evaluation/research**
  - Integration of NMCP data into DHIS2 adopted by the MoH, with quarterly data reviews.
  - Introduction of mobile health (mHealth) system to facilitate reporting of data at community level and reporting of weekly case counts.
  - Health facility supervision using tablet computers to streamline analysis and feedback.
  - Reinforce pharmacovigilance.
  - Piloting the introduction of low-dose primaquine for transmission reduction in elimination settings.
- **Supply chain management**: Improve storage and transport capacity, strengthen coordination between the NMCP and the Central Medical Stores (CMS), strengthen capacity for supply chain management at all levels, monitor drug quality and efficacy
- **Program management and coordination**: Improve managerial and operational capacity, increase resource mobilization and coordination efforts, and strengthen partnerships.

USAID/Senegal Health Program

To achieve the vision outlined in the Plan Senegal Emergent of "a Senegal where all individuals, all households and all communities enjoy universal access to promotional, preventive, curative health services of quality, without any form of exclusion," bold steps will be necessary. USAID is committed to helping Senegal achieve its ambitious health goals by building on more than five decades of success and lessons learned in health sector programming, and by implementing a focused, results-oriented program that fully leverages Senegalese capacity, systems, and resources. USAID has developed a suite of mechanisms—referred to collectively as the USAID/Senegal Health Program (2016-2021)—that together will seek to achieve sustainable, transformative impact.

Historically, USAID has provided technical assistance, training, commodities, and equipment in every region of the country. As maternal and under-five child indicators and capacity have improved, especially in specific regions, USAID has an opportunity to concentrate its investments in lower performing regions, referred to as regions of concentration, to significantly impact the key drivers of child and maternal mortality. Targeted investments in higher performing regions, referred to as consolidation regions, will leverage GOS resources and systems to ensure that gains in child and maternal health are sustained, even as USAID's physical presence in these regions declines. See map below (Figure 2) showing the classification of regions.

Figure 2. Classification of regions under the USAID/Senegal Health Program for 2016-2021



*Consolidation regions: Dakar,Fatick, Kaffrine, Kaolack, Louga, Thies, Ziguinchor
**Concentration regions: Diourbel, Kedougou, Kolda, Matam, Saint Louis, Sedhiou, Tambacounda

5. Updates in the strategy section

The NMCP has adopted a new strategy that covers 2016-2020 that seeks to achieve pre-elimination by 2020.

6. Integration, collaboration, and coordination

A coordination body was created in 2011, called the *Cadre de Concertation des Partenaires de Lutte contre le Paludisme*, which brings together funding, technical, and non-governmental partners. The president is selected on a rotating basis from among the partners, with the NMCP functioning as the secretariat. This group, currently chaired by a civil society representative, meets several times each year to exchange information and has been instrumental in helping resolve challenges and coordinate efforts.

Funding and technical partnerships

Senegal currently has one active **Global Fund** malaria grant for approximately $88 million, awarded to two principal recipients, the NMCP and IntraHealth International. Phase 1 of the grant was extended to the end of 2014 and the NMCP submitted a concept note in June 2014 under the new funding model for additional resources to cover the period 2015 to 2017, which is now being implemented. The Global Fund was the main contributor to the 2016 net campaign, with a total contribution of more than 4.3 million nets. The NMCP, PMI, and Global Fund Senegal teams enjoy frequent communication and close collaboration.

The **World Bank** provides support for malaria through the Senegal River Basin Development Organization and the Nutrition Enhancement Project. The World Bank contributed a total of 600,000 LLINs for the 2016 universal coverage distribution campaign and supports activities such as communication and education to promote net use.

The **World Health Organization** (WHO) provides limited technical and financial support for the implementation of treatment and prevention policies, planning, M&E, research, surveillance, and management of the NMCP.

The **United Nations Children's Fund** (UNICEF) provides support for district-level health plans in the regions of Kolda, Sédhiou, Kédougou, Tambacounda, and Matam. UNICEF collaborates with the United States Agency for International Development (USAID)-funded Community Health Program Component to support various community health interventions in more than 500 health huts. They also contributed to the scale-up of integrated PECADOM in four regions, and supported some operational costs for the 2013 SMC campaign (funding given by the Japan International Cooperation Agency (JICA)).

The **Islamic Development Bank** (IDB) provided $8 million in loans in 2009-2010 for the procurement of LLINs and RDTs, health personnel training, and supervision. It also provided 1.3 million LLINs for the 2016 universal ITN distribution campaign.

In addition to multilateral institutions, Senegal benefits from the support of various bilateral donors. The **French Cooperation** contributes to research activities through the ***Institut Pasteur Dakar*** and the ***Institut de Recherche pour le Développement*** (IRD) and places a technical advisor at the MoH. **JICA** and USAID have developed a joint partnership in Tambacounda and Kédougou regions; JICA donated $1 million for malaria activities in these regions through UNICEF in 2013. The **Chinese Cooperation** makes periodic donations of drugs for the treatment of uncomplicated and severe malaria, and the **Embassy of Thailand** has supported the participation of health personnel at malaria training courses in Thailand. The **Belgian Technical Cooperation** is supporting the overall development of the health sector primarily in Fatick and Kaolack regions.

Senegal's non-governmental and faith-based partners are also numerous. ***Medicos del Mundo*** and several Spanish non-governmental organizations are active in Sédhiou and Kolda regions. They have supported outreach activities by health post staff, rehabilitation of health huts, and LLIN distribution campaign operations.

Speak Up Africa is a local non-governmental organization dedicated to mobilizing African leadership, resources, and individual action against malaria, diarrhea, and pneumonia in several countries. In Senegal, the group has supported various communications/advocacy activities and helps to draw in national celebrities to support the malaria control cause.

The **International Committee of the Red Cross** supports outreach activities and LLIN distribution campaign operations in conflict zones in Ziguinchor and Sédhiou regions, as well as in the mining areas of Kédougou Region.

The **Malaria Control and Evaluation Partnership for Africa** (MACEPA), which began work in Senegal in 2009, has implemented a pre-elimination project in one northern district, including enhanced and integrated surveillance and case investigation, and a mass screen and treat program in hotspots in three additional districts. In collaboration with the NMCP, MACEPA defines hotspots as health posts with an incidence greater than 15 per 1,000.

Senegal is fortunate to have strong academic and research capacities in epidemiology, parasitology and entomology at the NMCP, ***Université Cheikh Anta Diop*** (UCAD), the **Parasite Control Service (*Service de Lutte Anti-Parasitaire-SLAP*),** IRD**,** and the ***Institut Pasteur Dakar***. These groups have strong collaborative relationships and together have published much of the recent literature on malaria in Senegal.

Private sector

In recent years the NMCP has been working with an increasing number of private enterprises on outreach and sensitization programs, LLIN distributions, and malaria case management. For example, collaboration with the **Senegalese Sugar Company** in the northern city of Richard Toll led the company to introduce RDTs in their clinic, to screen all seasonal workers for malaria, and to provide them with LLINs. The company continues to be active in pre-elimination activities in the district, which was highlighted during 2014 World Malaria Day events. **BICIS Bank** (BNP/Paribas) has become more active in the past year, supporting the printing of a popular children's comic book on malaria and airing spots/messages on the video screens in their branches. The fuel company **Total** has supported communications activities and will sell socially marketed LLINs in their stations' shops. Nevertheless, meaningful, longer-term partnerships have proven to be challenging due to the time commitment and skills required to develop them.

Within United States Government (USG)

The **United States Peace Corps** and PMI embarked on a new partnership in 2011. In Senegal, PMI staff and implementing partners continue to regularly participate in pre-service and in-service training sessions and over the past years supported three third-year malaria volunteers to oversee malaria Peace Corps volunteer malaria activities and liaise with PMI. Peace Corps volunteers also support PMI and the NMCP through information, education, and communication (IEC) activities and by participating in M&E and operational research (OR) activities. Two innovative strategies piloted by Peace Corps, universal coverage distribution of LLINs targeting every sleeping space, and PECADOM Plus, a community-based active fever detection program, have been adopted by the NMCP.

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.[4]

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

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

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

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

8. Progress on coverage/impact indicators to date

The table below shows that steady progress has been made for most malaria indicators in Senegal from 2005 until 2010, as measured by two Demographic and Health Surveys (DHS) (2005 and 2010), three rounds of the continuous DHS (2012-2013, 2014, and 2015), and two malaria indicator surveys (MISs) (2006 and 2008). Coverage indicators have improved again in 2015 after having plateaued for a few years, while parasite prevalence, anemia, and all-cause mortality continue to fall. Of note, most of the

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

surveys have taken place primarily during the dry season, when ITN use and parasitemia are generally lower, though this should not affect ITN ownership, IRS, and IPTp coverage, or child mortality.

Household ownership of at least one ITN rose from 20% in 2005 to 77% in 2015. Intra-household access to an ITN increased from 11% in 2005 to 66% in 2015. Utilization of ITNs by children under five rose from 7% in 2006 to 55% in 2015. Similar trends in utilization were observed with pregnant women and in the general population.

The proportion of pregnant women receiving two doses of IPTp with sulfadoxine-pyrimethamine (SP) increased from 12% in 2005 to 52% in 2008, but fell to 39% in 2010 due primarily to stockouts of SP. The most recent cDHS (2015) shows a notable improvement in IPTp2 to 49%. Comparing the proportion of children with fever who received prompt treatment with an ACT across the surveys is difficult given the introduction of RDTs in late 2007 and the falling incidence, with treatment being given only to patients with a positive test. In addition, the diagnostic algorithm mandated that only those without an obvious alternate cause for fever be tested with an RDT. In 2015, 15% of children had a fever in the last two weeks, 0.3% of which received an ACT within 24 hours.

As a result of the scale-up of malaria control interventions, parasitemia in children under five has fallen from 6% nationwide in 2008 to 1.2% nationwide in 2014. The mortality rate for children under five has fallen from 121 deaths per 1,000 live births in the 2005 DHS to 59 in the 2015 cDHS. These indicators are available at the national level annually through the continuous Demographic and Health Survey (cDHS).

Table 1: Evolution of Key Malaria Indicators in Senegal from 2005 to 2014

Indicator	2005 DHS	2006 MIS	2008 MIS	2010 DHS	2012-3 cDHS	2014 cDHS	2015 cDHS *
% Households with an ITN	20	36	60	63	73	74	77
% Households with at least one ITN for every two people	11	19	36	41	30	36	41
% General population who slept under an ITN the previous night	6	12	23	29	41	40	--
% Children under five who slept under an ITN the previous night	7	16	29	35	46	43	55
% Pregnant women who slept under an ITN the previous night	9	17	29	37	43	38	52
% Households with an ITN or sprayed within previous 12 months	--	--	--	66	76	76	--
% Women who received two or more doses of IPTp during their last pregnancy in the last two years	12	49	52	39	41	40	49
% Children under five with fever in the last two weeks for whom advice or treatment was sought	40	--	--	44	--	54	49
% Children under five with fever in the last two weeks who received a diagnostic test	--	--	9	10	15	12	--
% Children under five with fever in the last two weeks who received treatment with an ACT within 24 hours of onset of fever	--	3	2	3	0.5	0.3	0.3
% Women of childbearing age with anemia (<11 g/dL)	59	--	64	54	--	--	--
% Children 6-59 months with severe anemia (<8 g/dL)	20	--	17	14	10	5.3	2.8
% Children under five with parasitemia (*P. falciparum*)	--	--	6	3	3	1.2	--
Under-five mortality rate per 1,000 live births	121	--	85	72	65	54	59

*Results listed are from the cDHS 2015 Key Indicators Report; the full report is not yet available (as of May 2016).

9. Other relevant evidence on progress

The Impact Evaluation, which covered the period from 2006-2010, was completed in late 2013. All-cause under-five child mortality fell 40% during that period, coinciding with dramatic increases in coverage of ITNs and IPTp and a 50% decrease in malaria parasite prevalence. Strikingly, the most dramatic decreases in mortality were seen in the populations in which the increases in intervention coverage and decreases in parasite prevalence were the most pronounced: in the southeastern regions, in the poorest three quintiles, and in rural populations, suggesting that the decrease in mortality correlated with increase in intervention coverage and decrease in parasite prevalence. Routine data corroborated the picture from nationwide surveys, demonstrating a dramatic decrease in confirmed malaria cases and

deaths due to malaria, even as the numbers of total consultations and total hospitalizations increased, suggesting a simultaneous increase in access to health services.

The report findings indicated that while parasite prevalence among children under the age of five remained stable at 3% from 2010 to 2012, routine data available in 2013 showed an increase in incidence from 14 per 1,000 in 2009 to 27 per 1,000 in 2013, with the most pronounced increase in the southeast. The many contributing factors include: increased access to care and/or increased data completeness, particularly at the community level (342% increase in consultations reported by the community level from 2010 to 2013), with a 23% increase in total consultations among children under five from 2010 to 2013; increased rainfall; and degradation and attrition of LLINs distributed in 2010 in the four southeastern regions that were scheduled to have been replaced prior to the rainy season in 2013. In comparison, in the regions in which universal coverage was conducted in early 2013 (Dakar and Thiès), incidence dramatically decreased. In 2014, a dry year, incidence fell to 18 per 1,000, with the greatest decreases in the regions in which seasonal malaria chemoprevention was implemented for the first time in 2014, and parasite prevalence among children under five years in the cDHS fell to 1.2%

The NMCP identified the need to repeat a similar exercise to study and document the achievements in malaria control for the period 2011-2015. This Evaluation of Impact will be conducted during 2016 and funding for this activity in included in the FY 2015 Malaria Operational Plan.

III. OPERATIONAL PLAN

1. Vector monitoring and control

NMCP/PMI objectives

Senegal's 2016-2020 Strategic Plan includes a vector control plan with three major objectives:

a) to increase the percentage of the population sleeping under an LLIN to at least 80%,
b) to protect at least 90% of the population in zones targeted for IRS, and
c) to treat at least 95% of productive larval sites in selected zones.

The overarching strategy for malaria prevention related to LLINs is to increase access to ITNs by strengthening distribution mechanisms. Two distinct approaches are employed:

1) mass distribution of LLINs to achieve/maintain universal coverage every three years, quantification based on one LLIN per 1.8 persons; and
2) routine distribution to allow ongoing access to LLINs.

The NMCP has adopted a targeted approach for IRS where, in targeted districts, health post zones with incidence threshold of 15-30 per 1,000 or greater will receive IRS. Routine health system data and entomological parameters such as indoor biting and resting rates will be used to assist in determining where IRS may be appropriate. In addition, the entomologic evaluation of the IRS includes cone bioassays of sprayed walls, entomologic monitoring of effects on vector population and susceptibility of populations to insecticides.

a. Entomological monitoring and insecticide resistance management

Progress since PMI was launched

Prior to the inception of PMI in Senegal, the NMCP had a history of working with the *Laboratoire d' Ecologie Vectorielle et Parasitaire* of UCAD, SLAP and *Institut Pasteur Senegal* for entomological monitoring activities and thus when PMI activities began, the collaboration with these laboratories was an natural continuation. After IRS began in Nioro, Richard Toll, and Vélingara in 2007, teams composed of entomologists, technician, and graduate students conducted periodic entomological monitoring activities, including species composition and assessments of the insecticidal longevity of insecticide on walls in all three districts and expanded to the additional IRS districts as these were added. Teams are based in Dakar but periodically (every four to six weeks during the rainy season) they spend two weeks in each district to conduct entomological monitoring activities. Standard operating procedures were reviewed at the beginning of each rainy season.

Species composition: Molecular analyses revealed that four members of the *An. gambiae* complex (*An. arabienesis*, *An. coluzzii*, *An. gambiae s.s.* and *An. melas*) are found in Senegal. Only *An. arabiensis* is found in all areas including the north in the area of Richard Toll whereas *An. coluzzii* and *An. gambiae s.s.* are found in almost equal abundance as *An. arabienesis* in the central and southern regions of Senegal. The other member, *An. melas,* was only detected the salt marshes near Nioro. Species composition can vary depending on the time of the year and the location. For example, in Vélingara, *An. gambaie s.s.* was the predominant species in July whereas *An. arabiensis* became the most important

vector as the rainy season progressed. Other vectors are also present including *An. funestus s.l.*, *An. nili*, *An. pharoensis* and *An. rufipes.* Of the districts where IRS was conducted and in neighboring non-IRS control districts, sporozoites were only found in members of the *An. gambiae* complex in Vélingara (2009: 0.2%, 2011: 0.9%, 2013: 2.6%) Kolda (2012: 1.9%), and Nioro (2009: 0.2%, 2011: 0%, 2012: 0%). In the other districts, insufficient numbers of *An. gambiae s.l.* and other Anopheline mosquitoes were collected to give a meaningful estimate of sporozoite rates.

Feeding preferences: Five different vertebrate blood meal sources were identified in the mosquitoes: human, chicken, cow, horse and sheep. In some cases mixed blood meals were detected. In general, the most common blood meal source was human; however, in some areas, a large portion of mosquitoes fed on horse blood.

Resistance testing: Initially, insecticide resistance monitoring conducted by entomologists from the NMCP and UCAD was funded by a WHO/GATES Foundation project to monitor the insecticide susceptibility in 12 sites located throughout the country. When the project ended, PMI funding supported monitoring at those sites including sites in the zones where IRS activities were taking place. With this support, testing for susceptibility to five pyrethroids, three organophosphates, two organochlorines, and one carbamate has occurred. Until 2015, only the WHO paper-based assay was being used to detect insecticide resistance. In 2015, the CDC bottle bioassay was also introduced to determine resistance mechanisms.

Some level of resistance to pyrethroids and DDT has been detected in all districts (see Table 2, below) with the highest levels of resistance detected in Guediawaye, a suburb of Dakar with market farms. Mosquitoes from Guédiawaye also showed resistance to bendiocarb whereas in all other districts the mosquitoes still appeared susceptible to this insecticide. No resistance against the insecticide pirimiphos-methyl has been confirmed.

Table 2. Insecticide susceptibility test results from WHO Tube Bioassays for various insecticides in select districts of Senegal (% mortality)

District	Year	AC	DM	LC	PM	DDT	Bendio	Pir-Met
Koumpentoum[1]	2013	83	--	--	100	--	100	100
	2014	84	83	75	80	87	99	100
	2015	84	63	56	77	74	99	--
Koungheul[1]	2013	88	100	--	96	85	100	--
	2014	96	100	85	97	78	100	100
	2015	100	85	98	92	91	100	100
Malem Hodar[1]	2013	93	78	55	89	90	100	100
	2014	85	85	71	82	87	100	100
	2015	--	60	--	47	65	100	100
Nioro[1]	2013	93	98	97	70	83	99	100
	2014	--	80	76	46	73	100	--
	2015	97	83	82	64	79	100	100
Guinguinéo[2]	2013	70	--	--	70	65	99	100
	2014	--	--	--	--	67	100	100
	2015	--	94	--	84	64	--	--
Vélingara[2]	2013	94	--	--	74	92	100	100
	2014	--	86	--	--	77	95	--
	2015	90	88	77	92	83	100	100
Richard Toll[2]	2013	94	88	72	79	41	86	100
	2014	95	91	97	78	87	100	100
	2015	--	78	100	23	54	--	100
Guédiawaye	2013	--	--	--	--	--	--	--
	2014	69	43	39	5	2	64	100
	2015	43	47	17	3	1	35	100
Ndoffane	2013	90	94	88	59	67	78	100
	2014	--	82	70	45	45	95	--
	2015	--	88	--	60	43	96	100

AC=Alphacypermethrin, **DM**=Deltamethrin, **LC**=Lambdacyhalothrin, **PM**=Permethrin, **Bendio**=Bendiocarb, **Pir-Met**=Pirimiphos-methyl
[1]Current IRS district
[2]Former IRS district

Progress during the last 12-18 months

One of the principal roles of entomological monitoring is to assess the quality of spraying and the longevity of the insecticidal effect on the sprayed walls. The results of these activities are reported in the IRS section below.

Molecular assays including species identification for mosquitoes collected from July 2015 to April 2016 are currently underway.

Insecticide resistance assays using the WHO tube bioassay were conducted with 11 insecticides in 15 districts in 2015. Insecticide susceptibility data for six insecticides in selected districts are reported in Table 2. In general, pyrethroid and DDT resistance are widespread and bendiocarb resistance appears

limited to the Region of Dakar. Mosquitoes in all districts were found to be susceptible to pirimiphos-methyl even in the zones where this insecticide had been used for IRS. In an effort to determine mechanisms of resistance, mosquitoes from Richard Toll and Rufisque were tested with piperonyl butoxide (PBO) and permethrin or with ethacrynic acid (EA) and DDT. In both sites, a partial increase in susceptibility was observed with PBO suggesting oxidases are one of the mechanisms of resistance acting in these populations of mosquitoes. With EA, the mosquitoes from Richard Toll showed a partial increase in susceptibility whereas in Rufisque no change in percentage mortality was noted. Glutathione-S-transferase activity may be responsible for some of the resistance noted in the Richard Toll mosquito population.

In June 2016, the NMCP and UCAD began collecting documents related to and planning a workshop for the development of a national strategy for insecticide resistance management. The workshop with the NMCP, entomologists from UCAD, *Institut Pasteur Senegal*, SLAP, and IRD is planned for the end of 2016.

A Microsoft Access® database has been developed to provide a searchable and more user-friendly system to store entomological monitoring data, which hitherto had been stored in Excel® files on the UCAD team computer. In addition, a dedicated server and two computers have been purchased for database storage and use. Five people were trained on its use in June 2016 and have begun transferring the last eight years of data to this new format.

An evaluation of the entomological capacity in Senegal was conducted by an international consultant during a two week period in September 2015. Among the recommendations was the establishment of sentinel sites with trained local technicians and installation of equipment such as microscopes and dissecting scopes to avoid the long field visits from the central level. The NMCP has begun a pilot program to train members of the *Service National d'Hygiène* who are based at the district level and will conduct monthly collections with occasional supervision from the national level. In addition, the assessment indicated that the laboratory space at UCAD was limited and needed improvement. The NMCP and UCAD staff are investigating potential options for improving the laboratory capacity for the *Laboratoire d' Ecologie Vectorielle et Parasitaire* and thus for the NMCP.

Plans and justification

Although the NMCP and PMI plan to cease IRS activities, they will continue to support entomological monitoring activities with FY 2017 funds. These activities include monitoring mosquito abundance, behavior, seasonality, and susceptibility status in the areas where IRS activities have ceased, in areas in the pre-elimination zone in the north and the high transmission areas of the southeastern part of Senegal.

Proposed activities with FY 2017 funding: ($494,000)

1. *Entomologic monitoring ($465,000)*

PMI plans to continue to support entomologists from UCAD, SLAP, *Institut Pasteur Dakar*, and IRD to conduct entomologic monitoring including insecticide resistance assays (20 sites). Vector behavior will be assessed by monitoring indoor and outdoor biting rates and indoor resting densities. Parity rates will aid in determining female longevity and transmission potential. Finally, mosquito strains will be identified and checked for malaria sporozoites. Entomologists will continue to conduct insecticide susceptibility assays in the former spray districts, as well as in additional sites throughout the country

where entomologists have been following the evolution of insecticide resistance during the past several years. Molecular analyses of the mosquitoes collected will include identification to species level of the members of the *An. gambiae* and *An. funestus* complexes and identification of insecticide resistance genes.

2. Technical assistance ($29,000)
An entomologist from the Centers for Disease Control and Prevention (CDC) will provide technical assistance for the planning and implementation of all PMI-funded entomologic monitoring activities.

b. Insecticide-treated nets

Progress since PMI was launched

The NMCP and partners have supported various approaches to improving accessibility to LLINs:

1) **Periodic mass free distribution of LLINs:** In 2007, the NMCP began implementing large-scale mass "catch-up" distributions of LLINs to children under five, culminating in a national campaign in 2009. Universal coverage distributions targeting every sleeping space began in 2010 and were completed in April 2013, with 6.9 million LLINs distributed. This rolling universal coverage campaign restarted in 2013 in Kédougou, and returned to the eight regions covered in 2010 and 2011 during the first universal coverage campaign, distributing 3.8 million LLINs from July 2013 to November 2014.

2) **Routine distributions:**
    a. **LLINs for pregnant women:** During 2008 and 2009, PMI supported the subsidized sale of ITNs and later LLINs to pregnant women and children under five. This system involved agreements between facility health committees and private sector net distributors, with beneficiaries contributing a small copayment. Beginning in July 2012, free nets were made available to pregnant women during their first antenatal consultation. During 2015, 155,053 LLINs were distributed to pregnant women. Although this was an increase from 2014, health facilities often lacked sufficient stocks of LLINs due to difficulties with agents in charge of net distribution. It is expected that these challenges will soon be alleviated given the recent acquisition of a truck with PMI funding, which will support the NMCP's effort to provide nets to health facilities.

    b. **Free distribution in schools**: In 2013, PMI supported the NMCP to pilot free distribution to primary school students in two regions, with 75,710 LLINs distributed in classes CI and CE2 (six- and nine-year olds) once during the school year. The distributions were accompanied by educational activities. Two additional regions were added in 2014 and 135,117 nets were distributed in 2014. Very few nets were distributed in 2015 in anticipation of the 2016 mass distribution campaign.

    c. **Untargeted sales of subsidized bed nets:** From 2006 to 2007, the NMCP supported bed net sales to the general population at health facility pharmacies and through community-based organizations (CBOs) at a subsidized price of 1,000 West African Financial Community Francs (CFA) (about $2 per net), a portion of which was retained by the

health districts and CBOs, a policy continued by PMI until 2010. Beginning in July 2012, PMI began supporting a system to make subsidized nets available to all clients frequenting health facilities at a price of 500 F CFA (about $1). The NMCP set a goal of 217,300 nets to be sold in this manner and surpassed and achieved their goal in 2014 and 2015, respectively, even though health facilities were not receiving sufficient stocks of nets.

d. **Distribution via Community-Based Organizations (CBOs)**: PMI expanded the availability of subsidized nets in 2013 by supporting a pilot in two regions using CBOs. Community "relays" distribute coupons during home visits or from a fixed point and individuals then redeem the coupons at distribution sites. As with the health facility channel, the LLINs are sold for 500 F CFA (approximately $1) and the copay is shared at different levels to cover transport costs and communications activities. The current CBO system is funded by PMI and handled by the NMCP to help ensure nets at the village level. The CBOs receive the nets from the NMCP and use the funds received to promote nets and net care. The distribution points for this channel are designated by the CBOs.

e. **Social marketing:** Finally, PMI supports a social marketing program in urban centers (including Dakar and Thiès, for example) where pharmacies and other retail outlets such as grocery stores and gas stations are available. The NMCP and PMI's implementing partner coordinate tehse social marketing activities. Nets are sold at a price of 1,000 F CFA and are branded with a unique logo and promoted through a communications campaign that focuses on being a protective head of household. PMI provides the LLINs to pharmaceutical wholesalers, who then assure distribution through their normal supply chain. Actors at each level of the supply chain retain the profit from the sale of LLINs to cover their operational costs and communications activities.

3) **Commercial sales to the general public:** PMI supported social marketing of full-price LLINs in the private sector from 2007 to 2009. When mass free distributions began, however, the market was significantly weakened. Full-price LLINs can still be found in pharmacies and some shops, primarily in major urban areas, but they are generally not long-lasting varieties. These bed nets are sold at 3,000 – 7,500 F CFA ($6 – $15) each.

As a result of implementing these different strategies, household ownership of at least one ITN has increased substantially (from 20% in 2005 to 73% in 2012 and 77% in 2015). Utilization of ITNs by children under five rose from 7% in 2005 to 46% in 2012 to 55% in 2015 with similar trends observed among pregnant women and in the general population. However, these data mask significant disparities among regions, reflecting socio-cultural differences as well as the progression of the universal coverage campaign (see Table 3 below). For example, the West zone, which includes the populous and urbanized regions of Dakar and Thiès, had not yet been covered by the campaign at the time of data collection for the 2012 continuous survey but received nets in 2013. Net ownership in this region increased by 12% in the 2014 cDHS. Regions in the center received nets in a mass campaign 2014 and their net ownership increased by 11% from 2014 to 2015. Possession of ITNs is highest among the poorest quintiles (greater than 87%) and in rural areas (72% rural vs 58 % urban).

Table 3: ITN possession and use by zone and population in 2013-2015

Zone - year	Proportion of households possessing at least 1 ITN	Average number of ITNs per household	Proportion of population that slept under an ITN the previous night			In households with at least 1 ITN, proportion of population that slept under an ITN the previous night		
			General popn	Children under 5	Pregnant women	General popn	Children under 5	Pregnant women
North 2013	93	3.7	61	64	64	65	67	68
2014	81	3.2	48	53	35	59	63	44
2015	78	2.6	*	54	55	*	70	71
West 2013	50	1.7	24	19	24	41	45	34
2014	62	2.3	33	36	28	49	52	51
2015	61	2.1	*	45	33	*	64	50
Center2013	88	3.9	48	50	47	54	57	51
2014	82	3.3	37	38	40	45	46	50
2015	93	5.0	*	67	67	*	72	73
South 2013	86	3.2	40	43	45	47	50	52
2014	89	3.5	53	54	56	60	62	65
2015	92	4.0	*	54	53	*	57	56

Source: 2012-13 cDHS, 2014 cDHS, and 2015 cDHS
*Data not available at time of MOP writing.
Note: Due to the timing of the surveys, ITN use is measured during the dry season. Coverage estimates are therefore probably an underestimation of actual usage.
North=Regions of Matam, Louga, and Saint Louis; West=Regions of Dakar and Thiès; Center=Regions of Diourbel, Fatick, Kaffrine, and Kaolack; South= Regions of Tambacounda, Kolda, Kédougou, Sédhiou, and Ziguinchor.

Progress during the last 12-18 months

During 2016, the NMCP carried out a nationwide universal campaign in three phases, starting in the Axe I (the southern regions of Ziguinchor, Tambacounda, Kolda, Kédougou, and Sédhiou), then to Axe II (the central regions of Diourbel, Kaolack, Fatick, and Kaffrine) with most of Axe III (regions of St. Louis, Louga, Matam, Thiès and Dakar) covered last due to a delay in receiving ITNs. Organizations contributing nets to the campaign included the Global Fund, the Islamic Development Bank, the World Bank (via the Senegal River Basin Development Organization), and PMI. More than 8 million nets were distributed by June 2016, of which 1.9 million were procured with PMI funding.

PMI continues to focus on the routine distribution system, although this has slowed in FY 2014 due to delays in the transfer of management responsibilities from an implementing partner to the NMCP and to availability of funding. The NMCP undertook a situational analysis in February 2014 to consolidate information on the number of LLINs distributed and existing stocks, lessons learned during implementation, and recommendations for expansion of the pilot programs. A “relaunch” plan was validated by the national coordinating committee in April 2014, which served as a roadmap for the following year. Key elements included: 1) eliminating coupons for the health facility and community channels to simplify the acquisition process and reduce bottlenecks related to supplying the coupons; 2) increasing the involvement of local authorities in identifying appropriate storage facilities; and 3) a plan for introducing the different channels in each region. School-based distributions continued in the two pilot regions (Louga and Ziguinchor) and two additional regions (Saint-Louis and Matam). Routine distribution systems were underemphasized in 2015 in anticipation of the 2016 campaign.

The social marketing program received a boost 2014 from a partnership developed with *City Dia*, which operates grocery stores as well as the shops co-located with Total gas stations and distribution increased in 2015.

During FY 2015, almost 900,000 LLINs were distributed through the following channels:

Table 4. ITNs distributed through routine channels

Channel	FY 2014	FY 2015	FY 2016*
Health facility – ANC	105,686	155,053	134,455
Health facility – general consultations	222,053	214,353	101,136
Schools	135,117	1,291**	90**
CBOs	52,921	124,709	67,966
Social marketing (sold to distributors)	134,938	395,022	39,980
TOTAL	**650,212**	**890,428**	**343,627**

*Quantities for a partial year (October 2015 through March 2016).
**Not emphasized in 2015 in anticipation of 2016 mass campaign.

The NMCP and PMI developed a protocol and began implementing durability monitoring in May 2015 of seven types of LLINs distributed during the 2014 mass campaigns in six regions. The six-month and one-year samples have been removed from the field and hole-counts and cone bioassays have been completed for the six month samples and are underway for the one year samples. Although a local NGO was contracted to carry out the project, UCAD staff are conducting cone bioassays on the nets. Chemical analyses of the nets will be done at CDC in Atlanta.

Commodity gap analysis

Maintaining high LLIN coverage levels after the mass campaigns will require keeping up LLIN distribution via the different routine channels across the country. Approximately 1.8 million nets need to be distributed through the routine channels every year in order to maintain coverage. Under its new Strategic Plan (2016-2020), the NMCP will continue mass campaigns every three years and plans to implement a nationwide replacement campaign in 2019, although the distribution will take into consideration the nets in the field. The different routine channels will continue to operate, providing the population with several options for replacing worn out nets in the interim.

Table 5: LLIN Gap Analysis

Calendar Year	2016[1]	2017	2018
Total Population	**14,704,787**	**15,101,817**	**15,509,566**
Routine Distribution Needs			
Pregnant women during first prenatal care visit (3.9% of the population); assumes 100% attendance for one visit[2]	286,743	588,971	604,873
Other health facility clients; assumes 4% of all clients will purchase a subsidized LLIN based on 2013 estimate	164,988	217,308	217,308
Community-based organizations[3]	183,810	302,036	310,191
Primary school students	0	596,091	612,185
Social marketing	76,533	133,127	139,783
Estimated total need for routine channels	*712,074*	*1,837,533*	*1,884,340*
Mass Distribution Needs			
2016 national campaign	8,000,000	0	0
Estimated total need for mass campaigns	*8,000,000*	*0*	*0*
Total Routine and Mass ITN Needs	**8,712,074**	**1,837,533**	**1,884,340**
Partner Contributions			
PMI (primarily routine channels)	1,047,120	1,200,000	2,000,000
Global Fund (mass distribution campaign only)	4,178,854		
Islamic Development Bank	1,300,000		
Senegal River Basin Development Organization	600,000		
Total Partner Contributions	**7,125,974**	**1,200,000**	**2,000,000**
Total ITN Surplus (Gap)	**(1,586,100)**	**(687,533)**	**115,660**

[1]Routine needs for 2016 estimated to be half of earlier year's due to the national mass campaign occurring during 2016.
[2]Nets are not distributed during EPI visits in Senegal. The NMCP has determined that EPI channels are no longer appropriate to reach children eligible for routine vaccination given that those children traditionally sleep with their mothers and would thus be protected by nets that pregnant women receive at ANC visits.
[3]This is estimated at 80% of 2.5 % of the total population.

PMI plans to provide approximately 1.2 million of the needed LLINs in 2017 and 2 million in 2018, which will be distributed primarily through the routine channels. The surplus of PMI-procured nets in 2018 will be used for the campaign of 2019.

Plans and justification

With FY 2017 funds, PMI and the NMCP plan to focus efforts on maintaining a constant supply of nets and a strong, nationwide routine distribution system for LLINs as described above. PMI also plans to support communications activities to inform the population about mechanisms to acquire nets and their

proper use and maintenance. These activities are described in the social and behavior change communication (SBCC) section. Such efforts will be emphasized in the southeast regions with high transmission and, using past years funds, PMI will support the *Projet du Sud,* a project that aims at beating transmission down with target interventions in those regions.

PMI will continue LLIN durability monitoring of nets distributed during the November 2014 mass campaigns, as well as those distributed during the 2016 campaign. Collections are scheduled for November 2016 and November 2017. Under this protocol, the same cohort of nets distributed in 2014 and 2016 will be followed out to 2017.

Proposed activities with FY 2017 funding ($7,340,000)

1. *Procurement of LLINs ($6,640,000)*

PMI plans to support the routine LLIN distribution channels by procuring approximately 2.0 million LLINs. Any surplus nets not distributed via routine channels will be used for the planned 2019 mass campaign.

2. *Operational support for distribution of LLINs ($700,000)*

With FY 2017 funds, PMI will support the operational costs for the distribution of LLINs. Operational costs for the routine system are expected to decrease significantly as the different channels will be fully functional nationwide, but will continue to include transportation to regions/districts and supervision.

c. Indoor residual spraying

Progress since PMI was launched

Senegal has benefitted from IRS since PMI began work in the country in 2007. The first three districts sprayed with PMI support—Richard Toll, Nioro, and Vélingara—each represented different ecological zones. One spray round was carried out just before the high transmission season in each district, while in Richard Toll, a district along the Senegal River, another round was done immediately prior to the second seasonal peak in April. After entomological monitoring demonstrated that the insecticidal activity persisted long enough to cover the second peak, this second round was eliminated in 2010. Also in 2010, IRS operations were expanded to Guinguinéo, Malem Hodar, and Koumpentoum, districts that were among the 16 health districts prioritized for IRS by the NMCP. In 2011, because malaria rates were low and insecticide resistance was high in Richard Toll, spray operations ceased in this district and Koungheul was selected as a replacement. In early 2013, the IRS Steering Committee, composed of representatives from the NMCP, entomologists from UCAD, the National Hygiene Service, the National Directorate of Environment and Agriculture, the IRS implementing partner, and PMI, made the decision to cease IRS operations in the districts of Guinguinéo and Nioro because data indicated that malaria rates had become very low (incidence of 5 per 1,000 in 2012). A plan for post-withdrawal action was prepared, including communications at both administrative and community levels and enhanced surveillance. In November 2014, the IRS steering committee decided to cease spray operations in Vélingara because this district benefitted from a recent LLIN campaign and the use of SMC and because the entomological and routine health systems data did not provide convincing evidence of a benefit from IRS. The committee decided to return to Nioro where malaria incidence had increased in the past couple of years (incidence of 47 and 31 per 1000 in 2013 and 2014). In addition, starting in 2015, the country strategy changed to focal spraying, targeting health zones or districts where the malaria incidence was 30 per 1,000 or more, as a potentially more cost-effective method than blanket spraying. A long-lasting

organophosphate was chosen for use in the districts of Koumpentoum, Koungheul, Malem Hodar, and Nioro.

The population protected during the eight years of IRS ranged from around 650,000 in 2007 to more than 1 million in 2012, with high coverage rates being achieved in most years (see Table 6 for last five years). As malaria incidence decreases, fewer health post zones in the districts targeted for IRS will meet the NMCP criteria for IRS, therefore the population covered will decrease.

Table 6: IRS Coverage

Year	Number of Districts Sprayed	Insecticide Used (# districts)	Number of Structures Sprayed	Coverage Rate	Population Protected
2013	4	Bendiocarb	206,704	98%	690,090
2014	4	Bendiocarb (2) Organophosphate (2)	204,159	97%	708,999
2015	4 (hot spots)	Bendiocarb (1) Organophosphate (3)	130,170	98%	514,833
2016	4 (hot spots)	Organophosphate	124,757	97%	496,728
2017	TBD (hotspots)	Organophosphate	75,000*	TBD	250,000*
2018	No IRS planned with FY 2017 funding.				

*Represents projected targets

Pyrethroids were used during the first four years of spray operations, but a significant drop in insecticide susceptibility of mosquitoes to pyrethroids was observed and the decision was made to switch to a carbamate for the 2011 operations. Insecticide susceptibility to pyrethroids increased after this rotation and remained high in 2012.

Spray operations have been organized by PMI implementing partners under the direction of the NMCP, the Hygiene Service, UCAD, and district health management teams. PMI support includes training and equipping locally-recruited spraying agents with help from the NMCP and its vector control partners, with supervision by the National Hygiene Service. All spray rounds were followed by post-spray evaluation meetings to identify lessons learned and opportunities for improving the next round.

Progress during the last 12-18 months

In 2015, the NMCP and partners implemented a new IRS strategy targeting hotspots in four districts: Koumpentoum, Koungheul, Malem Hodar, and Nioro. The steering committee selected 51 health post zones with a malaria case incidence of 15 per 1,000 or more. Spraying activities with the organophosphate insecticide pirimiphos-methyl began in June in Koumpentoum and Nioro, and in early July in Koungheul and Malem Hodar. The eight health post zones in Nioro sprayed with the leftover 2014 stock of the carbamate bendiocarb were sprayed in September to ensure optimal coverage of the transmission season given the short duration of bendiocarb action. A total of 130,170 structures were sprayed (out of 133,252 targeted) and 514,833 people were protected. Despite the many challenges involved in IRS implementation, routine monitoring of spray operations suggests that high rates of acceptance have been consistently achieved in all spray rounds.

Cone bioassays to determine the longevity of insecticidal activity on the walls revealed that the pirimiphos-methyl remains active (greater than 80% mortality) five months after spraying in Koumpentoum, Koungheul, and Malem Hodar. In the sixth month, mortality rates in the assays dropped 18-67%. In Nioro, insecticidal activity decreased to 72% and 54% by the fourth and fifth months post spraying, respectively.

Based on the first year of spraying using the hot spot approach (2015), costs were slightly higher as compared with blanket spraying the previous year (2014). According to a comparative cost analysis conducted by PMI[5], costs in 2014 were $5.60 per person ($19.46 per structure), while in 2015 these were $6.46 per person ($25.54 per structure).

The effect of focal spraying on malaria incidence rates was difficult to tease out. In 2015, malaria incidence rates increased in most of the country except in the districts of Nioro and Ndoffane. In addition, malaria incidence rates differed from year to year in some health zones. The selection of health zones to spray in 2015 was based on the malaria incidence data from 2013. In some health zones the malaria incidence had decreased below the 15 per 1,000 threshold in 2014 whereas in others not selected for spraying it had increase above the threshold. Nevertheless, a slight effect of focal IRS on malaria rates was observed. In Nioro, although average malaria incidence decreased in all health zones, the greatest decline occurred in the sprayed zones (from 26 per 1,000 in 2014 to 8 per 1,000 in 2015) as compared to the unsprayed zones (where malaria incidence decreased from 14 per 1,000 to 7 per 1,000). In Koumpentoum and Malem Hodar, the opposite effect was observed; great increases in malaria incidence were noted in both sprayed and unsprayed health zones. In Koumpentoum, the greatest increase was seen in the unsprayed health zones whereas in Malem Hodar the sprayed zones showed the greatest increase in malaria incidence. Only in Koungheul was there a clear indication that the focal spray had an effect. From 2014 to 2015, the average malaria incidence in the sprayed zones decreased from 27 to 20 but in the unsprayed health zones they increased from 8 to 42 per 1,000. A similar evaluation will continue in the health zones sprayed in 2016 to ensure that the observed effects were not due to random variation in malaria incidence.

Spray operations for the 2016 campaign began in March 2016, including reviewing training tools, preparing soak pits, recruiting seasonal spray operators, and training. This is the second year that hotspots will be targeted and activities continue in the same four districts as in 2015. The long-lasting formulation of the organophosphate pirimiphos-methyl was used in all districts and because of the shorter than expected longevity of the insecticide in 2015, the actual spray activities were moved later in the year to July to cover the entire transmission season. A total of 124,757 structures were sprayed (97% of eligible structures found) and 496,728 people were protected with IRS.

Plans and justification

At the time of MOP writing, no PMI FY 2017 funding is planned for IRS support. After one year of implementation, focal spraying of hotspots on malaria incidence was only suggestive of a benefit from IRS. This high cost activity does not appear to bring a significant gain in malaria control in the small area it benefits. LLINs are distributed nationwide. At the request of the NMCP, the majority of the funds have been used to purchase LLINs to ensure coverage through routine distribution channels and forward

[5] Source: Africa Indoor Residual Spraying Project PMI IRS Country Programs: 2015 Comparative Cost Analysis, available at https://www.pmi.gov/how-we-work/technical-areas/indoor-residual-spraying

fund purchase of LLINs for the 2019 mass campaign. While the NMCP's current position is that IRS should be discontinued, the future of IRS in Senegal remains in flux due to a change in NMCP leadership that has led to reappraisal of the value of IRS within Senegal's vector control strategy. In August 2016, a consensus meeting was convened by the NMCP in order to discuss the future of IRS with a broad group of stakeholders including all key institutions involved in vector control (e.g. NMCP, SLAP, UCAD/Entomology, *Service National d'Hygiene*, Ministry of Environment, etc.). This meeting resulted in the formation of two technical working groups tasked with conducting a rigorous review of the evidence around IRS to date in order to inform Senegal's vector control strategy through 2020. The PMI/Senegal team is actively engaged in these discussions and PMI's FY 2017 support for IRS may be revised once the findings of these technical working groups are completed and a final evidence-based decision is reached on IRS policy for Senegal.

2. Malaria in pregnancy

NMCP/PMI objectives

In line with the previous Strategic Framework, which covered 2014-2018, the NMCP's Strategic Plan for 2016-2020 continues to emphasize the protection of pregnant women from malaria as a key intervention given the health risks that malaria poses to the pregnant woman and her fetus.

The specific objectives outlined in the Strategic Plan are as follows:

- At least 80% of pregnant women will be protected with IPTp3 according to national guidelines by 2020[6]
- At least 85% of pregnant women will sleep under an ITN by 2020
- All malaria cases in pregnant women will be seen at health facilities and treated according to national guidelines by 2020

In 2003, the NMCP adopted intermittent preventive treatment in pregnant women with SP given free of charge as directly observed therapy during focused ANC visits as national policy. This policy is implemented in all ANC sites nationwide, regardless of epidemiologic strata. The new Strategic Plan states that all pregnant women should receive at least three SP doses during their ANC visits, starting in the second trimester and with at least one month between doses. The Plan includes advocacy for health workers and the population at large, training and supportive supervision of health workers, and outreach activities by health post staff to provide ANC services at the community level at health huts, all of which are supported by PMI.

The four key IPTp interventions highlighted in the new Strategic Plan are:
(1) ensuring availability of commodities and materials for the provision of directly observed IPTp;
(2) implementation of IPTp, with the introduction of IPTp3 as the indicator to be tracked;
(3) monitoring of IPTp implementation; and
(4) engagement of the private sector.

[6] The NMCP's Strategic Plan for 2016-2020 contains the following inter-year targets for the indicator "Proportion of pregnant women who took three doses of SP in accordance with the guidelines": 2016: 50%, 2017: 55%, 2018: 70%, 2019: 75%, 2020: 80%). At present, the main source for tracking this indicator remains the continuous DHS, which provides an annual estimate for this indicator in addition to data collected at the health facility level.

In addition, the NMCP aims to treat 100% of pregnant women with confirmed malaria according to national guidelines, using quinine in the first trimester and ACTs in the second and third trimesters.

Progress since PMI was launched

In accordance with WHO recommendations, the NMCP continues to use quinine for the treatment of uncomplicated malaria in pregnant women during the first trimester and has now changed its case management policy to allow treatment with ACTs during the second and third trimesters. The NMCP has also updated its policy, guidelines, and training manuals to reflect the WHO recommendation to simplify IPTp guidelines and include the three-dose regimen for IPTp. With PMI's support, updated registers are now being used in health facilities nationwide and these include fields to record all three doses of IPTp as well as whether an ITN was provided.

PMI has supported the production, dissemination, and use by health care workers of new ANC registers and ANC cards that allow for accurate recording of IPTp treatments; job aids to promote the correct management of malaria in pregnancy and improve the counseling skills of health care providers; water filters/dispensers and re-usable cups for directly observed treatment with SP; and refresher training and supportive supervision. The PMI-supported MIP training is part of integrated training that covers data collection and record-keeping, prevention of malaria with IPTp and use of LLINs, and diagnosis and treatment of malaria in pregnant women. PMI supports a routine LLIN distribution system that offers free LLINs to women attending ANC (see ITN section for more details).

The majority of women in Senegal receive antenatal care from a trained provider during their pregnancy. According to the most recent cDHS (2015), attendance at ANC remains high; 95% of pregnant women make at least one visit, while 47% make four or more ANC visits. While there are some slight differences in ANC attendance based on wealth (poorest quintile: 90%, wealthiest quintile: 97%), the coverage of ANC services overall is equitable and homogenous throughout the various regions of the country.

ITN use among pregnant women in Senegal has increased from 9% in 2005 to 52% in 2015 (cDHS). Nationwide surveys and routine data show that IPTp2 coverage has also improved. While only 12% of pregnant women received two doses of SP (for pregnancies that occurred in the last two years) in 2005, this percentage increased to 49% in 2015 (cDHS). These improvements are corroborated by Senegal's routine health information system, which shows that IPTp2 coverage has progressively increased from 36% in 2010, to 66% in 2014, and 70% in 2015 (see Table 7 below, with breakdown by region). In 2015, coverage with IPTp3 stood at 11% according to the cDHS and at 43% according to the routine data system. While IPTp3 coverage remains low, the NMCP credits the introduction of this indicator as one of the driving factors behind the recent uptick in national coverage with IPTp2.

While Senegal's IPTp coverage is progressing, the large difference between the percentage of pregnant women who receive ANC care and those who receive successive doses of IPTp1, IPTp2, and IPTp3 points to missed opportunities in SP administration. The NMCP recognizes that this gap between ANC attendance and coverage with IPTp is problematic and that a concerted effort is warranted to ensure that women receive their first dose of SP and that they also return for subsequent doses over the course of their pregnancy. The NMCP considers IPTp as essential to the achievement of its Strategic Plan for 2016-2020 and has set an ambitious target of 80% coverage with IPTp3 by the year 2020. With the introduction of IPTp3, the NMCP has renewed its focus on this intervention and is implementing an "IPTp relaunch plan," which includes ensuring availability of SP and materials (such as cups) to

encourage directly-observed therapy, intensifying outreach approaches at the community level (such as actively seeking out pregnant women who may have missed SP doses, training and supportive supervision for health workers, and communication activities to disseminate messages on the benefits of IPTp and the importance of early ANC attendance.

Table 7. IPTp2 and IPTp3 coverage by region (2014-2015)

Region	**2014[1]**		**2015[2]**		
	IPTp2 coverage[3] (%)	***Data completeness (%)***	**IPTp2 coverage[3] (%)**	**IPTp3 coverage[3] (%)**	***Data completeness (%)***
Dakar	63	*98*	70	45	*99*
Diourbel	65	*100*	74	49	*99*
Fatick	71	*97*	74	43	*99*
Kaffrine	67	*99*	73	42	*99*
Kaolack	70	*99*	72	46	*99*
Kédougou	49	*99*	57	31	*100*
Kolda	59	*99*	64	33	*100*
Louga	67	*74*	72	42	*80*
Matam	62	*92*	67	38	*100*
Saint-Louis	79	*99*	73	46	*99*
Sédhiou	70	*51*	62	31	*94*
Tambacounda	54	*98*	57	28	*97*
Thiès	70	*95*	73	48	*99*
Ziguinchor	65	*100*	75	48	*100*
National	**66%**	***94%***	**70%**	**43%**	***97%***

(1) Source: Annual Epidemiological Bulletin for 2014, Senegal – February 2015. www.pnlp.sn. For 2014, data for IPTp3 are not available as this indicator was introduced in 2015.
(2) Source: Annual Epidemiological Bulletin for 2015, Senegal – February 2016. www.pnlp.sn.
(3) The NMCP calculates this coverage by dividing the SP dose numbers (1, 2, 3) by first ANC visit, for all women enrolled at their first ANC visit.

Table 8. Status of IPTp policy in Senegal

WHO policy updated to reflect 2012 guidance?	Yes. New policy adopted in 2013, with implementation begun in 2014.
Status of training on updated IPTp policy?	Training completed
Number of health care workers trained on new policy in the last year?	518 trained*
Are the revised guidelines available at the facility level?	Yes
ANC registers updated to capture 3 doses of IPTp-SP?	Yes
HMIS/ DHIS updated to capture 3 doses of IPTp-SP?	Yes

*This total includes: (i) 105 health workers trained in IPTp by the NMCP (during the CY 2015); (ii) 104 health workers from 69 health service delivery points trained in IPTp as part of FANC training in Dakar, Fatick and Sédhiou Regions by PMI-supported implementing partners (during the FY 2015); and (iii) 309 health workers from 110 health service delivery points

trained in IPTp as part of overall malaria case management in Louga, Kolda, Sédhiou, and Kaolack Regions by PMI-supported implementing partners. Source: NMCP and IntraHealth Year 4 Annual Report, FY 2015

Progress during the last 12-18 months

Over the past year, PMI continued to provide support to assist districts in three regions (Dakar, Diourbel, and Thiès) to identify factors affecting low uptake of IPTp and implement solutions. Activities were expanded from 13 districts to a total of 20 districts as of March 2016. Interviews and focus groups with health care providers, pregnant women, and community members indicated that there was confusion about the policy to provide SP for free, as well as a need to reinforce the IPTp guidelines. This formative research was used to develop key messages that were disseminated through road shows/caravans in the area. In addition, health facility staff were re-trained, cups and water filters were provided to encourage directly-observed administration of SP in facilities, and community members (particularly female leaders who provide health advice to other women in the community, known as *bajenu gokh*) were sensitized on the importance of preventing malaria in pregnant women.
This evidence-based approach resulted in improvements in IPTp2 coverage in the two test districts of Touba and Mbao; as a result the NMCP has adopted and is expanding this approach to additional districts. This past year, an innovation was added to this approach which involves contacting pregnant women who have missed their ANC visits. This "active" approach to finding women who missed their ANC visit was carried out in collaboration with *bajenu gokh* and with midwives in order to provide those women with their missed doses of SP. This innovation is also showing promising results. For example, the central district of Dakar showed an improvement in IPTp2 coverage from 55% during the first quarter of 2015 to 61% in the first quarter of 2016. Similarly, in the region of Thiès, IPTp2 coverage has also steadily improved, from 47% during the first quarter of 2014 to 86% in the fourth quarter of 2015.

During the period October 2014-September 2015, a total of 309 facility-based health workers were trained with PMI support in the prevention, diagnosis, and treatment of malaria in pregnancy. In addition, 104 health workers received training on focused antenatal care (FANC), with an emphasis on IPTp. With PMI support, more than 3,840 outreach visits were conducted by facility-level staff (either a nurse or midwife) to health huts. These visits resulted in 36,716 prenatal consultations, 117,374 pregnant women receiving two doses of IPTp as directly-observed treatment, and the distribution of 1,572 ITNs to pregnant women. According to Senegal's routine health information system, a total of 930,564 treatments of SP were administered to pregnant women during the calendar year 2015 nationwide (source: Annual Epidemiological Bulletin, 2015).

During the 2015 fiscal year, PMI also provided support to the NMCP to finalize and print malaria training manuals (e.g. trainer's manual and participant's manual) for all health workers (except CHWs). These materials now include the recent WHO recommendations with regards to IPTp, as well as SMC and chemoprophylaxis for travelers.

In addition to improving IPTp uptake for pregnant women, PMI/Senegal has also supported efforts to improve ITN coverage among pregnant women. Of note, in May 2016, Senegal launched its first nationwide universal coverage ITN campaign, which will result in the distribution of more than 8 million ITNs throughout the country. It is anticipated that this large-scale campaign will result in improvements in ITN use among pregnant women.

Commodity gap analysis

As in previous years, the Government of Senegal, through the Central Medical Stores, is expected to procure sufficient SP to cover the entire need for the country during 2018 (see Table 9 below). Thus, PMI is not procuring any SP for Senegal with FY 2017 funding. Since the adoption of IPTp with SP as national policy in 2003, the Government of Senegal has always procured the SP needed to provide pregnant women with all the recommended doses of SP for IPTp. The quantities of SP that are procured each year are sufficient to cover the needs nationwide. However, while the stocks at the Central Medical Stores are adequate, stocks at health facilities are not always available. This is in part due to the manner in which health facilities operate. Health facilities are expected to request all of their drugs (including ACTs, RDTs, SP, etc) from the Central Medical Stores, under a "pull system." While ACTs, for example, are provided for free to health facilities and health workers in turn provide them free of charge to patients, the system for SP is different. Health facilities must purchase SP from the Central level and, since they are required to provide the SP for free to patients during ANC visits, they are not able to recover their costs on the SP. As a result, there is little incentive for health facilities to be fully stocked at all times with SP. Costs related to SP are to be funded through the annual budget allocation from the Government of Senegal. The fund that is required for each district to cover its targeted population represents a very small portion of their budget. In terms of solutions, some promising results have been found in areas using performance-based financing approaches, which reward those districts that perform well with regards to their IPTp coverage.

Table 9. SP Gap Analysis for Malaria in Pregnancy

Calendar Year	2016	2017	2018
Total Population[1]	14,704,787	15,101,817	15,509,566
SP Needs			
Estimated pregnancies[2]	573,487	588,971	604,873
Total number of pregnant women attending ANC[3]	544,812	559,522	574,629
Total SP Need (in treatments)[4]	**1,307,549**	**1,342,853**	**1,379,110**
Partner Contributions			
SP carried over from previous year	0	0	0
SP from Central Medical Stores (GoS)	1,307,549	1,342,853	1,379,110
SP from Global Fund	0	0	0
SP from Other Donors	0	0	0
SP planned with PMI funding	0	0	0
Total SP Available	**1,307,549**	**1,342,853**	**1,379,110**
Total SP Surplus (Gap)	**0**	**0**	**0**

(1) Source: Senegal 2013 population census, assuming 2.7% growth per year.
(2) Estimated pregnancies assumes that 3.9% of the total population becomes pregnant each year.
(3) Calculation assumes 95% of pregnant women make at least one ANC visit,
(4) SP needs calculated assuming that 80% of pregnant women will receive all three doses.

On average, an estimated 8,000 cases of malaria are reported among pregnant women annually (2011: 6,672 cases, 2012: 9,648 cases, 2013: 8,635 cases, 2014: 6,465 cases, 2015: 9,154 cases). The ACTs needed to treat these cases are included in the overall ACT gap analysis in the case management section. The CMS also procures quinine for use in severe malaria cases and maintains adequate stocks. Iron/folate supplements (combination pill: 60 mg ferrous sulfate, 400 micrograms folic acid) are provided to pregnant women at ANC visits and are also procured by the CMS.

Plans and justification

With FY 2017 funding, PMI will continue to support activities aimed at reinforcing the provision of effective MIP services in health facilities nationwide. Support will continue for monitoring and supportive supervision for the delivery of MIP services, improving data collection including IPTp data, and training new staff on MIP. PMI will also continue to encourage collaboration between the NMCP and the Division of Reproductive Health and Child Survival on activities to address malaria in pregnancy.

Proposed activities with FY 2017 funding: ($550,000)

1. *Reinforce provision of effective malaria in pregnancy services in health facilities and through outreach strategies ($550,000)*

PMI will support Senegal's efforts to reposition the prevention of malaria in pregnancy. Building on the successful evidence-based methodology in the districts cited above, PMI will support the ongoing scale-up of this approach to additional districts. Support will include training for new health-facility level providers as needed on prevention and treatment of malaria during pregnancy, which includes topics such as the importance of LLIN use in pregnancy, diagnosis and management of MIP, and counseling and interpersonal communication skills. PMI also plans to continue to provide cups and water filters as needed for directly-observed treatment with SP. Support will continue for ANC outreach activities at health huts. Activities related to LLIN use and SBCC are covered in those sections.

3. Case management

a. Diagnosis and treatment

NMCP/PMI objectives

Diagnosis and treatment remain core priorities in the 2016-2020 national malaria control strategy. National malaria case management targets for 2020 include:

- Introduce molecular parasite detection in zones of low malaria prevalence
- Test 100% of suspected malaria cases with a RDT and/or blood smear according to national policies
- Treat 100% of confirmed malaria cases with safe and efficacious antimalarial medications according to national policies
- Provide pre-referral treatment to 100% of children less than five years of age with severe malaria

While the introduction of molecular parasite detection in zones of low malaria prevalence is an objective within the NMCP's Strategy, it is not necessarily an activity that the Government of Senegal plans to

implement immediately. Evaluation plans are under development at the NMCP to determine how this technology could assist in referrals and with active case detection.

In high transmission regions (e.g., Kolda and Kédougou regions), Senegal's NMCP has implemented the PECADOM Plus strategy. PECADOM Plus uses community health workers specialized in home-based care (DSDOMs, see definition below) to visit every household in their communities once per week during the high transmission season (July to December) to identify and test fever cases and treat positive cases in all age groups. The DSDOMs are also trained to identify and treat diarrhea and pneumonia in children under five during their household sweeps.

Senegal also implements seasonal malaria chemoprevention in four regions that meet the WHO criteria for this intervention. The NMCP's objective in the 2016-2020 Strategic Plan is to ensure 95% coverage for children aged 3-120 months in the targeted SMC zones by 2020.

The NMCP has adopted WHO recommendations regarding case investigation and active case detection in districts in which annual incidence is less than 5 cases per 1,000 population. In those areas, a confirmed malaria case triggers an investigation of the patient's household and neighboring houses. All members of the index case's household are tested and, in neighboring households, anyone who is symptomatic, has traveled recently, or is not using a LLIN is tested. All who test positive receive an ACT, and, beginning in 2016, confirmed cases will also receive low-dose primaquine.

While Senegal's national policy for pre-referral is not harmonized to the WHO-recommended target ages of 6 months to 6 years, the NMCP is open to discussing a harmonization of current policy and targets for consistency with WHO guidance.

Progress since PMI was launched

The NMCP adopted ACTs as first-line treatment in 2006 and introduced RDTs in 2007. Both artemether/lumefantrine (AL) and artesunate-amodiaquine (AS-AQ) were adopted simultaneously as first-line treatments, with AS-AQ being procured from the beginning, and AL procurement starting in 2010. In addition, dihydroartemisinin-piperaquine donated by the Chinese government is used in the public health sector and is considered a third first-line treatment. Quinine is used for treatment of severe malaria in all age groups and in pregnant women in the first trimester (with ACTs in the second and third trimesters). Intravenous artesunate was adopted along with quinine as first-line therapy for severe malaria, but this policy is being gradually implemented.

Rapid diagnostic tests were introduced in formal health facilities in late 2007, along with a diagnostic algorithm specifying that a patient would not be tested with an RDT nor be reported as a suspected malaria case if another obvious cause of fever was present. These cases are treated for the underlying non-malaria illness, but are eligible to return for re-evaluation, including an RDT, if symptoms persist. At the community level, RDTs were introduced in 2008, and all fevers are eligible for testing. Positive cases showing no signs of severity are treated with ACTs, while negative and severe cases are referred to the nearest health post.

Malaria RDTs and ACTs are provided for free to all patients at all levels of the health system. Medications for respiratory and diarrheal conditions are also free and costs of services to children under five are reimbursed by the government universal health insurance scheme.

Senegal currently follows WHO recommendations for the treatment of severe malaria, for uncomplicated malaria in pregnancy, and for SMC in children aged 3-120 months. These are: (1) pre-referral treatment with rectal artesunate for severe malaria, both at the health post level and at the community level; (2) intravenous artesunate as a co-first line treatment for severe malaria; (3) ACT treatment for uncomplicated malaria cases in pregnancy except during the first trimester for which quinine is still recommended; and (4) SMC for children aged 3-120 months with one treatment of SP-AQ monthly during the rainy season.

PMI has supported both diagnosis and treatment of malaria through integrated training of health care providers at all levels, supportive supervision, and commodity procurement. In health facilities, PMI has provided microscopes, trained laboratory technicians, and supported quality assurance/quality control systems for microscopy. At the community level, PMI supports two different activities: operation of health huts and home-based management of malaria (PECADOM). Health huts, staffed by community health workers (*agents de santé communautaire*), offer an integrated package of maternal and child health interventions, which has included malaria case management with RDTs and ACTs since 2008. PECADOM was piloted in 2008, and scaled up to nearly 1,000 villages by 2010. Under this model, a home-based care provider (*dispensateur de soins à domicile* or DSDOM) is chosen by a community at least 5 kilometers from the nearest health post, and trained in management of malaria with RDTs and ACTs. Diagnosis and treatment are provided to patients of all ages.

In 2012, an integrated home-based package (integrated PECADOM), including treatment of diarrhea and acute respiratory illness for children under 5 years old was piloted among 88 DSDOMs in 5 districts. Based on this experience, integrated PECADOM was expanded nationwide and is currently implemented in 13 out of 14 regions of Senegal. Despite the progress made by integrated PECADOM, there were still some limitations with this passive detection of malaria cases at the community level. In 2013, a new strategy named PECADOM Plus was piloted by Peace Corps volunteers in the Saraya District (Kédougou Region). This new strategy integrates an active weekly door-to-door survey by DSDOMs in their respective communities during the malaria high transmission season (July-December) to test, detect, and treat or refer any cases of malaria, diarrhea or acute respiratory illness in their community. Based on the success of this pilot, PECADOM Plus was expanded and is presently implemented in six southern districts of the Kédougou and Kolda health regions.

Seasonal malaria chemoprevention became a WHO-recommended intervention in 2012 and Senegal was quick to adopt SMC as policy the same year. Much of the existing research on SMC was conducted in Senegal, first in children under five, and subsequently in children up to ten years of age. Since 2013, the NMCP has implemented SMC campaigns with the support of partners, including PMI. In Senegal, 4 regions (16 districts) in the southeast of the country meet the WHO criteria for SMC: Kédougou, Kolda, Sédhiou, and Tambacounda (at least 60% of cases occur within four months of the year, at least 10% annual incidence among children). In 2013, PMI supported the NMCP to implement SMC in 4 districts, and the intervention was subsequently expanded to all 16 eligible districts in 2014 and 2015. Senegal utilizes the community health platform for the distribution of SP-AQ and distribution of SMC drugs occurs using a door-to-door approach targeting children up to 10 years of age. The campaigns have achieved high coverage levels (typically above 98%), which has resulted in protection of approximately 600,000 children each year. For the period 2013-2014, sentinel sites in the SMC zone reported 50% and 60% reductions in uncomplicated malaria cases among children under five years and children between the ages of 5-9 years, respectively. During the same period, two regional hospitals in the SMC zone reported an average reduction of 72% in the number of children hospitalized with severe malaria and an average decline of 79% in the number of deaths among children hospitalized with malaria.

Progress during the last 12-18 months

Diagnosis: In the last 12 months, PMI supported 401 training and supervision/quality control visits to 146 health facilities; in total 320 technicians (in 15 regional hospitals and 74 district health centers) were either trained or supervised, covering all public sector laboratories with microscopy capacity. During the quality control visits, supervisors complete a supervision checklist, verify five negative and five positive slides that the microscopists have read, and have the microscopists read a panel of pre-selected slides. This activity allows the NMCP to identify health facilities for remedial training and increased supervision. At the time of MOP writing, the quality control results for last year are not yet available.

In addition, PMI continued to support the evaluation of quality control of RDTs, selecting 25 RDTs from 3 different lots upon arrival in Senegal. These were tested against standard reference samples with either 200 or 2,000 parasites per microliter, and also negative controls. All RDTs performed as expected, with 100% sensitivity and 100% specificity. In the past year, PMI partners expanded this quality control effort to include collection of tests at different time points from health facilities to evaluate possible changes in test performance related to storage conditions.

The PMI team and partners in Senegal recently completed a PMI-funded operational research project to evaluate the NMCP diagnostic algorithm, specifically to determine the proportion of patients not tested with an RDT according to the diagnostic algorithm who actually have parasitemia. While the sensitivity of the algorithm to identify malaria parasitemia (compared to RDTs) is >80% in most of the country and in patients above the age of five, sensitivity is only 75% in the southeast and only 68% among children under five years. As a result of these findings, the NMCP updated the algorithm. A transitional diagnostic strategy was adopted in early 2015 until universal testing of all patients with fever or a history of fever can be rolled out in 2017. Beginning in May 2015, all children under five years of age presenting with fever were to be tested for malaria, with subsequent treatment for all confirmed cases. During 2016, all children under five years of age all year round and patients above five years of age with fever during July–January will be tested for malaria. Patients above five years of age from February to June with another evident cause for fever will not be tested for malaria and the suspected cause of illness will be treated. If no improvement is seen in 48 hours, then malaria testing is recommended. Senegal plans to move to universal testing of fever cases in all age groups throughout the year in 2017, once experience in quantification of RDTs is gained and funding is secured for the likely increase in RDT requirements. In 2015, a total of 1,421,221 suspected malaria cases were detected and 1,411,390 RDTs were used (99.3% tested by RDT) to detect malaria cases. The projected RDT requirement for 2016 is 2,186,485 tests.

Treatment: PMI procured 851,315 ACT treatments (509,340 AL targeted primarily to SMC regions and 338,975 AS-AQ and 30,000 artesunate suppositories). Case management activities in the formal health sector included training and supportive supervision, using a strategy of peer supervision and mentoring termed TutoratPlus. During FY 2015, PMI supported the training of 895 health workers at the facility level and 1,554 at the community level on malaria case management including RDTs and ACTs. Through PMI funding, the NMCP trained 105 people on the new case management directives and supervised 1,062 health workers at 82 health centers and 205 health posts.

For treatment of severe disease, the NMCP began implementing pre-referral treatment with rectal artesunate (for children aged 6 months to 6 years) prior to the 2014 high transmission season. This pre-referral treatment policy remains in place.

Antimalarial resistance testing: Senegal continues to be a regional leader in monitoring for antimalarial resistance, with two separate efforts receiving PMI funding. Over the last 18 months, PMI-funded therapeutic efficacy studies (TESs) were performed in N'Doffane, Vélingara, and Kédougou. Three ACTs—dihydroartemisinin-piperaquine (DP), artemether-lumefantrine (AL), and artesunate-amodiaquine (ASAQ)—were evaluated in N'Doffane and Vélingara. The results from these two sites were combined and revealed a greater than 99% adequate clinical and parasitological response to all three ACTs in the per protocol analysis. Two ACTs, ASAQ and AL, were evaluated in Kédougou and each had a greater than 97% adequate clinical and parasitological response in the per protocol analysis.

In addition to these TESs, the PMI Antimalarial Resistance Monitoring in Africa (PARMA) network continues to include researchers from UCAD. In the past year, this PARMA collaboration resulted in Senegalese investigators evaluating Senegalese samples (from 2011-2014) at the CDC. No mutations associated with antimalarial resistance were found. Together, the aforementioned results indicate the ACTs recommended by the NMCP and procured by PMI remain effective in Senegal. Because of the success of the PARMA technology transfer exercise at the CDC, future Senegal antimalarial mutation testing will be done in Senegal, and UCAD will be used as a base to instruct other researchers from the continent.

Seasonal malaria chemoprevention: During 2015, PMI-supported SMC covered 16 southeastern districts in 4 regions. Three rounds were implemented in the regions of Sédhiou, Kolda, and Tambacounda. A fourth round was implemented in Kédougou Region where the transmission season is longer. During the 2015 campaign, a total of 623,859 children aged 3 months to 10 years of age were targeted to receive SP-AQ. Of these, 620,877 (99.52%) received at least one treatment and an estimated 97% of children received all three recommended treatments.[7] PMI procured the drugs and paid for the operational costs. PMI worked closely with the NMCP to develop the implementation and monitoring plan. This new intervention is being rigorously monitored and evaluated using routine morbidity and mortality data, pharmacovigilance, monitoring of molecular markers, and process indicators, as recommended by WHO. An assessment of the coverage disaggregated by age group (e.g. 3-59 month olds vs. 60-120 month olds) is being included as part of the SMC evaluation. Currently, no other donors (aside from PMI) are supporting the SMC campaign for calendar year 2018; PMI is fully funding this intervention.

Commodity gap analysis

As Senegal expands the use of active case detection strategies and the roll out of PECADOM Plus, increased use of both RDTs and ACTs may be expected. The ACT gap analysis (Table 11) is based on consumption data from recent years and takes into account the additional cases that are expected to be found during the weekly sweeps conducted by DSDOMs (in areas implementing PECADOM Plus), those found during case investigations, and those detected during SMC campaigns. The RDT gap analysis (Table 10) also takes into account these activities. Of note, the change in the case management policy to test all fever cases with an RDT is likely to significantly increase RDT needs, though it is not yet clear what the magnitude of this change will be. The NMCP and PMI/Senegal remain committed to monitoring actual RDT use and revising procurement plans and estimates as warranted to account for any increases in testing.

[7] Source: NMCP Annual Activity Report for 2015, available at: www.pnlp.sn

Table 10: RDT Gap Analysis

Calendar Year	2016	2017	2018
RDT Needs			
Total country population[1]	14,704,787	15,101,817	15,509,566
Population at risk for malaria[2]	14,704,787	15,101,817	15,509,566
PMI-targeted at-risk population[3]	14,704,787	15,101,817	15,509,566
Total number of projected fever cases[4]	2,500,000	2,500,000	2,500,000
Percent of fever cases tested with an RDT[5]	87%	100%	100%
Total RDT Needs	**2,186,485**	**2,500,000**	**2,808,830[6]**
Partner Contributions			
RDTs carried over from previous year	500,000	813,515	813,515
RDTs from Government	0	0	0
RDTs from Global Fund	0	0	0
RDTs from Other Donors	0	0	0
RDTs planned with PMI funding	2,500,000	2,500,000	3,200,000
Total RDTs Available	**3,000,000**	**3,313,515**	**4,013,515**
Total RDT Surplus (Gap)	**813,515**	**813,515**	**1,204,685**

(1) Population estimate is a projection derived from the last census, which was conducted in 2013.
(2) 100% of the population is at-risk for malaria.
(3) PMI support is for the entire population at risk; gap analysis is therefore for national RDT needs.
(4) Total number of fever cases is based on discussions among partners and the percentage of positive testing in Senegal.
(5) Percentage of tested fever cases increases on a yearly basis due to the gradual implementation of universal testing for malaria.
(6) RDT needs for 2018 include buffer stocks at the different levels of the health system.

Table 11: ACT Gap Analysis

Calendar Year	2016	2017	2018
ACT Needs			
Total country population[1]	14,704,787	15,101,817	15,509,566
Population at risk for malaria[2]	14,704,787	15,101,817	15,509,566
PMI-targeted at-risk population[3]	14,704,787	15,101,817	15,509,566
Total projected number of malaria cases[4]	573,422	542,961	514,117
Total ACT Needs[5]	**668,992**	**633,454**	**599,803**
Partner Contributions			
ACTs carried over from previous year	196,368	599,376	765,922
ACTs from Government	0	0	0
ACTs from Global Fund	0	0	0
ACTs from Other Donors[6]	472,000	0	0
ACTs planned with PMI funding	600,000	800,000	1,100,000
Total ACTs Available	**1,268,368**	**1,399,376**	**1,865,922**
Total ACT Surplus (Gap)	**599,376**	**765,922**	**1,266,119**

(1) Population estimate is a projection derived from the last census, which was conducted in 2013.
(2) 100% of the population is at-risk for malaria.
(3) PMI support is for the entire population at risk; gap analysis is therefore for national ACT needs.
(4) Total projected number of malaria cases is based on NMCP data. The number of total cases is expected to decline by about 5% each year as a result of the impact of malaria control interventions.
(5) ACT needs include buffer stocks at the different levels of the health system to avoid stockouts at the facility level. The figure for ACT needs also includes a three-month security stock and accounts for the additional ACTs that will be needed to treat additional cases that are diagnosed during sweeps conducted by DSDOMs (PECADOM Plus) and those found during case investigations.
(6) Others donors are the Islamic Development Bank and the Chinese Cooperation.

Plans and justification

PMI will maintain its support for the diagnosis and treatment activities described above (training, supervision, procurement), for both uncomplicated and severe disease. With the expected increase in the number of districts with very low annual incidence (in 2015, 14 districts with incidence below 5 per 1,000), the NMCP has adopted a policy to introduce a single low dose of primaquine in association with ACT treatment for confirmed malaria cases, in accordance with WHO guidelines. Introduction of this approach is planned for selected districts with annual incidence < 5 per 1,000. As noted above, PMI will continue to provide procurement and distribution support for SMC in the four regions that were supported during the 2016 calendar year. Finally, PMI will continue to support therapeutic efficacy monitoring in two sites annually, rotating sites. Social and behavior change communication efforts to improve diagnosis and treatment are described in the SBCC section of this MOP.

Proposed activities with FY 2017 funding: ($8,686,000)

Diagnosis

1. *Strengthening microscopic diagnosis of malaria ($200,000)*

Laboratory worker training is part of an ongoing quality assurance program supported by PMI. PMI plans to continue to provide training in microscopic diagnosis of malaria for new microscopists, as well as remedial training for those found not proficient during supervision. The planned $200,000 in FY 2017 funding for this activity is based on recent years' experience, during which approximately 1,200 healthcare workers were trained in malaria diagnostics (microscopy and RDTs). PMI plans to provide supportive supervision of malaria diagnosis by microscopy for laboratory and health facility staff and assist the NMCP and its partners to implement the quality assurance and control standards for malaria diagnostic testing. Sites showing poor performance will be targeted for additional on-site training and quality control visits. This budget will include support for regular slide-reading workshops for group training, as well as support for the accreditation of the national slide reading course. Workers who will benefit rom this training are based in approximately 140 healthcare facilities nationwide.

2. *Procurement of microscopes and laboratory consumables ($15,000)*

PMI plans to provide laboratory consumables and to replace aging microscopes as needed.

3. *Procurement of RDTs ($1,696,000)*

The NMCP has requested that PMI procure approximately 3.2 million RDTs to contribute to nationwide needs, including diagnosis of symptomatic patients at health facilities, at the community level, and active case detection where indicated.

4. *Quality control of microscopy and RDTs ($40,000)*

PMI plans to assist in the implementation of quality control programs for both microscopy and RDTs, in conjunction with NMCP and the *Université Cheikh Anta Diop*. This includes review of a percentage of positive and negative slides as well as the evaluation of RDTs upon arrival in Senegal and at regular intervals thereafter at the point-of-care. In addition to that ongoing quality assurance strategy, PMI will support the expanded use of an updated supportive supervision checklist that will include user performance of RDTs. This checklist will be scaled-up through current supportive supervision visits that are part of the PECADOM plus program (costs covered under PECADOM Plus budget line item).

Treatment

1. *Improve case management at health facilities ($465,000)*

As part of the effort to improve the management of malaria, PMI plans to support training for health care workers in case management with RDTs and ACTs (initial and refresher training, as indicated), as well as management of severe disease. Implementing partners will work with the MoH to provide supportive supervision to promote correct management of malaria at health posts, health centers, hospitals, and in the private sector. The planned $465,000 in FY 2017 funding for this activity is based on recent years' experience, during which approximately 1,500 healthcare workers were trained in malaria case management. Workers based in approximately 140 healthcare facilities nationwide will benefit from this training.

2. *Strengthen community case management ($650,000)*

With FY 2017 funding, PMI plans to continue to provide technical support on correct diagnosis, treatment, stock management, and referral practices for CHWs at health huts. Attention will also be given to timely data collection and integration of community case management data into the MoH reporting system. The PMI funding will complement other USAID/MCH funding to support the training, supervision, and monitoring of community-based staff nationwide.

3. *Intensification of integrated home-based management of malaria (integrated PECADOM) and PECADOM Plus ($1,500,000)*

PMI plans to continue to support supervision of village malaria workers in malaria diagnosis with RDTs and treatment with ACTs as part of an integrated case management package that includes acute respiratory infections and diarrhea, which includes support to health post nurses and DSDOMs. PMI plans to support operational costs to extend integrated PECADOM Plus in up to 40 districts (in four regions: Sédhiou, Tambacounda, Kédougou, and Kolda), including support for existing DSDOM and CHWs at health huts, further recruitments of DSDOMs to support the expansion to cover more villages with PECADOM Plus, supervision of all DSDOMs and replenishing of their home-based kits.

4. *Procure ACTs ($1,100,000)*

PMI plans to procure approximately 1,100,000 ACT treatments, which will meet the majority of the country's needs for the year. Artemether-lumefantrine will be procured and distributed in the four regions where SMC is implemented to avoid treating confirmed malaria cases with the same drug that is used for chemoprevention (amodiaquine). In previous years, approximately half of the country's malaria cases have occurred in these regions. Artesunate-amodiaquine will be procured and targeted to the remaining regions.

5. *Operational costs ($1,540,000) and procurement of drugs ($950,000) for implementation of SMC*

PMI plans to continue to fund SMC with three or four doses of SP-AQ for children from three months to ten years in the four highest transmission regions. The age groups and geographic zones to be covered during the 2018 campaign may be re-evaluated based on lessons learned from previous years. The operational funds are slated to support training, supplies, and supervision. Funds for communications activities are included in the SBCC section. The intervention will protect approximately 633,000 children in total; there will be three rounds in the regions of Sédhiou, Kolda, and Tambacounda regions, four rounds in Kédougou Region. The costs for the procurement of SMC drugs are higher this year given the shift to the more expensive co-blister formulation of SP-AQ (rather than loose SP and AQ). This formulation is expected to simplify campaign logistics (and eliminate costs associated with repackaging loose SP and AQ) and further improve children's adherence to the treatment regimen.

6. *Operational costs of expanding pre-referral treatment to the community level nationwide ($75,000), procurement of rectal artesunate suppositories ($18,000), and procurement of injectable artesunate for treatment of severe malaria ($222,000)*

PMI plans to continue to procure 30,000 doses (100mg per dose) of rectal artesunate for pre-referral treatment for severe malaria. Pre-referral treatment with rectal artesunate at the community level will be scaled up nationwide. The budget/quantity for procurement of rectal artesunate will be revised as necessary. PMI plans to procure approximately 12,600 treatments (5 ampules per treatment) of injectable artesunate sufficient to treat cases of severe malaria referred to the hospital or health center level. While the expectation is that the number of severe cases will decrease, this amount is sufficient to treat approximately 60% of 21,000 severe cases, estimated based on incidence data of severe malaria currently available.

7. *Procurement of primaquine ($15,000) and implementation of single low-dose primaquine in elimination districts ($40,000)*

PMI plans to procure primaquine for single low-dose treatment in elimination districts with incidence approximately 1 per 1,000. PMI will target the regions of Saint-Louis and Louga, which have five and eight health districts respectively, with a combined population of approximately 1,880,000, and a malaria incidence of 1.6 per 1,000. PMI will also support a detailed M&E plan, which will likely include regular supervision, data analysis, case investigation, and pharmacovigilance. Operational funds will cover training, job aids, and supervision.

8. *Therapeutic efficacy monitoring ($160,000)*

PMI plans to support therapeutic efficacy studies at two sites to monitor the susceptibility of *P. falciparum* to the first-line ACTs (artesunate-amodiaquine and artemether-lumefantrine) and monitor molecular resistance markers for SP, amodiaquine, and artesunate. Sites for therapeutic efficacy studies will be rotated to provide data from western, central, and southeastern Senegal. Four sites are rotated: Deggo (Dakar), Keur Soce (Central), and two in the South (Vélingara and Kédougou). Both southern sites are areas with a great deal of regional population movement, with the Kédougou site also known for a great influx associated with mining. PMI plans to continue to conduct TES in two sites annually, testing the three ACTs in circulation in Senegal each year. A UCAD laboratory has developed advanced molecular capacity to test for K13. This laboratory has the capacity to become a regional testing center, and we plan to conduct K13 testing in Senegal to build capacity and avoid ethical issues associated with exporting samples.

b. Pharmaceutical management

The ultimate goal of PMI's support for the supply chain is to ensure that SP, ACTs, and RDTs are procured and made available in sufficient quantities at all service delivery points. In its strategic plan for 2016-2020, the NMCP's specific objective for pharmaceutical management is to:

- Ensure permanent availability of malaria commodities in 99% of service delivery points by 2020

Progress since PMI was launched

To address recurrent stockouts of several commodities, in 2011 PMI supported an assessment of the CMS aimed at identifying root problems and potential solutions. Challenges identified by the assessment included the lack of a procedures manual, inadequate utilization of the commodity management

information system, and insufficient capacity among various personnel. PMI then provided assistance to update the procedures manual, which was disseminated throughout the health system to chief pharmacists, accountants, and other staff. Also, a new drug management software (SAGE) was developed and installed at the CMS. Technical assistance from PMI has also supported efforts to improve stock management at the lowest levels of the system, with an emphasis on ensuring good ACT prescribing and dispensing practices at health posts and health huts.

PMI continued its support to the CMS by providing technical assistance to develop a strategic plan for 2014-2018 that will guide it towards meeting the challenges it is facing, with all stakeholders sharing the same vision. Some specific improvements have been made and new initiatives are being piloted, including a mobile pharmacy for the three regions that do not have a pharmacy structure, and the Informed Push Model for some essential products (including malaria in one region).

In FY 2014 PMI continued its support to activities aimed at improving governance of the health system for increased access and quality service delivery. Under the leadership of the MoH, Senegal has been piloting Performance-Based Financing (PBF) in three districts. After one year of implementation, an evaluation of the pilot demonstrated that PMI-supported activities, including training and supervision in three districts, contributed to improving those malaria prevention and case management services for which compensation is paid. Because IPTp coverage is an indicator included in the PBF management plan and is compensated, the uptake of IPTp has significantly increased in the target districts. In the District of Kaffrine for example, IPTp coverage has improved from 29% to 48% over a one-year period and from 31% to 69% in the District of Birkelane. Moreover, SP stockouts have been reduced considerably due to appropriate steps taken by service providers to ensure SP availability on a permanent basis during ANC services. Discussions are underway between USAID, the MoH, and the World Bank to expand the number of districts covered by PBF, which will contribute to the Government of Senegal's vision of Universal Health Coverage.

Progress during the last 12-18 months

In May 2015, with PMI funding, the first integrated and evaluative supervision visits were conducted by the NMCP and the Department of Reproductive Health and Child Survival in seven health facilities in Joal (Thiès Region) using end-use verification tools. The preliminary findings show that the availability of essential drugs (including ACTs, RDTs and SP) is still weak in health facilities. None of the health facilities visited had ACTs in stock and 43% had expired drugs in storage. In addition, 57% of health facilities reported that they do not order drugs on a regular basis and 14% of drug managers had not received training in the past three years. Efforts will continue to increase supervision to make ACTs available on a permanent basis at all health facilities.

Following the development of its 2014-2018 strategic framework, the CMS designed a project with the aim of improving drug distribution from regional pharmacies to health districts to increase availability in health facilities (health centers and health posts). Known as *Jegessi naa* ("we are getting closer" in the Wolof language), the project started in January 2015 and is being piloted in three districts. Although it is too premature to assess the impact of the project on health care delivery, anecdotal reports from the field, mainly from Fatick Medical Region, indicate that availability of essential drugs at health post depots has improved. The CMS and its partners have evaluated this new approach in order to learn lessons and support scale-up as necessary. The Mission will use PMI and other health element resources to support the evaluation of the project one year into implementation in order to learn lessons and support scale-up as necessary. The final evaluation report will become available in June 2016.

PMI continues to support drug quality monitoring activities in nine sites, as well as advocacy for the enforcement of drug quality standards. These policy and advocacy investments have had an impact on enforcement. For example, in 2010-2011, the *Laboratoire National de Contrôle des Médicaments* (LNCM), identified and supervised the removal of a lot of artesunate-amodiaquine (not procured by PMI) from the market due to the discovery of higher-than-acceptable levels of amodiaquine. The Government of Senegal has also taken bold actions to close down the *Keur Serigne Bi* black market.

Plans and justification

Under its current 2016-2020 health strategy, the Mission plans on enhancing its support to the supply chain and pharmaceutical system. The FY 2017 resources of the current MOP will coincide with the third year of the strategy (calendar year 2018). Therefore, PMI resources together with other program element funding will contribute to improving the capacity of the national pharmacy stockpile, the performance of the CMS, and the availability of commodities at service delivery points.

Proposed activities with FY 2017 funding: ($1,545,480)

With FY 2017 funding, PMI plans to support the following activities to strengthen pharmaceutical management and develop capacity at sub-national and central levels.

1. *Support supply chain management at the central level ($700,000)*

With FY 2017 funds, PMI plans to continue to support the implementation of key reforms instituted during prior years and provide technical assistance to improve drugs and RDTs quantification through the use of consumption data collected from peripheral levels.

2. *Increase the storage capacity for malaria commodities ($500,000)*

PMI FY 2017 funding will be used to refurbish warehouses at the central and regional levels, thus contributing to improving storage capacity for malaria commodities. Priority will be given to high malaria transmission regions in the southeast of the country (Kédougou, Kolda, Sédhiou, and Tambacounda) where lack of adequate storage capacity is a major challenge to ensuring that commodities are available in a timely manner.

3. *Drug quality monitoring and advocacy ($225,000)*

In collaboration with the NMCP, the Directorate of Pharmacies and Medicines and the National Drug Control Laboratory, PMI plans to continue its support to drug quality monitoring activities in nine sites. In addition, PMI plans to support advocacy for policy enforcement of drug quality standards. Proposed activities will also include technical assistance to the National Drug Control Laboratory as it seeks to meet the requirements to be a regional reference laboratory. Due to delays in securing a G2G mechanism, this implementing partner has not received funds nor conducted activites in Senegal for more than two years. As such, the $225,000 proposed for FY 2017 is part of a “catch-up” strategy to complete drug quality monitoring and advocacy activities not conducted during the 2013-2015 gap, and to accelerate Senegal's progress toward ISO certification.

4. *Cost of commodities management at the PNA (3% of commodities costs, not including nets) ($120,480)*

PMI funds will be used to cover delivery fees for all PMI-procured malaria commodities (with the exception of ITNs as these do not transit through the CMS). This is calculated at 3% of the commodity costs and is applied to all partners that procure commodities for Senegal.

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 2016 –2020 National Strategic Plan identifies the following key objectives for health system strengthening:

- Promote universal access to the package of interventions to facilitate protection of vulnerable groups and under-served populations as well as quality health care. Highly endemic zones will be targeted in order to achieve objectives set forth in a short time period. Contribution to the sustainable strengthening of the health system will also be a priority, including devolving more responsibilities to the regional and operational levels of the health system.
- Promote community-based approaches to increase demand and strengthen the provision of health care by communities themselves. In order to achieve that objective, a coherence will be sought between community-based interventions identified in the plan and the interventions described in the community health strategic plan.
- Improve management and coordination capacities of the health system, in the framework of malaria control, with decentralization and local governance as major pillars to increase participation of local governments and communities in planning, resource mobilization, promotion, and implementation of interventions.
- Reinforce partnership with the private sector in order to optimize opportunities for financing and coordination.
- Promote multi-sectoral approaches.
- Contribute to sustainable strengthening of the health system. Emphasis will be placed on decentralized planning, improvement of the supply chain, extension of community-based interventions, strengthening of the information system through innovative tools and development of research.

The above-listed objectives for the health system will contribute to achieving the following malaria objectives and lead the country to pre-elimination by 2020: a) Reduce malaria incidence by at least 75% compared to 2015 baseline, b) Reduce malaria mortality by at least 75% compared to 2015 baseline, c) Interrupt local malaria transmission in northern districts.

The Senegalese Ministry of Health has a strong record of working collaboratively with other multi- and bilateral donors to strengthen the health system. These include the French Cooperation, the African Development Bank, the World Bank, the Belgian Technical Cooperation, AMREF, JICA, the GFATM-HSS, GAVI-HSS, The Luxemburg Development Agency (LuxDev), UNFPA, and USAID. The Global Fund has recently approved a health system strengthening grant that will be implemented during the next three years. Support to the CMS, among other HSS components, is part of this grant and the Government of Senegal has created a HSS platform composed of thematic working groups to better

coordinate the implementation of the grant. PMI is represented on the pharmaceutical and medical products working group which is discussing priorities to focus on.

Progress since PMI was launched

Since beginning work in Senegal, PMI has supported health system strengthening and capacity building of the MoH to implement its malaria control program. PMI resources have supported pharmaceutical management activities, training, supervision, drug quality monitoring, and policy reform. In 2014, and to comply with the Global Fund New Funding Model requirements, the NMCP conducted a review of the program's performance that led to the development of the concept note submitted to the Global Fund. Basically, the program's objectives were maintained with the malaria pre-elimination objective by 2018. In 2015, the malaria program review conducted by the NMCP led to the development of a new strategic plan covering the period of 2016-2020.

Although a formal evaluation of the direct financing under the G2G mechanism has not been conducted, PMI resources have significantly and progressively contributed to increasing the capacity of the NMCP to coordinate malaria control activities and report results over the past years. With the significant increase of G2G funding during the past five years, the NMCP has demonstrated their capacity to implement and monitor planned activities and achieve milestones.

PMI has reinforced its efforts to build capacity and integrate across programs. Moreover, PMI has supported the development of the first ever strategic plan for the development of the CMS covering the period 2014-2018. Under this strategic plan, PMI also supported the CMS through the creation of a mobile distribution scheme, a push system that is being experimented and consolidated by the Government of Senegal to achieve its health objectives. Pharmacy managers were trained on supply chain management as part of an integrated activity covering principles that apply to all essential drugs. Similarly, malaria drug quality monitoring was integrated with medicines for the treatment of tuberculosis and HIV/AIDS, as well as oral contraceptives, with different programs contributing to support the overall budget.

As planned two years ago, the PBF activities were expanded in 2015 in two new districts with financial support from the World Bank.

Capacity building: For the past several years, PMI has supported the NMCP to supervise case management at hospitals, health centers, and health posts. PMI helps build national capacity in malaria control by supporting an annual malariology course and in M&E through funding the attendance of health system staff at the annual data management and M&E course at the African Center for Advanced Management Studies (*Centre Africain d'Etudes Supérieures en Gestion- CESAG)*. In 2012, PMI was closely involved in developing and shepherding through policy changes related to case management and prevention.

Progress during the last 12-18 months

As in the past five years, PMI's support to the health system during the past 12 to 18 months covered three main areas: a) support to the CMS, b) support to the ongoing results-based financing activities, and c) support to strengthen the institutional capacity of the NMCP.

During the past 18 months, PMI resources have been used to support policy and reforms designed to strengthen the health system and facilitate achievement of malaria results. PMI support covered the following three main areas, a) institutional support to the NMCP, the CMS, the Directorate of Pharmacies and Medicines and the National Laboratory for Quality Control, b) strengthening of the supply chain, and c) support to PBF.

Institutional support to the NMCP and the Directorate of Pharmacies and Medicines: PMI resources have been used to support the NMCP conduct the external evaluation of the malaria program, which led to the development of the new 2016-2020 strategic plan. PMI also supported the Directorate of Pharmacies and Medicines to develop the register of drugs equivalences. In order to monitor the performance of the CMS, PMI supported the development and signing of a performance-based contract between the CMS and the Minister of Economy and Finances.

During the same period, PMI continued to build the capacity of the National Laboratory for Quality Control (LNQC) to improve its performance and ensure that drugs procured and used in the country meet the pharmaceutical requirements and provide data to prevent or fight sub-standardized drugs. PMI support included the procurement of a High Performance Liquid Chromatography system equipment designed to help the LNQC perform quality control according to international norms and obtain WHO pre-qualification.

Support to the Supply Chain: In 2015, as a follow-up to the development of the strategic plan for the development of the CMS, PMI supported a round table for resource mobilization in support of the plan. The effort resulted in commitment by donors such as the Belgian Technical Cooperation Agency to strengthen the human resources capacity of the CMS.

Support to Performance-Based Financing (PBF): The goal of PBF is to ensure that PBF schemes are financially viable and that they drive high impact interventions and motivate community health volunteers. PMI continues to contribute to the PBF since its experimentation started in Senegal in 2012. PBF was put in place in two pilot regions (Kolda and Kaffrine) with high malaria prevalence and low coverage indicators in 2011. In 2015, the PBF scheme was extended to four new regions (Tambacounda, Kédougou, Ziguinchor, and Sédhiou), bringing the total to six regions currently. The malaria indicators are the number of pregnant women who received two doses of IPTp and the number of cases of uncomplicated malaria that received correct treatment.

While the number of health posts included in the program only increased from 110 to 253, the number of pregnant women who received two or more doses of IPTp increased from 33,751 in 2015 to 50,753 in 2016, an increase of 66%. Stockouts continue to be reduced under the PBF scheme as health managers and care providers take all appropriate actions to make SP, RDTs, and ACTs available for IPTp and case management services.

Building Capacity of the NMCP: Integrated logistics supervision visits were conducted at all regional medical stores and health districts, and PMI also supported the NMCP to supervise case management at hospitals, health centers, and health posts. Upon the NMCP's request and following the organizational audit conducted in 2013, a detailed report was delivered highlighting the weaknesses, strengths, and opportunities that the NMCP presents. The major weaknesses identified were: a) the organogram of the NMCP is not up-to-date; b) the governance structure of the NMCP lacks simplicity and clarity; c) the NMCP staff members do not have clearly defined work objectives, therefore are not evaluated on a regular basis based on their work performance; d) there is no system to follow up on interventions

described in the national strategic plan; e) the leadership of the NMCP seems weak, which negatively reflects on the coordination efforts. Recommendations are provided in the report to address each specific weakness, mainly for the improvement of the governance structure, provide training, reinforce management, and partnership. Measures to address these identified weaknesses are included in the NMCP's 2016-2020 Strategic Plan.

Plans and justification

The NMCP requires ongoing skills development to respond to changes in malaria trends. Increased supervision is also necessary at all levels of the health system to ensure that policies and guidelines are implemented as appropriate. Besides concentrating on improving data collection to monitor drug availability and distribution, drug quality control activities will continue to receive more attention.

With FY 2017 funding, PMI plans to support activities to develop capacity at sub-national and central levels to continue working towards the attainment of the NMCP's pre-elimination objective. More concretely, PMI will complement other Mission health component programs to promote local governance by strengthening the capacity of local elected officials to address malaria as a priority in local development plans and increasing participation of communities in decision-making and financing. Also, PMI will encourage the NMCP to empower their staff at the decentralized level to plan, manage and coordinate activities and allocate resources as appropriate to achieve expected results. As the Government of Senegal deems appropriate pursuing the PBF experiment, PMI will continue working with the World Bank and other interested donors to expand the reach of the program and contribute to better impact on malaria prevention and control. Given the challenges identified in the supply chain and commodities distribution system, PMI will increase its support to the CMS at the central as well at the regional levels. PMI will also support the development of a strategic plan for strengthening the policy and regulatory capacity of the pharmaceutical system and the drugs quality control system.

Peace Corps: Active linkages with Peace Corps volunteers are planned to continue, allowing volunteers and their communities to benefit from the technical resources that partners provide. In this partnership, PMI benefits from the committed community presence of more than 200 volunteers, making it the largest Peace Corps program in the world. In May 2016, 64 new Peace Corps Volunteers have taken an oath, 40 of whom were assigned to various regions of Senegal to support public health efforts in communities. While malaria funds have not in the past supported the third year malaria coordinator, they will in the future. Specific projects that require funding will be submitted to the Small Project Assistance committee for approval. Projects that have been funded in the past include net care and repair activities, piloting the active detection of fever cases, training women's groups/community care groups, and organizing malaria fairs.

Proposed activities with FY 2017 funding ($1,102,520)

(1) NMCP capacity building

- *Support to NMCP to enable program supervision ($327,520)*
  With FY 2017 funds, PMI plans to contribute to the NMCP's supportive supervision visits to regional and health district levels. Supervision at health posts, health centers, and hospitals will continue to receive increased attention.

- *Quarterly meetings between the NMCP and PMI implementing partners ($70,000)*

These proposed quarterly meetings will bring together NMCP staff, the Global Fund, representatives from the different regions, partners and implementing partners, so as to review planned activities and facilitate information sharing and ensure better coordination of malaria-related activities across the country.

- *State-of-the-art capacity building opportunities ($30,000)*
  Given the ambitious objective of achieving malaria pre-elimination by 2020, NMCP personnel and the country program will greatly benefit from participating in international technical, scientific, and professional meetings that present opportunities to learn best practices, share experiences, and develop networks. Potential meetings include the American Society for Tropical Medicine and Hygiene and the Pan-African Malaria Conference. PMI would encourage the NMCP to seek funding from the MoH and conference organizers before supporting participation at such events.

- *Malariology course ($100,000)*
  In 2008, the NMCP developed a malariology course (including curriculum development), which was intended to provide in-country training opportunities for health staff at all levels in the health system and build a cadre of trained staff at the district level capable of leading the implementation of malaria control activities. Given the frequent turnover in district leadership and evolving malaria policies, continued availability of the course is needed. Two sessions are offered each year and the personnel trained in this course are at the forefront of implementation, and assure quality supervision. It is offered in conjunction with the school of public health in Senegal. PMI has supported this course for the past five years and plans to continue to support it with FY 2017 resources.

(2) Peace Corps

- *Support for specific malaria-related Peace Corps volunteer projects ($25,000)*
  Funds will support a third year volunteer and one or more short-term response volunteers as requested by the NMCP, as well as small projects.

(3) Other

- *Support for Performance-Based Financing for malaria indicators ($150,000)*
  A few malaria indicators were selected as part of the PBF performance management plan. PMI plans on providing continued support for the PBF program in participating districts, including training, supervision, data collection and verification, and payment of performance bonuses.

- *Increase communities' participation (civil societies, local elected officials, women's groups, etc.) in the governance of malaria control ($200,000)*
  Activities will include supporting the local government to include malaria and other health priorities in their local development plans and increasing participation of communities in decision making regarding health issues. Some planned activities include developing information sharing processes and procedures (e.g., work plans, participatory budgeting, periodic performance and review reporting, radio programming) as well as sensitizing local government entities about the important role that civil society can play in advocating for quality services.

- *Technical assistance for the management of Fixed Amount Reimbursement Agreement (FARA) under the G2G mechanism (TAP) ($200,000)*
  The Technical Assistance Project is a new mechanism designed to support the planning, the design and the monitoring of the NMCP FARA and enable the PMI team to review reports submitted by the NMCP in a timely manner.

Table 12: Health Systems Strengthening Activities

HSS Building Block	Technical Area	Description of Activity
Health Services	Case Management	PMI will continue supporting training and supervision of health workers in case management in health facilities as well as in health huts and households. This includes support for seasonal malaria chemoprevention activities.
Health Workforce	Health Systems Strengthening	PMI will contribute with other health funding streams to train newly recruited health work force staff as the Government of Senegal engages in filling the human resources gap in the health system to achieve universal coverage of health services.
Health Information	Monitoring and Evaluation	PMI will continue supporting the strengthening of routine information system as well as continuous DHS and DHIS2.
Essential Medical Products, Vaccines, and Technologies	Case Management	PMI will continue supporting the supply chain and drug distribution system through reinforcing the management and storage capacity of the CMS and strengthening the capacity of human resources at the regional level. Activities will include drugs quality control and ensuring quality diagnostic and efficacy of treatment drugs.
Health Finance	Health Systems Strengthening	PMI will work with other partners such as the World Bank and the Global Fund to expand the PBF activities to increase access to malaria prevention measures and case management services.
Leadership and Governance	Health Systems Strengthening	PMI will support activities that strengthen the leadership of the NMCP at each level of the health system as well as encouraging local elected officials and communities to prioritize malaria and other health issues in their local development plans.

5. Social and behavior change communication

NMCP/PMI objectives

The overarching goal of Senegal's current national malaria communication strategy is to bring 80% of the population to adopt healthy behaviors with regards to malaria prevention measures and case management by 2020. More specifically, the communication strategy is designed to:

- Increase the proportion of people sleeping under ITNs to > 80%
- Increase the proportion of pregnant women who take at least three doses of SP under directly observed treatment at ANC to > 80%
- Increase the proportion of people who seek care at health facilities within 24 hours of the onset of fever to > 80%
- Increase compliance in the treatment of uncomplicated malaria
- Increase acceptance of IRS to > 90% of households in targeted districts (Note: This objective has been achieved in all previous spray rounds supported by PMI. At the time of MOP writing, the NMCP's plan is to discontinue IRS beginning in 2018 but discussions are underway in-country regarding the future of this intervention.)
- At least 95% of children aged between 3 to 120 months in target zones receive all three doses of seasonal malaria chemoprevention care during transmission season
- 100% of suspected malaria cases are diagnosed with RDTs or blood smear according to national guidelines
- 100% of confirmed cases are treated according to national guidelines and with effective drugs
- 100% of complicated malaria cases among children under 10 years of age have access to pre-reference treatment
- Strengthen partnerships with the private sector, media, local government, Parliament, and other government departments

The objectives of the current yet to-be validated integrated malaria communication strategy are consistent with the NMCP's 2016-2020 National Malaria Strategic Plan. The latter emphasizes that IEC/BCC approaches in Senegal should be evidence-based and tailored to specific populations and geographic areas. The NCMP is keen to ensure that approaches are grounded in formative research that identifies key determinants of behavior for specific audiences, appropriate communication channels, and suitable printed materials.

Communications about malaria are expected to take into account local specificities such as differences in net use culture. Since the NMCP implements various malaria control interventions depending on the malaria burden of specific areas (e.g., SMC in four regions, IRS in hotspots of selected districts, etc.) communications efforts are also tailored accordingly.

Strategic approaches:
The current communication strategy adopt three main approaches: a) advocacy, b) social mobilization, and c) behavior change communication.

- *Advocacy*

  Using a multi-sectoral approach, advocacy efforts will particularly target the private sector and other sectors associated with the malaria pre-elimination objective in Senegal. The NMCP plans to reinforce advocacy for resource mobilization in order to scale up interventions proven

effective and reduce mortality and morbidity. Advocacy efforts will select specific themes included in the national malaria strategic plan and will target stakeholders with specific strategies and activities geared towards increasing resources to achieve specific objectives. Currently, the private sector's engagement in malaria control is limited to few private companies (e.g. Ecobank) that provide nets during mass campaigns. Also, only a few NGOs are involved in partnerships with the NMCP. The current national strategic plan aims at broadening the partnerships between the NMCP and the private sector as the country works towards pre-elimination.

High-level institutions such as the Parliament will also be targeted for advocacy efforts. The NMCP has recently started discussions with a group of deputies to raise their awareness of the importance of increasing budgetary support to the health sector and specifically for malaria as the country moves towards pre-elimination. Of note, Senegal's President recently signed a commitment to eliminate malaria. However, this advocacy needs a longer time to concretize.

- *Social mobilization*
  This communication approach will reinforce community participation in malaria control through enhanced collaboration with local NGOs and community-based organizations which capacities will be strengthened. The strategies of *Malaria Jambars* (Malaria Champions) will be reinforced to seek increased commitment from communities for malaria control activities through local events covered by the media. Overall, the NMCP will strengthen the IEC/BCC capacities of civil society's groups to contribute to malaria prevention and control. Social mobilization activities will also target individual citizens as well as specific groups such as artists, sport practitioners, local leaders, local elected officials, etc.).

- *Social Behavior Change Communication*
  The NMCP will adopt an inclusive approach in designing its behavior change communication strategy. Such an approach will involve partners all levels to identify the targets, the channels and define parameters of campaigns. In order to achieve the objectives of usage of preventive measures by different segments of the population, SBCC efforts will focus on proximity communication, communication and information of the general public using TV channels, radios shows at national and community levels, non-traditional media and NTIC as well as billboards). A partnership will be established with the Sociology Department of UCAD in Dakar to conduct formative research and gather a critical mass of information on malaria and behavior change.

Progress since PMI was launched

PMI has supported various community mobilization and SBCC activities in Senegal. These include both ongoing malaria communications (mass and interpersonal) and communication activities promoting specific events, such as IRS or LLIN distribution campaigns. Typical communications activities in Senegal have included community meetings on a specific topic, home visits, theater, community radio (radio spots as well as interviews and programming), and social mobilization (setting aside a day to focus on a specific theme or topic and bringing the whole community together around that topic – for speeches, music, skits, with banners and t-shirts with messages, etc.). Topics of ongoing IEC/BCC at community level include the importance of owning and using ITNs, prompt care-seeking in the case of fever, recognition of danger signs, the importance of attending ANC visits, and the importance of

receiving the recommended doses of IPTp. Through Peace Corps volunteers and bilateral implementing partners, PMI has supported malaria education and prevention throughout the country.

To date, there has been little if any effort to evaluate the impact of the different communications activities on health/malaria indicators, such as LLIN use or care-seeking behavior. This weakness was expressed often as USAID/Senegal was developing its 2011-2016 health strategy and directly led to the creation of a new program to concentrate on streamlining and "upgrading" communications interventions. Going forward, the focus will be on strategic activities with specific objectives, the results of which can and will be evaluated.

In 2012, the NMCP and National Health Education and Information Service (SNEIPS) created a national Malaria IEC/BCC Coordination Committee to promote harmonization of approaches and activities among the numerous partners. This was followed by a workshop to share actual materials and work plans, and to revise the 2011 malaria BCC plan. PMI supported both of these activities and has taken a lead on ensuring rigor in the development of BCC activities. A team from Senegal, composed of the NMCP, SNEIPS, PMI, and two implementing partners, attended the PMI Malaria BCC workshop in September, 2013. This provided a good opportunity to share perspectives and experience and develop a common plan for moving forward with more evidence-based communications activities. Given the reduction in malaria burden that has been observed in Senegal and the roll out of specific interventions tailored to different parts of the country based on malaria burden, one complexity of the Senegal program is that communications activities need to be tailored to local contexts to reflect the interventions being implemented.

Progress during the last 12-18 months

With PMI's assistance, the NMCP is taking a more strategic and evidence-based approach to developing and implementing communications campaigns, which is described in the NMCP's 2016-2020 Strategic plan that is now translated in the new communication strategy. The NMCP's approach includes identifying the determinants of behaviors related to malaria and using the findings to develop communication campaigns with an appropriate mix of messages and channels. Developed with the technical assistance of professional media/marketing firms and based on the determinants of the behaviors PMI seeks to influence, the new messages speak more directly to the targeted populations. This evidence-based approach will allow PMI to more rigorously gauge the impact of the supported SBCC campaigns.

SBCC for LLINs:

Social marketing of ITNs: Since 2013, PMI has supported the implementation of a communications campaign to accompany the introduction of subsidized LLINs in the private sector in large urban areas nationwide. The campaign focuses on increasing brand recognition and creating demand through television and radio spots as well as printed media. Building on the results of market research showing that, for many people, nuisance avoidance is a more important factor for net use than malaria prevention, the campaign emphasizes getting a good night's sleep, the protective qualities of the nets ("MILDA: The mosquito net that kills mosquitoes"), their affordability ("1,000 FCFA for 1,000 nights"), and where to obtain them (pharmacies, grocery stores, gas stations). For this campaign, TV and radio spots were produced and broadcast in major urban areas. Newspaper insertions and internet banners were also used to reach a wide audience. As a result, a total of 407,557 MILDA-branded ITNs were sold over the period of April 2015 through March 2016.

Preliminary findings of an evaluation of the MILDA social marketing campaign conducted in late 2016 revealed that 64% of pharmacies and 95% of private outlets in gas stations had nets in stock. The evaluation also showed that 9 in 10 women reported having heard about or witnessed the mass net distribution campaign. Results from some high to medium transmission regions were particularly telling. For example, 100% of women in Kedougou, 97% in Kaffrine, 90% in Thies and 69% in Zinguinchor declared having heard messages about net use. Among all men who were interviewed, 84% declared having heard messages on net use and 85% of those men said they intended to purchase nets.

Mass ITN communications campaign: PMI continued to provide support for the NMCP's overarching communications campaign to increase use of ITNs in general. The campaign, called the "Three Alls" (*Les Trois Toutes: Toute la famille, Toutes les nuits, Toute l'année*) emphasizes that nets must be used by "all the family, all year long, on all nights." The campaign combines mass media and inter-personal communication strategies, all which have been supported with PMI funding. These include the creation of TV spots which have been broadcast on multiple national networks, as well as radio spots and radio shows, and erecting billboards in five major cities. Over the period September 2015-March 2016, with PMI's support, activities implemented by community-based organizations contracted by PMI implementing partners contributed to reaching 244, 387 people through malaria prevention and control messages. In addition, 28, 018 radio spots and 125 radio shows were broadcast via community radios, an important increase from the 8,827 spots and 35 radio shows aired in previous year. In addition, PMI worked with community-based organizations to sensitize communities (e.g. using road shows) about the importance of using nets; these efforts reached 4,800 people.

In July 2015, a first formative study was conducted by a PMI implementing partner to identify factors determining the use of malaria prevention measures and control services. For use of LLINs for example, the study targeted factors such availability, expected results, feelings, products features and social support. A second formative study related to factors determining uptake of IPT by pregnant women and household leaders behavior regarding use of ITNs was conducted. Finally, the same PMI implementing partner conducted a third formative study on service providers' behavior vis-à-vis products and factors determining the success of LLINs, IPTp and ACT/RDTs use. Results of those studies designed to improve BCC strategies are yet to be finalized and released.

SBCC for IRS: During the 2014 and 2015 spray rounds, PMI continued to support communication activities in areas targeted for IRS to inform beneficiaries about the timing of spray activities, what they can expect, the precautions they need to take (e.g. removing household items before spraying), and the health benefits of IRS. For the 2015 campaign, materials to support SBCC activities (posters, training guides, and manuals) were produced to support the NMCP's transition from blanket spraying to focal spraying of hotspots only. NCMP staff met with the communication focal points in areas targeted for the 2015 spray campaign and designed a communications strategy that was adapted to the new hotspots approach. Acceptance of IRS activities since PMI began spraying in Senegal has been high (>90% during each spray round).

SBCC for SMC: PMI funded the development of informational materials for the first SMC campaign in four districts in 2013, and UNICEF supported dissemination costs. Materials were reviewed and revised based on that initial experience for the 2014 campaign that was implemented in four regions and these materials will again be used for the 2016 campaign. Acceptance of SMC campaigns has been high, indicating that the population understands the utility of the interventions.

SBCC for IPTp: In order to design appropriate messages to increase uptake of IPTp services, a PMI implementing partner implemented a study in 2015 on factors affecting the use of IPTp services. The following four key factors were identified by the study:

a) Severity and vulnerability: The uptake of IPTp prevents malaria in pregnant women, which is dangerous for the foetus.
b) Social norms: In general, pregnancy is kept a secret during the first three months, which results in women seeking ANC later in their pregnancy and thus possibly missing SP doses. Pregnancy should be uncovered as early as possible.
c) Social support: Men's involvement, both morally and financially, is key to ensuring that women seek ANC care early and receive at least three doses of IPTp.
d) Presentation of products: The size of SP tablets (SP tablets are large) and the perception that they may cause side effects can be barrier to uptake.

The above-listed determinants have helped to create messages to educate women, men, and other key community members (e.g. *badjenu gox*) and have contributed to improve uptake of IPTp services as evidenced by significant increase of IPTp2 in many regions.

General Malaria SBCC: Senegal has a large Peace Corps presence; of the more than 200 volunteers in-country, at least one third conduct malaria-related activities. Peace Corps volunteers continued to play a significant role in disseminating net transformation techniques to communities and training people on net care and repair. Volunteers also hosted local language radio programs, helped test new communications materials, and organized home visits that touch on various malaria themes, including use of LLINs, MIP, diagnosis and treatment, and PECADOM Plus. As a result, 1,194 community mobilizers were trained in behavior change communication and 5,014 community members received messages to improve their knowledge of malaria signs, prevention and treatment.

More specifically, interpersonal communications activities were implemented through outreach workers at health huts and sites under USAID's community health program, which covers all 14 regions of the country. During the period October 2015 to March 2016, IEC/BCC activities were carried out in 4,316 health huts and 1,674 community-level sites (97% of the 1,717 sites planned) on a variety of topics such as ITN use and maintenance, signs and symptoms of malaria, early care-seeking, and IPTp. Approximately 7,000 community-level health workers were mobilized to conduct outreach activities and a total of 2,201,574 (78% of women and 22% of men) people were reached with malaria IEC/BCC messages during this period, a big jump from the 933,137 in 2014. Activities included a variety of interpersonal communication approaches such as home visits for case management, support groups for pregnant women, outreach to grandmothers, care groups, etc.

As Senegal moves towards the pre-elimination of malaria, a key challenge for communication will be ensuring that populations continue to use malaria prevention tools and seek treatment, even as malaria becomes rarer.

Plans and justification

With FY 2017 funds, PMI will continue to support a range of communications activities to improve the adoption of key malaria prevention and care-seeking behaviors (e.g., net ownership, proper net use, net care and maintenance, IPTp, when and where to seek care). After the implementation of a universal coverage LLIN campaign in 2016, PMI will support intensive communication efforts to encourage the population to use nets. The NMCP plans on focusing on high net ownership via the routine distribution

systems (ANC, EPI and schools) in the next years. With FY 2017 funds, PMI therefore plans to fund communication efforts that encourage the population to obtain nets through these routine channels – as the next universal coverage campaign will not occur until 2019, per the NMCP's strategy for 2016-2020. In addition, communication efforts will also encourage other key behaviors, such as prompt care seeking, which is becoming even more important as transmission intensity and acquired immunity decrease. PMI will continue supporting communication activities geared towards maintaining the rise of IPTp2 coverage as data recently presented at NMCP regional data review workshops indicated significant improvement of this indicator in many regions of the country. PMI will continue to reinforce delivery of messages stressing the need for pregnant women to obtain at least three doses of SP during their pregnancy.

Under the new NMCP integrated communication strategy that values multi-sector approaches, PMI plans to continue to work in close partnership with the SNEIPS, NMCP, the MoH and other ministries (the Ministry of Education, Ministry of the Family, etc.), private sector entities, and various other local partners. Those approaches will maximize the use of effective materials/tools and media products already developed and used successfully in Senegal while also seeking to develop innovative methods. Focused on evidence-based social marketing principles, PMI plans to support the NMCP and its SBCC partners use a mix of channels to deliver messages that promote malaria-related products and behaviors to targeted populations. Social mobilization and mass media activities will be conducted to reach large numbers of people, while interpersonal communications will be used at the community and health facility levels to reinforce messages and tailor them to individual contexts.

Through participation in the national Malaria IEC/BCC Coordination Committee, PMI plans to continue promoting coordination across ministries, donors, implementing partners, and the private sector to harmonize the implementation of SBCC programming. All planned SBCC activities will be monitored in order to improve their outcomes and impact.

Proposed activities with FY 2017 funding ($1,000,000)

1. *Development, implementation, and evaluation of SBCC activities ($800,000)*
   PMI plans to continue to support the NMCP's strategy to promote appropriate malaria prevention and care-seeking behaviors. This will include ensuring harmonization amongst the PMI-funded partners who work at different levels of the system, from the community level to the central level at the Ministry of Health. These funds will be used for formative research on determinants of behavior (quantitative and qualitative, as indicated), to contract with marketing firms to design materials and campaigns, to fund actual implementation (printing, mass media, national and regional events), and to evaluate results. Some of the campaigns will include messages that can be disseminated nationwide (such as promoting IPTp) while others will be tailored to specific contexts and developed to support particular interventions in localized areas. At this stage of implementing SBCC interventions, no data are available to indicate what proportion of SBCC resources is allocated to each channel or approach of SBCC interventions. The PMI Team and the Health Office will work with new implementing partners to ensure that they appropriately allocate the SBCC budget between various communication channels or approaches. PMI will also continue working with the NMCP to engage the private sector in malaria prevention efforts as well as primary and elementary schools. PMI's support for the Malaria IEC/BCC Committee (jointly coordinated by the NMCP and SNEIPS) will continue to ensure that communications about malaria are of high quality and have a strong impact.

2. *Community sensitization and mobilization for SMC ($100,000)*
   In the four regions where SMC is being implemented, PMI will continue funding the implementation of communications activities to ensure that populations are well-informed of the SMC campaign and acceptance rates continue to be high. Experiences and lessons learned from the previous SMC campaigns (implemented annually with PMI support since 2013) will be utilized to revise and adapt materials as needed. With FY 2017 funds, PMI plans to continue to support the roll-out of the 2018 SMC campaign using a combination of approaches to sensitize communities, including radio spots, community meetings, and house-to-house visits. One potential challenge with communication around SMC is that medicines need to be given to children who are not ill. The success of the campaign therefore hinges upon gaining the consent of parents/caregivers. PMI therefore particularly emphasizes interpersonal communications to explain the rationale for SMC and the importance of administering all doses. The success of SMC campaign hinges upon the willingness of parents/caregivers to provide preventive treatment to their child even though the child is well and has no symptoms and to continue to administer the two subsequent doses of sulfadoxine-pyrimethamine and amodiaquine.

3. *Promotion of LLIN use ($100,000)*
   While private pharmacies/shops/gas stations do have their own commodity distribution systems, these additional PMI funds will be used to cover operational expenses associated with the social marketing of LLINs in the private sector, including packaging (such as providing bar code and logo stickers), transportation from the warehouse to wholesalers, and medical detailers who visit pharmacies to check on stock levels and placement. The implementation of this activity is contingent upon a PMI-funded assessment of Senegal's social marketing program, which will take place at the end of 2016. This assessment will determine the appropriateness of social marketing in the Senegal context and whether it indeed fills a gap that is not covered by other existing net distribution strategies. The assessment will help clarify if/how social marketing complements the other net distribution strategies that Senegal currently employs (campaigns, routine distribution at ANC, schools).

6. Surveillance, monitoring, and evaluation

NMCP/PMI objectives

The NMCP objective for M&E is to ensure 100% prompt and complete routine reporting at all levels and use of data for M&E of the 2016-2020 Strategic Plan. To achieve this objective, during the next five years, the NMCP will focus on building capacity in surveillance, monitoring and evaluation and continue to focus on strengthening the routine information system at all levels: national, regional, district, and facility. The NMCP will work closely with the Division of Social and Health Information Systems (DSISS) to integrate the NMCP malaria system into the national HMIS that now uses the District Health Information System (DHIS2) platform and work with the Ministry of Health to improve the quality of the malaria data.

Progress since PMI was launched

Senegal is known for its robust routine malaria information system, providing prompt and complete data to guide and measure scale-up of malaria control activities. The NMCP gathers routine malaria mortality and morbidity data that is collected by all health posts and sent to health districts on a monthly basis. In this Excel®-based system, all relevant malaria data flow up from the community level health huts and DSDOMs through hardcopy register workbooks to health posts, which are then synthesized in Excel®

forms and sent to the districts. From the districts, data are then sent simultaneously to the regional and central levels. The NMCP also organizes quarterly review meetings with health districts to share malaria burden data as well as policy and technical information. This routine malaria information system was adversely impacted by a nationwide data retention strike in public health facilities from June 2010 to March 2013. The quarterly review meetings resumed in July 2013. In 2014, efforts to backfill missing data were completed.

By early 2015, the MoH supported the development of the District Health Information System (DHIS2) platform for their nationwide, integrated health information system. For malaria, the NMCP M&E director has been actively engaged in the development and roll-out of the DHIS2 and has incorporated all of the malaria indicators currently collected through the Excel® workbooks that are used for the routine malaria information system. There is continued improvement in the completeness of the HMIS system. In 2015, the system was reporting at 70% and now in 2016, the system is reporting at 90% completeness from all districts. The malaria system is currently reporting at 97% and above from all facilities. The quarterly review meetings that are supported by both the NMCP M&E Director and the DSISS have been cited as an important element to increasing HMIS completeness. The integrated system on the DHIS-2 platform is continuing to be rolled-out at the facility level across the country this calendar year, which will lead to a continued increase in completeness in data as more facilities come on-line. When the PMI/Senegal team met with the DSISS, it was clear that the leadership, ambition, and focus of the DSISS are also key factors to the relatively quick roll-out of the system. It was also cited that the system itself, being able to see levels of reporting and data more easily, and the regular review meetings are encouraging friendly competition across districts and facilities that has motivated district health officers to improve their completeness levels.

The NMCP and the DSISS continue to collaborate to fully transition the NMCP reporting system to the MOH HMIS. Starting in May 2016, the DSISS will expand the training and use of the DHIS2 to the health facility level in all districts. The DSISS has a very ambitious goal of full deployment to the facility level by the end of 2016 or early 2017. At that time, the NMCP will assess the quality of the malaria data in the system to determine when they can fully transition to the MOH HMIS. The NMCP is committed to an integrated system in Senegal.

Once all health facilities are on-line in the DHIS2, this will facilitate the full integration of the NMCP system into the HMIS. With support from the MOH and in collaboration with the Disease Surveillance Division, the DSISS is building onto the DHIS2 platform to also include commodity data, disease surveillance data on a weekly basis, starting with tuberculosis data, as well as data from the community and private sector. Data that will be collected from the community and put in the DHIS2 platform are almost the same as those that are collected at the public facilities level as far as their relevance to that health facility. In the private sector, the focus will be put on disease surveillance data, case management, IPTp, and, in some cases, net distribution. At the community level, disease surveillance and case management data will be taken into consideration.

The Global Fund is heavily supporting the roll-out of the DHIS2 with hardware and connectivity. The DSISS is expecting 200 computers from the GAVI HSS project to be distributed to the districts. In addition, a request for funding was sent to the World Bank to provide southern medical regions (Kédougou, Kolda, Sédhiou, and Tambacounda) as well as Kaffrine with computers. With the support of PATH, they are planing to implement mobile (tablets) use in some health posts. To deal with internet connectivity issues, internet keys have been included in the request for funding sent to the World Bank.

Multiple national-level household surveys have been conducted to provide information on key malaria indicators, including MISs in 2006 and 2008, and DHSs in 2005 and 2010, and a post-campaign survey in 2009 to assess the ownership and use of ITNs after a campaign targeting children under five years of age. In 2012-2013, Senegal began implementing a Continuous Demographic Health Survey (cDHS) consisting of population-based and service provision assessment (SPA) components, which provides information to guide programming on a regular basis. The cDHS provides annual estimates of all standard household-level malaria indicators (including anemia and parasitemia) as well as information on the availability and quality of services in the health sector (including private providers). Results are available nationally and by urban/rural and epidemiologic strata annually, and by region every two years. The cDHS is supported by USAID, using malaria and other funds, as well as other partners including the MoH, the World Bank, and UNFPA. The Senegalese government has now become a funding partner to the cDHS and is very interested in continuing this survey in Senegal. The cDHS has been adopted among the official annual surveys supported by the government. The MoH and donors continue to discuss and look for ways to continue the cDHS with increased funding from the government.

A system of epidemic surveillance sites has been operational since 2008, starting in the Senegal River Valley. Ten districts across seven regions (Saint-Louis, Matam, Louga, Kaolack, Dakar, Tambacounda, Kédougou) are now enrolled in the program, each with two sites reporting morbidity, mortality, and stock information on a weekly basis. Beginning in 2012, in the northern region of Saint-Louis, MACEPA initiated a project in the Richard Toll District, where malaria incidence is under 2 per 1,000. All positive patients identified through health facilities are investigated and reactive case detection is conducted in the household and the five closest households of the index case. Based on analysis of data collected during the first two years of the project, MACEPA recommended testing all household members of the index case, and among the five closest households within a 100 meter radius, only testing individuals who are: 1) symptomatic, 2) have traveled recently, or 3) do not sleep under an ITN.

In the four high transmission regions of southeastern Senegal—Tambacounda, Kédougou, Kolda, and Sédhiou—where SMC is implemented, standard M&E protocols and tools as outlined by the WHO SMC Field Manual are used to monitor SMC indicators, molecular markers of resistance to SP and AQ, estimate coverage rates, and assess adherence, and track pharmacovigilance. The routine information collected weekly by the NMCP from the surveillance sites was examined in 2013 and 2014 to determine the impact of SMC on morbidity and mortality. The morbidity data between the surveillance sites and the routine health system were consistent and showed substantial decreases across the key indicators that were being monitored (confirmed malaria cases, hospitalized malaria cases, and number of deaths due to confirmed malaria). Based on the results, the NMCP decided to continue SMC through 2018. PMI continues to support therapeutic efficacy testing and drug quality monitoring. Table 13 below summarizes the different data collection activities that have been supported by PMI and other partners.

Progress during the last 12-18 months

The 20 epidemic surveillance sites continued to send data on a weekly basis with 100% completeness and prompt reporting. Since March 2013, the NMCP has continued to send out weekly surveillance bulletins to a large and varied group of stakeholders that presents data describing trends in malaria burden and commodity availability at each site. Reactive case detection activities were expanded to three additional districts (Podor, Dagana, Pete) in the Saint-Louis Region, bringing the total number of districts covered to four out of a total of five districts. In parallel with this expansion, PMI supported the malaria epidemic surveillance system to expand data collection and improvement to all health posts of

the region. Currently, all health posts are reporting to the system in Saint-Louis and there are approximately 10-15 posts per district. To support reactive case detection, it is critical that all health posts continue to report into the system; this has required increasing the number of supervision visits and improving transmission of data through an SMS platform. In 2016, as Saint-Louis Region is fully covered, the NMCP began the expansion of surveillance sites in two regions in the North (Louga and Matam Region) with MACEPA and an additional three regions (Kaolack, Kaffrine, and Ziguinchor) with PMI. Weekly reporting will be introduced as standard procedure to these sites and eventually all health posts.

With funding from the Global Fund and West Africa for Health and technical assistance provided by Oslo University, the DHIS2 was established by the MoH for their nationwide integrated health information system. The system design and training of district level data managers was completed in early 2015. The training is now being expanded to health facilities starting in May 2016. There are planned quarterly reviews of the data collected through the DHIS2. Currently, the DHIS2 is reporting at 90% completeness for malaria indicators and the NMCP is continuing to collect information through Excel® workbooks with plans to fully integrate into the DHIS2.

The cDHS has completed Phase 3 of data collection and the final report was disseminated in March 2016. Key findings from Phase 1, 2, and 3 are reported in Table 1. Key results from the Phase 3 survey show an increase in IPTp2 from 40% to 49% and an increase in the use of ITNs in pregnant women from 38% to 52%. At the time of writing this document, the parasite prevalence estimates were not available from Phase 3. In early 2016, regional estimates, from aggregating Phase 1 and Phase 2 surveys, were also provided. The report confirmed the regions of highest prevalence in the South. While the national parasite prevalence is 1.1%, the South has an estimate of 5.4%. In the South, the regions with the highest prevalence are Kolda (15%), Kédougou (12%), and Tambacounda (8%). All other regions in the country ranged from 2.5% in Sédhiou to 0% in Saint-Louis. Senegal is the first PMI focus country to implement a cDHS which has helped strengthen capacity for data collection and use as well as informing malaria-specific programs. The cDHS is expected to be a permanent part of the MoH's data stream and the expectation is that fewer national household surveys will be needed.

The NMCP completed development of the malaria-specific SM&E course for Senegal. The first workshop will be held in May 2016 and will include the central, regional and district levels. There will be support for implementation for the first two workshops before the NMCP takes on the management of the workshop on their own in 2018.

Table 13. Surveillance, Monitoring, and Evaluation Data Sources

Data Source	Survey Activities	Year								
		2010	2011	2012	2013	2014	2015	2016	2017	2018
Household surveys	Demographic Health Survey (DHS)	X		X	X	X	X	X	(X)	(X)
	Malaria Indicator Survey (MIS)							(X)*!		
	Universal Coverage Evaluation				X					
Health Facility Surveys	SPA survey as part of cDHS			X	X	X	X	X	(X)	(X)
Malaria Surveillance and Routine System Support	Malaria epidemic surveillance	X*	X*	X	X	X	X	X	(X)	(X)
	Case investigation			X*	X*	X	X	X	(X)	(X)
	DHIS2 Integrated Routine Information System	X*	X*	X*	X*	X*	X*	X*	(X)*	(X)*
Therapeutic efficacy monitoring	In vivo efficacy testing	X		X	X	X	X	X	(X)	(X)
Entomology	Entomological surveillance and resistance monitoring	X	X	X	X	X	X	X	(X)	(X)
	LLIN durability monitoring						X	X	(X)	(X)
Other Data Sources	Malaria Impact Evaluation				X			(X)		
	SMC M&E					X	X	X	(X)	(X)
	Drug quality monitoring	X	X	X	X	X	X	X	(X)	(X)

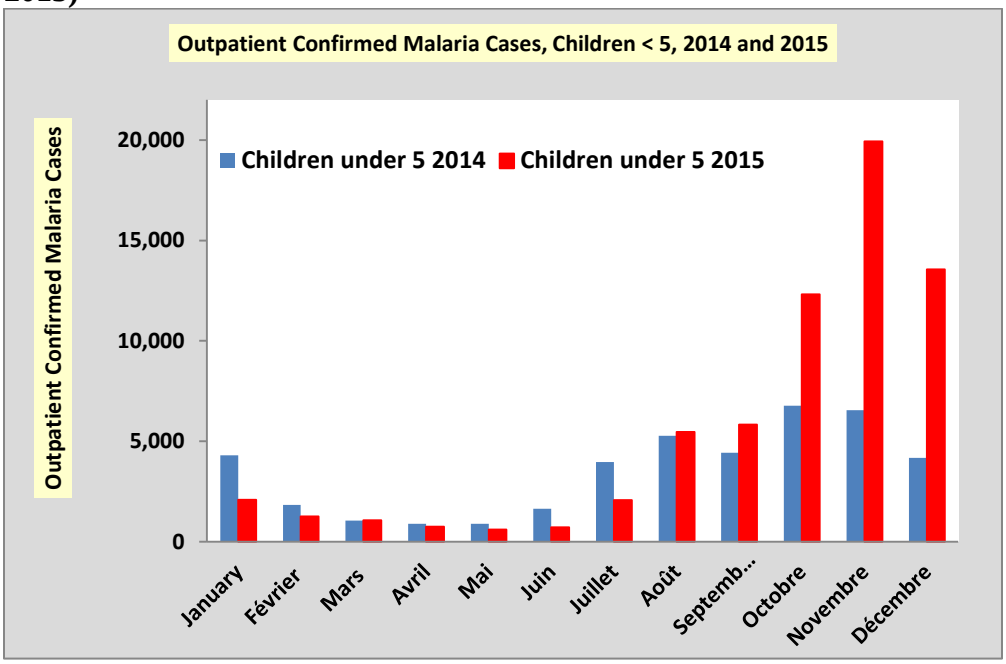
! This MIS is funded by the Global Fund and will be implemented near July 2016. A protocol is currently being developed. The purpose of this survey will be to obtain coverage estimates at the district level, nationally. This survey will not include biomarkers. The cDHS does not provide estimates at the regional or district level on an annual basis. For regional estimates in the cDHS, data from two continuous survey years are aggregated.

*not funded by PMI ( ) not yet completed

Table 14. Routine Surveillance Indicators

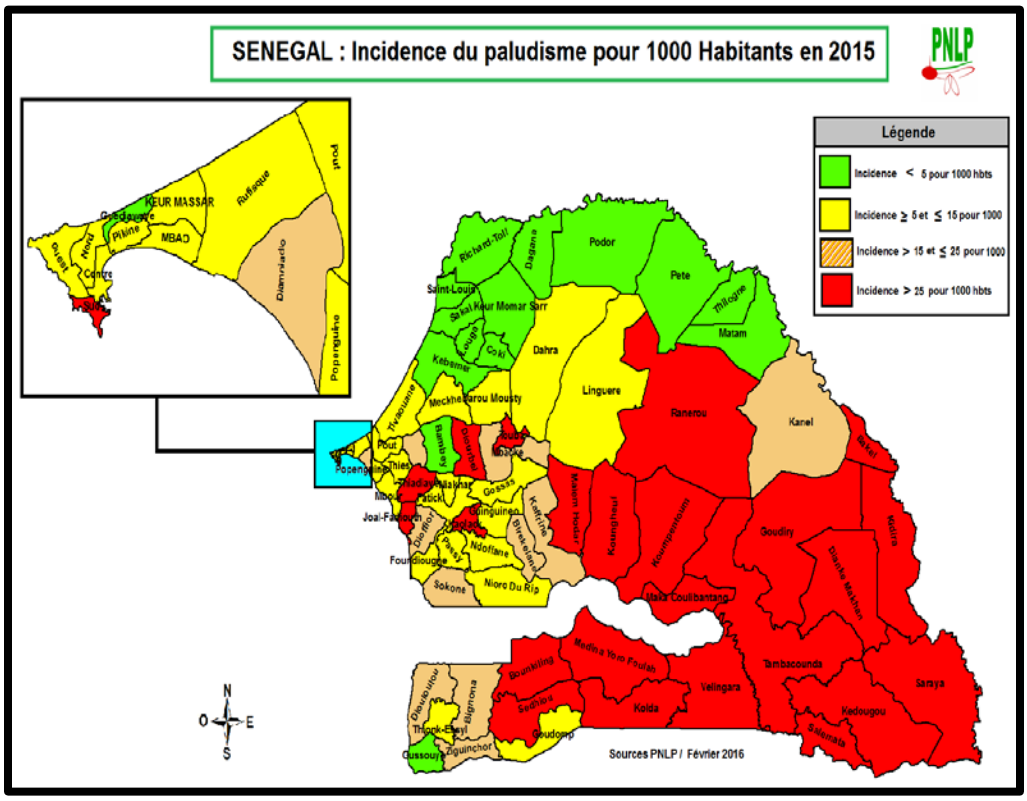
Indicators	Value (All ages)	Value (<5 years)	Comments
1. Total number of reported malaria cases Data source: Malaria system	502,084	68,306	
Total diagnostically confirmed cases	492,253	65,682	
Total clinical/presumed/unconfirmed cases	9,831	2,624	
Outpatient number of reported malaria cases	484,238	65,048	
Diagnostically confirmed	474,407	62,424	
Clinical/presumed/unconfirmed	9,831	2,624	
Inpatient number of reported malaria cases	17,846	3,258	
Diagnostically confirmed	17,846	3,258	
Clinical/presumed/unconfirmed	None	None	All are confirmed
2. Total number of reported malaria deaths Data source: Malaria system	526	158	
Diagnostically confirmed	526	158	
Clinical/presumed/unconfirmed	None	None	All are confirmed
3. Malaria test positivity rate (outpatients) Data source: Malaria system	33.61%	17.11%	
Numerator: Number of outpatient confirmed malaria cases	474,407	62,424	
Denominator: Number of outpatients receiving a diagnostic test for malaria (RDT or microscopy)	1,411,390	364,771	
4. Completeness of monthly health facility reporting Data source: Malaria system	97.12%	97.12%	
Numerator: Number of monthly reports received from health facilities	16,724	16,724	
Denominator: Number of health facility reports expected (i.e., number of facilities expected to report multiplied by the number of months considered)	17,220	17,220	

Figure 3. Confirmed outpatient malaria cases in children under the age of five, Senegal (2014 and 2015)



Source: Senegal NMCP

Figure 4. Malaria incidence per 1,000 population, Senegal (2015)



Source: Senegal NMCP, February 2016.

Plans and justification

Using FY 2017 funds, PMI plans to continue support for the expansion of case investigation in districts within the regions of Louga and Matam that are classified as low transmission by the NMCP, with less than five cases per 1,000 population, as determined by the routine information system that includes the number of confirmed malaria cases identified at the community and facility level. Information on positive malaria cases will be sent to the district health supervisor and, within three days of notification, a team will be deployed to the community level to conduct a detailed investigation of the index case and screening of the five neighboring households, only testing individuals who are: 1) symptomatic, 2) have traveled recently, or 3) do not sleep under an ITN. Support from PMI will contribute to key data collection and analysis activities, as well as enhancing activities to support pre-elimination objectives.

As the national routine information system is being expanded and built on the new DHIS2 platform, the NMCP will work closely with the DSISS and MOH to evaluate the completeness and timeliness of data and perform data quality checks through quarterly reviews at the district level and on-site verification through supervision.

Proposed activities with FY 2017 funding: ($1,770,000)

1. *Technical assistance and operational support for a full malaria module, including biomarkers, as part of the continuous DHS (cDHS) ($350,000)*

With FY 2017 funding, PMI plans to maintain its support for the cDHS which is co-funded with other donors. The support includes technical assistance to the National Statistics and Demography Agency to continue strengthening their capacity to analyze and present the collected data. The Senegalese Government and donors continue to explore ways to further contribution from the government for this survey. With the reduced contribution this year, PMI is no longer the largest contributor to the cDHS.

2. *Strengthening and expanding epidemiologic malaria surveillance ($500,000)*

As Senegal moves toward pre-elimination and expands reactive case detection in the northern regions, PMI will continue to support the malaria surveillance system, including weekly case notification, in both the formal public health sector (hospitals, centers, and posts) and at the community level (health huts and DSDOMs). This system includes electronic transmission of data by short message service (SMS) and will be integrated with the DHIS2. This support will expand the system by recruiting new sites in Diourbel and Fatick regions with continued support for initial districts in Saint-Louis region.

3. *Case investigation in districts with incidence <5 per 1,000 ($600,000)*

As case detection is expanded in the northern districts with incidence <5 per 1,000, there will be training for additional CHWs, health post nurses, and district health supervisors for investigation of index cases and neighboring households. Weekly electronic data transmission through SMS will be supported. Results will be collected, analyzed, and shared by the NMCP through weekly bulletins. The increased funding will support the logistics and case management of cases. As the burden in Louga and Matam regions are higher than Saint-Louis, it is expected that there will be more investigations.

4. *Monitoring and evaluation of seasonal malaria chemoprevention ($50,000)*

The NMCP will continue SMC in the four high transmission regions of southeastern Senegal: Tambacounda, Kédougou, Kolda, and Sédhiou. In accordance with the WHO field manual for SMC M&E, PMI will continue support for the existing routine health information system to monitor

indicators relevant to SMC. PMI will support process monitoring and an end of season coverage survey. Molecular markers will be monitored. As CY 2017 will be the last year of evaluating the program, FY 2017 funds will be used to continue with monitoring activities.

5. *Monitoring and evaluation course by NMCP ($250,000)*
This will be the third year this course is offered in Senegal. The course is a malaria-specific M&E course with the inclusion of pre-elimination and elimination M&E issues – specifically including lessons learned from activities currently being implemented in northern Senegal. The two prior years were technically supported by the MEASURE Evaluation project and training was rolled out to all regions and districts in Senegal. In this third year, the NMCP will manage the course themselves and will open the course to candidates from other countries. Provider skills will continue to be strengthened by the NMCP through post training supervision.

6. *Two technical assistance visits from CDC ($20,000)*
CDC staff will provide technical support for M&E activities, including the expansion of the surveillance and routine malaria systems and providing input to the aspects of surveillance for the development of the M&E course in collaboration with M/Evaluation. Two visits are planned to provide follow-up of planned activities.

7. *LLIN durability monitoring ($0)*
Please see the proposed activities in the ITN section for further details.

7. Operational research

NMCP/PMI objectives

The goal of operational research in Senegal, which is grouped with M&E in the NMCP National Strategic Plan, is to provide data for decision making and in particular to evaluate issues related to achieving pre-elimination, both in the low transmission North and the high transmission South. There are two specific objectives related to operational research in the NMCP Strategic Plan for 2016-2020:

- Strengthening coordination and promotion of operational research among partners, and
- Developing operational research projects of national interest

Progress since PMI was launched

Many partners are involved in conducting operational research in Senegal. PMI's support for OR has been complementary to those existing efforts. For example, MACEPA and UCAD are conducting studies of case investigation, MDA, MSAT, etc. in the North, while PMI has supported a study on the burden of malaria in nomadic pastoralists that move between the North and South. In the South, the evaluation of SMC implemented by UCAD is being co-funded by PMI and Wellcome Trust. PMI also funded a study to evaluate causes of persistent high transmission in a district (Vélingara) in which all interventions had been scaled up, and to suggest strategies to address the challenges identified. Furthermore, PMI funding supported the operational research study on PECADOM Plus conducted by the NMCP and Peace Corps. Please see the table below for a summary of all PMI-funded operational research studies completed to date. Additionally, the text below provides a brief summary of the results of the operational research projects which were completed in the past 12 months.

Table 15. PMI-funded Operational Research Studies

Completed OR Studies			
Title	**Start date**	**End date**	**Budget**
Phase III evaluation of long-lasting insecticide-treated nets (multi-country study with Malawi and Kenya)	12/2009	12/2015	$92,000
Longevity of insecticides used for indoor residual spraying (multi-country study with Kenya)	07/2011	12/2014	$200,000
Evaluation of the diagnostic algorithm	09/2012	06/2014	$125,000
PECADOM Plus: An active version of the PECADOM model in the context of seasonal malaria chemoprevention	07/2013	12/2013	$8,000
Burden of malaria among nomadic pastoralists	08/2014	10/2014	$100,000
Qualitative study of seasonal malaria chemoprevention	09/2014	03/2015	$50,000
Qualitative study of causes of elevated transmission in Vélingara	11/2014	03/2015	$40,000

Qualitative study of seasonal malaria chemoprevention. This study on the acceptability of SMC was performed by researchers from UCAD in close coordination with the NMCP. Results are still pending.

Phase III evaluation of long-lasting insecticide-treated nets (multi-country study with Malawi and Kenya). The majority of activities have been completed including monitoring of LLINs in the field, hole counting in the laboratory, cone bioassays and chemical analyses for 6, 12, 18, 24, 30, and 36 months. Data analyses and report writing are underway. The data from this study are also being included in an eight country "meta-analysis" to determine if any general trends can be discerned.

Plans and justification

No operational research activities are planned with FY 2017 PMI funding.

8. Staffing and administration

Two health professionals serve as resident advisors to oversee PMI in Senegal, 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 resident advisor 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 professional staff work together to oversee all technical and administrative aspects of the 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 to PMI 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 resident advisors, 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. The technical expertise housed in Atlanta and Washington guides PMI programmatic efforts.

The two PMI resident advisors are based within the USAID health office and are expected to spend approximately half their time sitting with and providing technical assistance to the national malaria control programs and partners.

Locally-hired staff to 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 US Global Malaria Coordinator.

Proposed activities with FY 2017 funding ($1,512,000)

These funds are slated to be used for coordination and management of all in-country PMI activities including support for salaries and benefits for two resident advisors and local staff, office equipment and supplies, and routine administration and coordination expenses.

1. *USAID technical staff ($928,035)*
   Funding will support the salaries for one USAID resident advisor and local staff. During the past four years the PMI Team has functioned with the two Resident Advisors and one FSN staff member. Given the increasing burden of Government to Government mechanism (25% of the FY 2017 budget allocated to the NMCP), one additional Malaria Technical Specialist is under recruitment as well as a G2G Specialist and an Administrative Assistant. PMI funds will be used to partially fund the latest two positions.

2. *CDC technical staff ($583,965)*
   Funding will support the salary and expenses for one CDC resident advisor.

Table 1: Budget Breakdown by Mechanism

President's Malaria Initiative – Senegal
Planned Obligation for FY 2017

Mechanism	Geographic Area	Activity	Budget ($)	%
CDC IAA	Nationwide	Support for salary and expenses for one CDC Resident Advisor, technical assistance for SM&E, capacity building, and entomological monitoring	632,965	3
Global Health Supply Chain-PSM	Nationwide	Procurement of LLINs, ACTs, SP-AQ coblisters, artesunate suppositories, artesunate injections, primaquine, laboratory consumables, and RDTs. Support for improvement in warehouse capacity and for commodity distribution fees.	11,276,480	47
TBD - Supply Chain	Nationwide	Supply chain management and management of antimalarials from central to peripheral level.	700,000	3
HSS	7 consolidation regions*	Improve case management for malaria as well as malaria prevention services among pregnant women at service delivery level and through outreach strategies. Reinforce community case management. Support for malaria indicators in the performance-based financing model.	965,000	4
ISD	7 concentration regions**	Improve case management for malaria as well as malaria prevention services among pregnant women at service delivery level and through outreach strategies. Reinforce community case management. Support for malaria indicators in the performance-based financing model. Development, implementation, and evaluation of SBCC activities.	1,650,000	7
Measure DHS	Nationwide	Support for the malaria module within the continuous Demographic and Health Survey (cDHS).	350,000	1

National Malaria Control Program	Nationwide	Support for surveillance, implementation and supervision of programs such as: SMC, routine ITN distribution, quality control for microscopy and RDTs, pre-elimination activities (case investigations, implementation of primaquine), pre-referral treatment at the community level and PECADOM Plus. Support for the malariology and monitoring & evaluation courses organized by the NMCP. Quarterly review meetings between the NMCP and implementing partners and support for participation of central and field staff of the NMCP to participate in state-of-the-art technical, scientific, and professional meetings.	6,122,520	26
SHOPS+	Nationwide	Promotion of ITN use.	100,000	0
TAP	Nationwide	Technical assistance for the implementation of the FARA.	200,000	1
TBD	Nationwide	Reinforce community participation in governance for malaria control (civil society, elected officials)	200,000	1
TBD-Central case management mechanism	Nationwide	Therapeutic efficacy studies	160,000	1
TBD-Central IRS mechanism	Nationwide	Reinforce entomological capacity and entomological monitoring activities.	465,000	2
US Peace Corps	Communities with Peace Corps volunteers	Support for malaria projects implemented by Peace Corps volunteers.	25,000	0
US Pharmacopeia	Nationwide	Drug quality monitoring and advocacy.	225,000	1
USAID	Nationwide	Support for salary and expenses for one USAID Resident Advisor and local staff	928,035	4
Total			**24,000,000**	**100**

*Consolidation regions: Dakar,Fatick, Kaffrine, Kaolack, Louga, Thies, Ziguinchor

**Concentration regions: Diourbel, Kedougou, Kolda, Matam, Saint Louis, Sedhiou, Tambacounda

Table 2: Budget Breakdown by Activity

President's Malaria Initiative – Senegal
Planned Obligation for FY 2017

Proposed Activity	Mechanism	Budget		Geographic Area	Description
		Total $	Commodity $		
PREVENTIVE ACTIVITIES					
VECTOR MONITORING AND CONTROL					
Entomological monitoring and insecticide resistance management					
Strengthen entomological capabilities and entomological monitoring	TBD - Central IRS mechanism	465,000		Nationwide	Entomological monitoring
	CDC IAA	29,000		N/A	Technical assistance for entomologic monitoring. In addition PMI will cover costs ($15,000) to purchase materials to conduct entomological monitoring through the CDC IAA using PMI core funds.
SUBTOTAL Entomological monitoring		**494,000**	**0**		
Insecticide-treated Nets					
Procurement of ITNs	Global Health Supply Chain-PSM	6,640,000	6,640,000	Nationwide	Purchase of 2,000,000 LLINs for routine distribution.

Operational costs of maintaining the routine LLIN distribution system	NMCP	700,000		Nationwide	Transport, support materials, supervision.
SUBTOTAL ITNs		**7,340,000**	6,640,000		
SUBTOTAL Vector monitoring and control		**7,834,000**	**6,640,000**		
Malaria in Pregnancy					
Reinforce provision of effective malaria in pregnancy services in health facilities and through outreach strategies	HSS	300,000		7 consolidation regions*	Monitoring and supportive supervision, update materials to reflect revised guidelines, training/refresher training of new staff.
	ISD	250,000		7 concentration regions**	
SUBTOTAL MIP		**550,000**	0		
SUBTOTAL PREVENTIVE		**8,384,000**	**6,640,000**		
CASE MANAGEMENT					
Diagnosis and Treatment					
Strengthen microscopic diagnosis of malaria	NMCP	200,000		Nationwide	Training, supervision, quality assurance, quality control, and maintenance of microscopes.

Procurement of laboratory consumables and microscopes, as needed	Global Health Supply Chain-PSM	15,000	15,000	Nationwide	Laboratory consumables and replacement of aging microscopes, as needed.
Procurement of RDTs	Global Health Supply Chain-PSM	1,696,000	1,696,000	Nationwide	Procurement of approximately 3,200,000 RDTs.
Quality control for microscopy and RDTs	NMCP	40,000		Nationwide	Support for the implementation of quality control programs for both microscopy and RDTs (both upon arrival in country and in the field), in conjunction with the NMCP and the Universite Cheikh Anta Diop.
Improve case management at health facilities	ISD	250,000		7 regions de concentration**	Support for training and supervision of malaria case management at all levels of the health system, including the private sector.
	HSS	215,000		7 regions de consolidation*	
Strengthen community case management	ISD	350,000		7 regions de concentration**	Support for community case management of malaria (at health huts by CHWS and by DSDOMs). Includes training, supervision, and monitoring of staff.
	HSS	300,000		7 regions de consolidation*	
Operational costs for the expansion of PECADOM Plus and enrollment of new DSDOMs	NMCP	1,500,000		Districts eligibles	Extension of PECADOM Plus to up to 40 districts. Support for the recruitment of news DSDOMs as well as training and supervision to provide malaria diagnosis and treatment as part of an integrated package of services. Includes costs to replenish DSDOMs' kits.

Procurement of ACTs	Global Health Supply Chain-PSM	1,100,000	1,100,000	Nationwide	Procurement of approximately 1,100,000 ACTs.
Operational costs for SMC implementation	NMCP	1,540,000		Kédougou, Sédhiou, Kolda, Tambacounda	Operational costs of the SMC campaign in 4 districts for 3-4 months
Procurement of drugs for SMC implementation	Global Health Supply Chain-PSM	950,000	950,000	Kédougou, Sédhiou, Kolda, Tambacounda	Monthly doses of SP-AQ for approximately 633,000 children (ages 3 months to 10 years), administered by community volunteers for 3-4 months during the high transmission season.
Operational costs of expanding pre-referral treatment to the community level	NMCP	75,000		Nationwide	Support for progressive nationwide scale-up of community-level pre-referral treatment.
Procurement of rectal artesunate for pre-referral treatment	Global Health Supply Chain-PSM	18,000	18,000	Nationwide	Procurement of approximately 30,000 suppositories to provide for community level expansion.
Procurement of injectable artesunate for treatment of severe malaria	Global Health Supply Chain-PSM	222,000	222,000	Nationwide	Injectable artesunate to treat severe malaria cases referred to the hospital or health center level (estimate is for approx. 60% of need based on 2015 severe malaria incidence levels). Represents 12,600 cases treated (60% of the 21,000 estimated severe malaria cases)
Procurement of primaquine	Global Health Supply Chain-PSM	15,000	15,000	Pre-elimination districts	Procurement costs for primaquine for single low-dose treatment.

Expansion low-dose primaquine administration in pre-elimination districts	NMCP	40,000		Pre-elimination districts	Support for introduction of single low-dose treatment in one pre-elimination region.
Therapeutic efficacy monitoring	TBD - Central Case Management Mechanism	160,000		2 sites	Therapeutic efficacy studies in 4 sites (2 sites per year on a rotating basis).
Subtotal Diagnosis and Treatment		**8,686,000**	4,016,000		
Pharmaceutical Management					
Support supply chain management at the central level	TBD-Supply Chain	700,000		Nationwide	Support for the NMCP to improve quantification through regular consumption data collection from the peripheral level.
Increase storage capacity for malaria commodities	Global Health Supply Chain-PSM	500,000		Central Medical Stores and Regional level warehouses	Costs to refurbish warehouses at the central and regional levels, with priority given to high malaria transmission regions in the southeast of the country (Kédougou, Kolda, Sédhiou, and Tambacounda).
Monitoring of antimalarial quality and advocacy	USP	200,000		Nationwide	Sampling and testing antimalarials from 9 sites nationwide.
	USP	25,000		9 sites	Technical assistance for accreditation and drug quality monitoring.

Cost of commodities management at the PNA (3% of commodities costs, not including nets)	Global Health Supply Chain-PSM	120,480			PMI funds will be used to cover delivery fees for all PMI-procured malaria commodities (with the exception of ITNs as these do not transit through the CMS). This is calculated at 3% of the commodity costs and is applied to all partners that procure commodities for Senegal.
Subtotal Pharmaceutical Management		**1,545,480**	0		
SUBTOTAL CASE MANAGEMENT		**10,231,480**	4,016,000		
HEALTH SYSTEM STRENGTHENING / CAPACITY BUILDING					
Support to the NMCP for program supervision	NMCP	327,520		Nationwide	Support visits by national staff to regional and district levels. Expansion of supervision by peers from 5 to 7 regions. Nationwide supervision of all EPS.
Quarterly meetings between the NMCP and implementing partners	NMCP	70,000		N/A	Quarterly meetings to bring together NMCP staff, the Global Fund, representatives from the different regions, partners and implementing partners, to review planned activities and facilitate information sharing.

Capacity building opportunities for NMCP staff	NMCP	30,000		N/A	Support participation in international technical scientific and professional meetings to provide NMCP staff (central and field level) with opportunities to learn best practices, share experiences, and develop networks. Potential meetings will include the American Society for Tropical Medecine and Hygiene and Pan-African Malaria Conference. 2-4 trips total.
Malariology course	NMCP	100,000		N/A	The NMCP is requesting PMI's support for the implementation of the second year of a malariology course that will be offered to health staff at various levels and will allow for in-country training opportunities.
Support for malaria activities implemented by Peace Corps volunteers	U.S. Peace Corps	25,000		Peace Corps Communities	Support for specific malaria-related Peace Corps volunteer projects.
Support for malaria indicators in the Performance-Based Financing model	HSS	150,000		Targeted districts	Continued support for the collection of malaria indicators under the Performance-Based Financing model.
Strengthen community involvement (civil society, elected officials) in governance for malaria control	TBD	200,000		Nationwide	Support for the local government to include malaria and other health priorities in their local development plans and increase participation of communities in decision-making regarding health issues.
Technical assistance to ensure effective implementation of the FARA	TAP	200,000		Central level and 7 consolidation regions*	Preparation and monitoring of the FARAs. Technical support for the management, monitoring, and reporting.

SUBTOTAL HSS & CAPACITY BUILDING		**1,102,520**	0		
SOCIAL AND BEHAVIOR CHANGE COMMUNICATION					
Development,implementation and evaluation of social and behavior change communication activities	ISD/TBD	800,000		Nationwide	Overall support for the development, production, and dissemination of IEC/BCC materials, including support for the national IEC/BCC Committee to ensure harmonization of messages among partners.
Community sensitization and mobilization for SMC	NMCP	100,000		Kédougou, Sédhiou, Kolda, Tambacounda	Promotion of SMC through radio spots, community meetings, and house-to-house visits in regions targeted for this intervention.
Promotion of LLIN use	SHOPS+	100,000		Nationwide	Social marketing of LLINs in the private sector, including packaging and transportation to wholesalers.
SUBTOTAL SBCC		**1,000,000**	0		
SURVEILLANCE, MONITORING, AND EVALUATION					

Support for the malaria module in the 2018 cDHS	Measure DHS	350,000		Nationwide	Technical assistance for the sampling and analysis ($100,000) as well as operational costs ($250,000) for the malaria module within the planned 2018 cDHS. Co-financing from the Government of Senegal and other partners.
Support for surveillance and epidemic response to malaria	NMCP	500,000		Nationwide	Strengthening notification, particularly using mobile communication. ($75,000 of funds reserved for potential response to epidemics).
Case investigations in districts with malaria incidence <5/1,000	NMCP	600,000		Pre-elimination districts	Support training for the investigation of index cases and neighboring households and weekly electronic data transmission with DHIS2 integration.
Monitoring and evaluation of seasonal malaria chemoprevention	NMCP	50,000		Kédougou, Sédhiou, Kolda, Tambacounda	Support process monitoring, end of season coverage survey and molecular markers.
Monitoring and evaluation course organized by the NMCP	NMCP	250,000		Nationwide	Support to the NMCP for the 2nd year of implementation for two M&E courses that include surveillance and monitoring as these relate to malaria pre-elimination/elimination.
Technical assistance for M&E	CDC IAA	20,000		Nationwide	One technical assistance visit to Senegal from CDC to support SM&E efforts.
SUBTOTAL M&E		**1,770,000**	0		

OPERATIONAL RESEARCH					
SUBTOTAL OR		**0**	0		
IN-COUNTRY STAFFING AND ADMINISTRATION					
USAID technical staff	USAID	928,035		Nationwide	Support the salaries and expenses for one USAID Resident Advisor and local staff.
CDC technical staff	CDC	583,965		Nationwide	Support the salaries and expenses for one CDC Resident Advisor.
SUBTOTAL IN-COUNTRY STAFFING		**1,512,000**	0		
GRAND TOTAL		**24,000,000**	**10,656,000**		

*Consolidation regions: Dakar,Fatick, Kaffrine, Kaolack,
Louga, Thies, Ziguinchor
**Concentration regions: Diourbel, Kedougou, Kolda, Matam, Saint Louis, Sedhiou,
Tambacounda