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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U.S. PRESIDENT'S MALARIA INITIATIVE

PRESIDENT'S MALARIA INITIATIVE

UGANDA

Malaria Operational Plan FY 2017

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ABBREVIATIONS and ACRONYMS

ACT	Artemisinin-based combination therapy
AMF	Against Malaria Foundation
AL	Artemether-lumefantrine
ANC	Antenatal care
AS/AQ	Artesunate/Amodiaquine
CDC	Centers for Disease Control and Prevention
CHAI	Clinton Health Access Initiative
CHEW	Community health extension worker
CIDA	Canadian International Development Agency
CPHL	Central Public Health Laboratory
DFID	U.K. Department for International Development
DHIS2	District Health Information System 2
DHMT	District Health Management Team
DHS	Demographic and Health Survey
DOT	Directly observed treatment
DP	Dihydroartemisinin–piperaquine
EPI	Expanded Program on Immunization
EUV	End-use verification
FANC	Focused antenatal care
FETP	Field Epidemiology Training Program
FSN	Foreign service national
FY	Fiscal year
Global Fund	Global Fund to Fight AIDS, Tuberculosis and Malaria
GoU	Government of Uganda
HC	Health center
Hgb	Hemoglobin
HLC	Human landing catch
HMIS	Health Management Information System
HRH	Human resources for health
HSS	Health system strengthening
IC	Improvement collaborative
iCCM	Integrated community case management
IEC	Information, education, communication
IMM	Integrated management of malaria
IPC	Interpersonal communication
IPTp	Intermittent preventive treatment in pregnant women
IRS	Indoor residual spraying
ITN	Insecticide-treated mosquito net
IVM	Integrated vector management
JMS	Joint Medical Stores
LMIS	Logistics Management Information System
M&E	Monitoring and evaluation
MCH	Maternal and child health
MIP	Malaria in pregnancy
MIS	Malaria indicator survey
MoH	Ministry of Health

MOP	Malaria operational plan
NDA	National Drug Authority
NGenIRS	Next generation indoor residual spraying
NGO	Non-governmental organization
NMCP	National Malaria Control Program
NMS	National Medical Stores
OR	Operational research
PBO	Piperonyl butoxide
PCR	Polymerase chain reaction
PCV	Peace Corps Volunteer
PCW	Positive control well
PEPFAR	President's Emergency Plan for HIV/AIDS Relief
PFP	Private for-profit health facilities
PHFP	Public Health Fellowship Program
PMI	President's Malaria Initiative
PMTCT	Prevention of mother-to-child transmission
PNFP	Private not-for-profit health facility
ProAct	Proactive Community Treatment
PSC	Pyrethrum spray catch
QA/QC	Quality assurance/quality control
QI	Quality improvement
RA	Resident Advisor
RBM	Roll Back Malaria
RDT	Rapid diagnostic test
RHD	Reproductive Health Division
SBCC	Social and behavior change communication
SM&E	Surveillance, Monitoring & Evaluation
SP	Sulfadoxine-pyrimethamine
TASO	The AIDS Support Organization
TPR	Test positivity rate
TWG	Thematic working group
UCC	Universal coverage campaign
UMRC	Uganda Malaria Research Center
UMRSP	Uganda Malaria Reduction Strategic Plan 2014–2020
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USG	United States Government
VHT	Village health team
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.

Uganda was selected as a PMI focus country in FY 2006.

This FY 2017 Malaria Operational Plan presents a detailed implementation plan for Uganda, 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 Uganda Malaria Reduction Strategic Plan 2014 – 2020 (UMRSP) and build on investments made by PMI and other partners to improve and expand malaria-related services, including the United Kingdom's Department for International Development (DFID) and 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 Uganda, 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 Uganda is $33 million. PMI will support the following intervention areas with these funds:

Entomologic monitoring and insecticide resistance management: Proven interventions such as IRS and ITNs can impact vector behavior and insecticide resistance. Therefore, the UMRSP supports monitoring these and other entomological indices as a key component to evaluating progress in malaria

reduction goals. PMI supports comprehensive entomologic monitoring, which includes decay rate testing, bionomics monitoring, CDC bottle intensity bioassays, and oxidase enzyme testing. In addition, traditionally six eco-epidemiological zones throughout Uganda have conducted biennial susceptibility monitoring to the four classes of World Health Organization (WHO)-recommended IRS insecticides. In 2016, two sites were added to the existing six sites, increasing the total to eight sites and allowing for a more comprehensive understanding of the resistance status in Uganda. During the 2015 calendar year, analyses of intensity bioassays showed some resistance to high intensity insecticide dosing of *An. gambiae* s.l. to permethrin and deltamethrin. Both insecticides are used on ITNs and the operational impact of high intensity resistance on the effectiveness of ITNs to protect users has yet to be determined. CDC bottle synergist bioassays using piperonyl butoxide (PBO) were also conducted in 2015 and found to significantly increase mortality of *An. gambiae* s.l to permethrin and deltamethrin. With FY 2017 funding, PMI will continue to monitor malaria mosquito bionomics in four IRS districts, along with vector resistance status. Additionally, insecticide susceptibility monitoring will be conducted in eight eco-epidemiological zones to test for resistance to WHO-recommended IRS insecticides; four zones will be surveyed each year on alternate years.

Insecticide-treated nets (ITNs): The UMRSP supports universal access to ITNs through mass campaigns and routine distribution channels, including antenatal care (ANC) clinics, Expanded Program on Immunization (EPI) visits, outreach distribution points, private providers, and commercial outlets. PMI has procured 14,144,213 and distributed 12,247,177 ITNs. With FY 2015 funds, PMI procured 2,427,720 ITNs and distributed 747,320 ITNs through ANC/EPI clinics. Nearly 65,000 of these ITNs were distributed through ANC/EPI and directly to communities in the north affected by a malaria upsurge. Additionally, 267,000 PMI-procured ITNs were distributed to refugees and Ugandan nationals in settlements nationwide. In FY 2016, PMI plans to support the upcoming universal coverage campaign with approximately 1 million ITNs and robust technical assistance towards planning, implementation, and evaluation of the campaign. With FY 2017 funds, PMI will procure 1,575,000 ITNs: 800,000 will be distributed through ANC/EPI, 600,000 will be distributed at outreach distribution points for vulnerable populations, and 175,000 towards a pilot of traditional school-based distribution. PMI will use mass media and community mobilization strategies to increase knowledge and promote proper and consistent use of ITNs. PMI will also support the third and final year of the prospective ITN durability monitoring to determine survivorship, attrition, and bio-efficacy of nets distributed in northern Uganda.

Indoor residual spraying (IRS): The UMRSP supports scale-up and sustainment of IRS in 45% (50/112) of Ugandan districts. From 2009–2014, PMI implemented IRS in ten high burden districts in the Northern region. As a result, the malaria burden in these districts decreased significantly and PMI shifted its spray operations to target higher burden districts in the Eastern region. PMI will support spraying in nine Eastern districts with high malaria prevalence (Tororo, Lira, Butaleja, Namutumba, Kibuku, Budaka, Pallisa, Bugiri, and Serere) during the 2016 calendar year targeting over 850,000 houses to protect approximately 3 million people. In addition, with DFID support PMI will spray an additional five high burden districts in the Eastern region in 2016 (Otuke, Alebtong, Dokolo, Kaberamaido, Amolatar). With FY 2017 funds, PMI will continue to implement IRS in nine Eastern districts with plans to use an organophosphate insecticide to ensure prolonged residual and insecticidal effectiveness, and to counter emerging carbamate resistance. Should Uganda benefit from the UNITAID-sponsored Next Generation Indoor Residual Spraying (NGenIRS) Project to subsidize the purchase of long-lasting, non-pyrethroid insecticides for IRS, PMI, in collaboration with the NMCP, plans to support IRS in two additional districts. To ensure compliance with Ugandan environmental laws, PMI will also fund an external environmental compliance inspection.

Malaria in pregnancy (MIP): With PMI technical support, coordination of MIP-related efforts has improved with the Ministry of Health's Reproductive Health Division and the NMCP, through the establishment of a functional national MIP working group. In 2014, Uganda successfully updated its national MIP policy, guidelines, job aids, and social and behavior change communication (SBCC) materials to reflect the revised WHO guidance on IPTp. With FY 2017 funds, PMI will continue to support prevention of malaria in pregnant women through provision of ITNs at ANC clinics, IPTp, and early diagnosis and prompt treatment of MIP. PMI will also strengthen the coordination of ANC workers and continue to provide on-site training and supportive supervision related to MIP in the public and private sector. To increase uptake of IPTp, PMI will work through integrated projects that leverage resources available through the President's Emergency Plan for AIDS Relief (PEPFAR) that support scale-up of prevention of mother-to-child HIV transmission (PMTCT). PMI will continue to provide clean water and drinking cups so that health workers can administer sulfadoxine-pyrimethamine (SP) at ANC clinics as directly observed treatment (DOT).

Case management: The UMRSP objective is to achieve and sustain the target of at least 90% of malaria cases in the public and private sectors and community level receiving diagnosis and prompt treatment according to national guidelines by 2018. Since the launch of PMI, a total of 5.1 million rapid diagnostic tests (RDTs) and 7.5 million ACTs have been procured. In the past year, PMI has supported the revision of the country's Integrated Malaria Management (IMM) training manual and worked to improve diagnostic capacity for malaria and effective case management of febrile illness through the training of health care workers in malaria diagnosis and treatment. Due to current restrictions on supplying commodities to public sector health facilities through the National Medical Stores (NMS), PMI is limited to supplying commodities to private not-for-profit (PNFP) facilities through the Joint Medical Stores (JMS). Currently, PMI is advocating to distribute PMI-procured commodities to the public sector through the JMS in hard-to-reach areas and in times of outbreaks. The Global Fund continues to distribute commodities through the NMS. With FY 2017 funds, PMI will support the scale-up of an appropriate quality assurance/quality control system for diagnostics and continue to support strengthening treatment for uncomplicated and severe malaria through training, supportive supervision, clinical audits, and on-the-job mentoring in both public and private facilities. PMI will prioritize strengthening prevention and treatment services in communities through integrated community case management (iCCM) in eight districts, in addition to the procurement of approximately 2 million RDTs and 1.6 million ACTs to be distributed to PNFP health facilities through the JMS. Additionally, with FY 2017 funds, PMI will continue to support strengthening the national pharmaceutical management system.

Health systems strengthening and capacity building: In 2012, the Uganda Parliament passed the Wage Bill as a result of the efforts of USAID/Uganda's health systems strengthening activities, which are supported in part through PMI. This has increased the recruitment of staff with the relevant professional backgrounds, especially at the health center III and IV levels. As a result, the availability of human resources for health has increased from 58% of positions filled in 2012 to 70% in 2015, with projected increases to 75% by the end of 2016. With FY 2017 funds, PMI, in collaboration with PEPFAR and other USAID health programs, will continue to support regions and districts to improve performance management, planning, staff training (pre-service and in-service), and improvement of service quality. Through secondment of two senior staff, PMI will continue to support the capacity of the NMCP to manage and coordinate multi-sectoral malaria reduction efforts at all levels. PMI will also support training of two new Ugandan nationals through the Field Epidemiology Training Program and three Peace Corps volunteers.

Social and behavior change communication (SBCC): Past PMI activities have reached nearly all Ugandans with key malaria messages on the importance of net use, malaria testing, timely treatment, and prevention of malaria during pregnancy. The communication approaches used included radio talk shows and radio spots, interpersonal communication, print materials, and health education activities in 200 schools. During the 2015 calendar year, PMI intensified SBCC in northern Uganda to counter the malaria upsurge by training 8,000 village health workers to conduct home visits for mass fever treatment, facilitating over 1,000 small group discussions, and conducting approximately 130 large-group educational shows. PMI also trained 28,783 individuals as malaria champions and they were deployed throughout the country to conduct interpersonal communication (IPC) and social mobilization. With FY 2017 funds, PMI will continue to support targeted and evidence-based SBCC at the national, district, and community levels. PMI's SBCC activities will encourage consistent and proper usage of ITNs, the importance of IPTp, timely testing of all fevers, and appropriate malaria treatment for confirmed cases. In addition, communication efforts will disseminate targeted messages in PMI-supported iCCM districts.

Surveillance, monitoring and evaluation (SM&E): From 2006 – 2015, PMI supported the collection of high quality malaria surveillance data from sentinel sites. Although PMI no longer supports the sentinel site system approach, the data continues to assist PMI and the NMCP in understanding the effect of interventions and informing current and future strategies. In 2014, PMI targeted a health management information system (HMIS) strengthening activity to improve malaria data quality and use by building cost-effective, sustainable data collection and reporting capacity at 26 level IV health facilities. These facilities, which include former sentinel sites, received computers, training and supervision, and piloted enhanced outpatient registers that capture for the first time suspected malaria cases, testing, test results, and treatment. In December 2014, Uganda completed its second Malaria Indicator Survey (MIS) which showed a remarkable drop in parasitemia since the last MIS in 2009. With FY 2017 funds, PMI will build on successes to date of the HMIS strengthening within the 26 facilities to develop a long-term strategy to enhance HMIS strengthening at the national, district and lower facility levels. PMI will continue leveraging the USG integrated regional health platform for health systems strengthening, focus on improving the quality and NMCP's use of malaria data, and provide support for the implementation of the 2018 MIS. PMI will also continue to support national, regional, district, and health facility level activities including training health workers on new HMIS tools and supportive supervision.

Operational research (OR): PMI has been integral in supporting studies related to the improvement of case management and vector control activities to help inform malaria prevention and programmatic policies. Completed studies have included: improving case management of severe malaria; formative research on net care and repair behaviors and effectiveness of post-campaign door-to-door hang-up and communication interventions to improve ITN use. There is currently one ongoing PMI-supported OR study, which is evaluating the effectiveness of the improvement collaborative (IC) approach to improve the quality of health facility data. Although data collection is ongoing, preliminary results show improved quality of data accuracy, validity, and timeliness at the health facilities participating in the IC intervention. Based on the lessons learned from the 2015 upsurge of malaria cases in northern Uganda after the withdrawl of IRS, PMI is proposing an OR study with FY 2017 funds to implement a pilot intervention to assess the impact and cost-effectiveness of Proactive Community Treatment (ProAct) as a post-IRS withdrawal strategy, which will help inform IRS transition plans in the future.

II. STRATEGY

1. Introduction

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

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2. Malaria situation in Uganda

Uganda has the third highest number of *P. falciparum* infections in sub-Saharan Africa, and some of the highest reported malaria transmission rates in the world.[1,2] There is stable, perennial malaria transmission in 90–95% of the country. In the rest of the country, particularly in the highland areas, there is low and unstable transmission with potential for epidemics. According to 2015 data from Uganda's Health Management Information System (HMIS), malaria accounts for 34% (monthly range, 29–39%) of outpatient visits and 28% (monthly range 21–39%) of hospital admissions. Of all the reported malaria cases in 2015, an average of 55% was laboratory confirmed, although this average increased to 64% between July and December. Compared to 2014 HMIS data, hospital admissions decreased by two percentage points (from 30%) in 2015, while laboratory confirmed cases increased by 16 percentage points (from 39%). Both show a positive trend in malaria case management.

The most common malaria vectors are *Anopheles gambiae* s.l. and *An. funestus*. *Anopheles gambiae* s.l.is the dominant species in most places, while *An. funestus* is generally found at sites having permanent water bodies with emergent vegetation. Like *An. gambiae*, it is strongly endophagic and is commonly collected indoors, resting on walls during early morning hours, making ITNs and IRS viable vector control strategies. Recently, *An. arabiensis* has been found in northern and eastern Uganda, having been identified from *An. gambiae* s.l. samples. *Anopheles arabiensis* tends to bite earlier in the evening, feeds more willingly on domestic animals, and has a greater propensity to feed outdoors than does *An. gambiae*, but remains an effective malaria vector. Limited sampling from Apac District (in the previous northern IRS zone) indicates that *An. arabiensis* may have replaced *An. gambiae* as the predominant malaria mosquito in this district.[3]

Figure 1. Malaria prevalence by sub-region, 2009 and 2014, Uganda

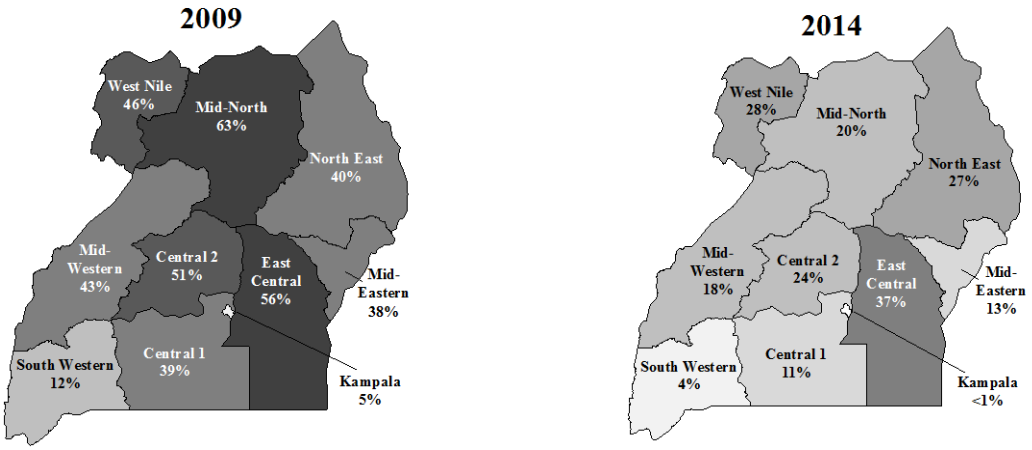


Figure 1 shows the percent of children aged 0–59 months that tested positive for malaria by microscopy in the 2009 and 2014 Malaria Indicator Surveys (MIS). Over these five years, the national prevalence decreased from 42% to 19%. Prevalence was higher in rural areas than in urban areas (22% vs. 6% by

[1]World Health Organization (2014): World Malaria Report. Geneva: WHO.
[2]Okello PE, Van Bortel W, Byaruhanga AM, Correwyn A, Roelants P, et al. (2006) Variation in malaria transmission intensity in seven sites throughout Uganda. Am J Trop Med Hyg 75: 219-225
[3]Okia et al. 2015. Impact of indoor residual spraying (IRS) on malaria vector bionomics in IRS districts compared to a non-IRS district in northern Uganda. Under review.

microscopy) and ranged from 37% in the East Central sub-region to less than 1% in Kampala. Survey data also indicate that severe anemia (often a result of malaria) is a public health problem in Uganda, though improving; 4.6% of children 0–59 months of age were severely anemic (<8.0 g/dL) in 2014, compared to 9.7% in 2009. In the Mid-North in 2009, severe anemia was the highest in the country at 15.9%, but by 2014, the mid-north (in which 10 of the 15 districts got carbamate IRS) had dropped to 4.9%.

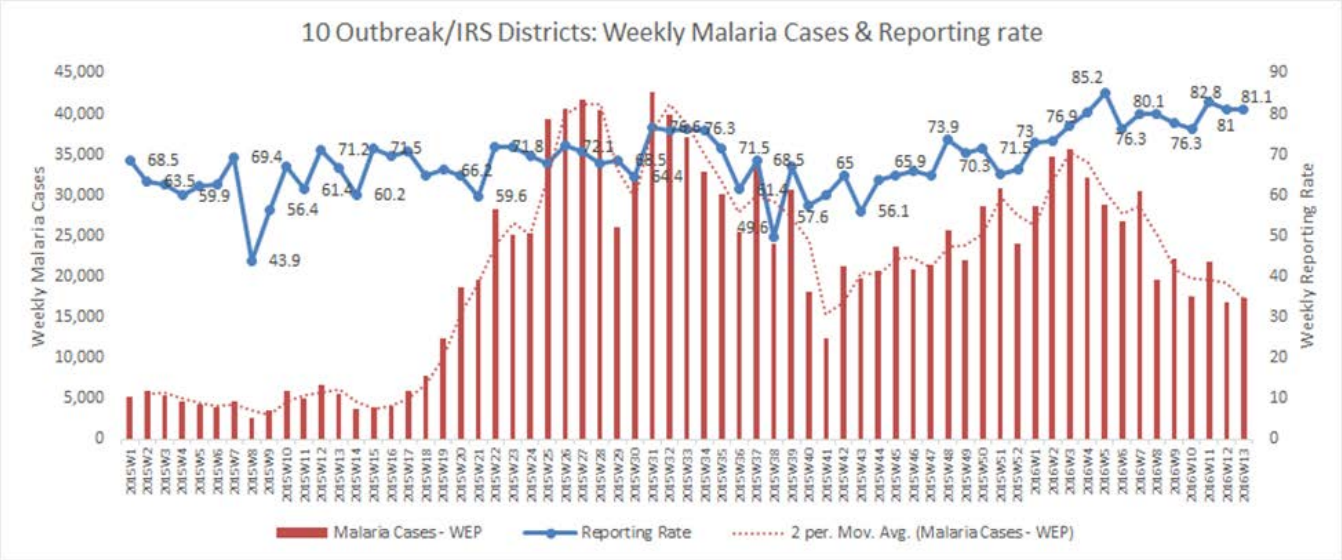
The Uganda MIS, conducted in late 2014, showed that *Plasmodium falciparum* is the species responsible for the vast majority of malaria cases. *Plasmodium malariae* accounts for less than 1% of cases as a single infection, but is more commonly found as a mixed infection with *P. falciparum* (up to 3% of childhood infections in highly endemic areas). Both *P. vivax* and *P. ovale* are rare and do not exceed 2% of malaria cases in Uganda.

2015 Malaria Upsurge in Uganda

A systematic review of district level monthly data retrieved from the District Health Information System 2 (DHIS2) covering 2012-2015 showed that from April – June 2015, 50 of the 112 districts combined saw a 156% increase in rapid diagnostic test (RDT) use and 184% increase in RDT positivity compared to the baseline period of 2012-2014 (same months). In addition, data shows an 80% increase in malaria admissions during this time period as compared to the baseline. Based on national data, it was found that the most affected districts were the former ten IRS districts that had transitioned from IRS to universal coverage of ITNs and improved case management in 2014. In response, the NMCP and partners, including PMI, provided technical assistance to the affected districts, health facilities, and communities. This support included provision of additional supplies of ITNs, ACTs, and RDTs, which were complemented with comprehensive social and behavior change communication (SBCC) messages. PMI supported the northern districts by providing over 300,000 doses of ACTs for mass fever treatment and trained 8,000 village health teams (VHTs) that moved door-to-door to identify persons with fever and perform directly observed treatment (DOT) with ACTs based on age. At the same time, the VHTs used the opportunity to promote key prevention methods (correct and consistent ITN use and prevention of malaria in pregnancy) and early diagnosis and treatment. PMI's efforts helped to stabilize the malaria upsurge and prevented excessive deaths in the northern districts.

District-level data from 2016 indicates a downward trend in malaria cases in the former IRS districts. PMI is working with partners to further assess the situation and provide support as needed. Changing weather patterns such as El Nino, have the ability to majorly impact the intensity of malaria transmission and cause further malaria upsurges in the future. In addition, a lack of emergency preparedness and response funding are potential threats for a rapid response to future upsurges.

Figure 2. Weekly Malaria Cases & Reporting Rate in 10 Northern Districts, January 2015 – March 2016



Geographic Coverage of PMI Activities

PMI's activities are implemented in 106 districts nationwide (of 112 districts total); providing close to national coverage (Figure 3). The remaining districts (which include Kampala) will be covered by other partners and the NMCP. PMI's support at different levels of the health system depends upon need, NMCP priorities, and geographic coverage of other donors and partners, in order to ensure complementarity and have the greatest impact. For additional information on PMI's geographic coverage, see the technical sections below.

Vector Control: PMI provides focused support to the mass distribution of ITNs through universal coverage campaigns (UCCs), which cover the entire country. In addition, PMI supports continuous distribution through ANC which covers all public and private not-for-profit (PNFP) facilites in 106 districts. Future support will include adding facility outreach distribution points and school-based distribution of ITNs in priority areas in West Nile and Central regions, respectively. PMI-supported IRS currently covers nine districts in the east and central part of Uganda, with plans to expand to two additional districts under the UNITAID-funded Next Generation Indoor Residual Spraying (NGenIRS) project.

Malaria in Pregnancy: PMI's MIP support is national except for commodities, which go through the Joint Medical Stores (covering over 600 PNFP facilities nationwide). Serious issues with the National Medical Stores' (NMS) capacity, accountability, and transparency have been documented, leading to the prohibition of supplying malaria and non-malaria U.S. government (USG)-procured commodities to the public sector through the NMS over the past several years (see "*supply chain challenges*" on page 17 for further details).

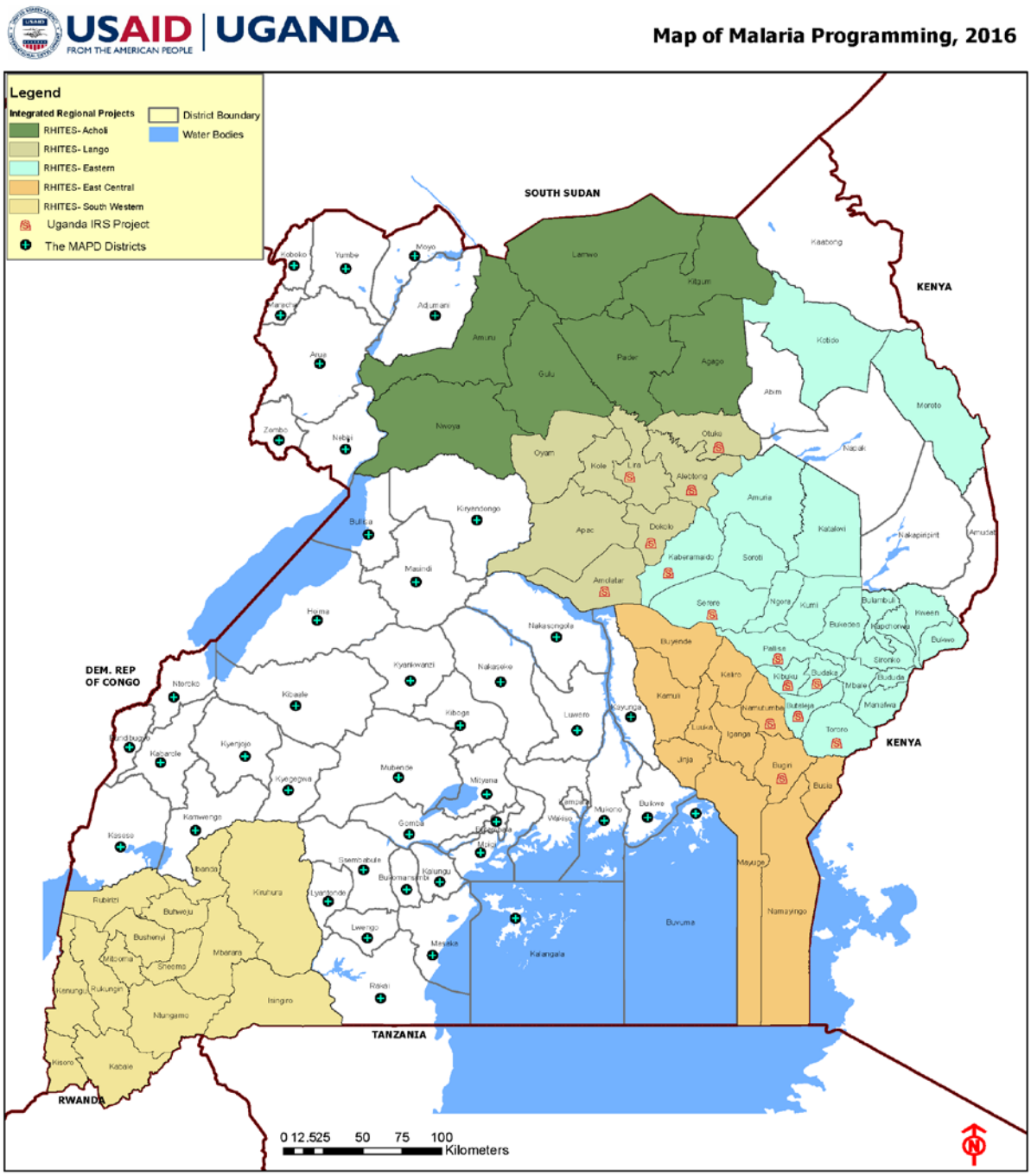
Case Management: The bulk of PMI's work in case management will be implemented in 43 high burden districts in West Nile, Mid-west and Central regions, with additional support in 63 additional districts in North-Acholi, North-Lango, Eastern, East-Central, and South West regions. In addition, iCCM will be rolled out in a phased manner, beginning in two districts in 2016/2017 and expanding

to four districts in 2017/2018 and then eight districts by 2018/2019. Case management commodities support is currently directed at all PNFP facilities nationwide.

Surveillance, Monitoring & Evaluation: SM&E activities are predominantly implemented in 43 high burden districts (West Nile, Mid-west and Central regions), however, some national level support will be provided in addition to focused activities implemented in five regions (North-Acholi, North-Lango, Eastern, East-Central, and South West).

Social & Behavior Change Communication: SBCC activities will be mainly supported at both the national level as well as in 43 high burden districts, with limited activities in four additional regions (East, East Central, North-Acholi, North-Lango regions). Activities in the remaining South West region will be covered by PMI's national level partner and through existing non-PMI integrated SBCC funding.

Figure 3. Geographic Coverage of PMI Activities



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

The National Health System in Uganda is made up of the public and the private sectors. The public sector includes all government health facilities under the MoH, health services of the Ministries of Defense (Army), Internal Affairs (police and prisons), and Ministry of Local Government. The private health delivery system consists of private health practitioners, private-not-for-profit (PNFP) providers and the traditional and complementary medicine practitioners. The MoH has four levels of administration: the national, regional, district, and county levels. The central level includes the National Directorate of Public Health of the MoH (which houses the NMCP), where national guidelines and norms are promulgated.

The MoH provides leadership for the health sector and is responsible for overseeing the delivery of curative, preventive, palliative, and rehabilitative services to the people of Uganda. The provision of health services in Uganda has been decentralized with districts and health sub-districts playing a key role in the delivery and management of health services at each respective level. The health services are structured into National Referral Hospitals and Regional Referral Hospitals, general hospitals, and health centers (HCs) IVs, IIIs, and IIs. The HC IIs provide the first level of interaction between the formal health sector and the communities. HC IIs only provide outpatient care and community outreach services, and nurses are key to the provision of comprehensive services and linkages with the VHT. The HC IIIs provide basic preventive and curative care while also providing supportive supervision to the community and HC IIs under their jurisdiction.

The HC I does not have a physical structure but rather consists of a team of people—VHTs—that links health facilities with the community. These VHT networks facilitate health promotion, service delivery, and community participation in access and utilization of health services. The MoH carried out an assessment in 2015 to determine the national status and functionality of VHTs in Uganda in order to improve the planning and delivery of health services to households and communities. The assessment indicates that the VHT strategy has been implemented to varying degrees across the districts. Funding of the program by the government has been gradually decreasing since its inception, leaving donors to fund most of the activities. Districts have different levels of capacity to coordinate, train, and supervise VHT activities but have been hampered by a lack of funds. Coordination and supportive supervision by the MoH have not been conducted as desired due to funding constraints. Overall, VHT coverage is still limited because of challenges surrounding lack of tools, resources, motivation, and regular supervision, which has resulted in high attrition among VHTs. The assessment recommended that the government should have a clear commitment to adequate financing and institutionalization of the VHT strategy and should ensure regular payment of VHTs for the sustainability of the program.

4. National malaria control strategy

The Uganda NMCP carried out a midterm review of the 2010–2015 National Malaria Control Strategic Plan and subsequently prepared a six-year UMRSP (2014–2020). The UMRSP has three main goals to be achieved by 2020: 1) reduce annual malaria deaths from 2013 levels to near zero, 2) reduce malaria morbidity to 30 cases per 1,000 population, and 3) reduce malaria parasite prevalence to less than 7%. The UMRSP calls for a rapid and synchronized nationwide scale-up of cost-effective interventions to achieve universal coverage of malaria prevention and treatment. It is a very ambitious strategic plan with a $1.23 billion proposed budget expected to be funded by the Government of Uganda (GoU) with assistance from donors. The UMRSP was developed by a government-led consortium of major donors including PMI.

The objectives of the UMRSP are:

1) By 2017, achieve and sustain protection of at least 85% of the population at risk through recommended malaria prevention measures;
2) By 2018, achieve and sustain at least 90% of malaria cases in the public and private sectors and community level receive prompt treatment according to national guidelines;
3) By 2017, at least 85% of the population practices correct malaria prevention and management measures;
4) By 2016, the program is able to manage and coordinate multi-sectoral malaria reduction efforts at all levels;
5) By 2017, all health facilities and District Health Offices report routinely and timely on malaria program performance; and
6) By 2017, all malaria epidemic-prone districts have the capacity for epidemic preparedness and response.

The role of the NMCP at the central level continues to be to support the implementation of the UMRSP through policy formulation, setting standards and quality assurance, resource mobilization, capacity development and technical support, malaria epidemic identification and response, coordination of malaria research, and monitoring and evaluation (M&E). The UMRSP calls for vector control through IRS, ITNs, and larviciding according to the WHO guidelines, prevention of malaria in pregnancy (MIP) through ITNs and IPTp, effective case management including parasite-based diagnosis and treatment with ACTs, and M&E of all components of the program.

5. Updates in the strategy section

- **MIS 2014**: The 2014 MIS showed tremendous progress in malaria control efforts. Dissemination of the MIS results was carried out in August 2015. During the dissemination, PMI ensured that stakeholders were cognizant of the gaps remaining in malaria prevention and treatment, and emphasized that the achievements are fragile. In addition, all relevant partners including PMI are using the results from the MIS (and HMIS) to guide their future activities in Uganda.

- **National Registration for the National Identification Card:** The Government of Uganda carried out a huge national registration for all citizens of Uganda who are 18 years and above. This will help as an additional data set for determining the adult population in Uganda.

- **NMCP capacity assessment**: With funding from DFID and technical support from PMI, a capacity assessment of the NMCP was completed in early 2015. The assessment indicated an urgent need for strengthening the capacity of the NMCP, including structure and functions involving the recruitment of qualified staff. The assessment also proposed that the MoH elevate the profile of the NMCP to a department of malaria and other vector-borne diseases if the vision of malaria elimination by 2030 is to be achieved. In addition, the assessment proposed the decentralization of planning, programming, and support supervision of malaria service delivery to the districts and regional/zonal levels. The findings and recommendations of the assessment were communicated to the highest levels of the MoH, including the Minister of Health. PMI will support the efforts to strengthen the capacity of the NMCP by seconding two long-term advisors within the NMCP to focus on vector control and case management, in addition to the support already being provided by PMI's two in-country Resident Advisors (RAs). In addition, several other donors including DFID, UNICEF, and Global Fund have committed to funding key positions within the NMCP over the next two years.

- **2016/2017 Universal ITN coverage campaign:** The completion of Uganda's first universal ITN coverage campaign (UCC) from May 2013 to August 2014 demonstrated the effective partnership between the GoU and its donors, namely the Global Fund, PMI, DFID, and World Vision. Over 22 million ITNs were distributed to all 112 districts in Uganda using VHTs to reach over 90% of the population. The next UCC is planned for 2016/2017 and is being supported by Global Fund, PMI, DFID, and Against Malaria Foundation. Despite the existing pledges from all donors, there still exist significant funding gaps in operations costs for distribution.

- **Supply chain challenges in the public sector:** Commodity supply to public sector health facilities remains a major challenge. Serious issues with the NMS's capacity, accountability, and transparency have been documented, leading to the prohibition of supplying malaria and non-malaria USG-procured commodities to the NMS over the past several years. However, the USG is currently exploring placing PEPFAR commodities through the public sector as this is where the biggest burden lies. The USG is conducting high-level discussions with the MoH regarding strengthening the public supply chain system. In Uganda's FY 2017 Country Operational Plan, PEPFAR is proposing a number of measures to increase internal controls, including governance reforms, information management through the procurement of an Enterprise Resource Planning tool, and recruiting fiduciary agents to monitor and track commodities at the central and health facility levels. PMI is working with PEPFAR and other USG partners on these reforms and intends to contribute to the integrated mechanisms to strengthen the accountability and effective management of the public sector supply chain. In the future, PMI will consider distributing malaria commodities through the public system once improvements are made with the NMS' supply chain operations. In the interim, PMI will continue to supply commodities to the public sector through the Joint Medical Stores (JMS) in hard-to-reach areas and in times of outbreaks.

6. Integration, collaboration, and coordination

Over the years, malaria control activities in Uganda have been successfully implemented and the NMCP has benefited from increasing support from various partners. PMI works hand-in-hand with the NMCP and coordinates closely with all malaria partners in Uganda to ensure efforts are harmonized and complementary.

- **Global Fund**: The Global Fund has signed two new funding model (NFM) grants, one with Ministry of Finance, Planning and Economic Development and another with The AIDS Support Organization (TASO) with approved grant funds of $119.3 million and $29.6 million, respectively. Both grants provide critical support for case management, vector control, health information systems, and program management. The signed NFM grants are to support two years of program implementation between January 2015 and December 2016, with the possibility for a costed extension to continue supporting the core malaria control interventions until the end of 2017. Uganda was identified by RBM partners and Global Fund as one of ten "redline" countries, predominantly because the Global Fund malaria allocation was insufficient to finance two ITN UCCs during the period 2014-2017. As a result, discussions are ongoing on how to fill the gap using existing resources and a costed extension.

  The current Global Fund grants include a budget for 11.3 million ITNs for the 2016/2017 UCC. An additional 2 million ITNs are planned to be procured using the savings from both principal recipients. Procurement and routine distribution of ITNs through antenatal care (ANC) and Expanded Program on Immunization (EPI) clinics are implemented by TASO. The Global

Fund's funding will support procurement and distribution of ACTs, IV artesunate, and RDTs for treatment and diagnosis of malaria in 2015/2016. The case management component of the grants also includes support for SBCC, integrated community case management (iCCM) as well as subsidized ACTs for the private sector (co-payment mechanism). Through the effective partnership among NMCP, PMI and Global Fund, PMI provided 2.1 million ITNs to Global Fund for distribution to public ANC facilities in geographic areas where PMI does not reach.

- **DFID**: DFID made a commitment in 2010 to significantly increase support for health and malaria control in Uganda. In 2014, a special arrangement between USAID and DFID allowed the use of PMI's funding mechanisms and implementing partners to scale-up its contribution to malaria control in Uganda. DFID funds supported the procurement and distribution of ITNs for the 2013/14 universal coverage campaign and for routine net distribution and commodity surveillance through PMI's implementing partners. DFID through PMI has also supported two ITN-related assessments: 1) Phase one: process evaluation of the UCC 2013/14, 2) Phase two: evaluation of the effectiveness, efficiency, and impact of the UCC 2013/14 distribution to learn for future campaigns.Using DFID funding, PMI scaled up implementation of IRS from 9 districts to 14, increased the number of health workers trained in Integrated Malaria Management (IMM), and provided capacity building to the NMCP and district health management teams (DHMTs). The current DFID grant is ending in 2017; however, discussions are ongoing on DFID's future support to malaria efforts in Uganda.

- **WHO/Uganda**: WHO provides malaria control technical assistance at the national level including support to M&E (data collection and analysis) and emergency preparedness and response.

- **United Nations Children's Fund (UNICEF)/Uganda**: UNICEF supports implementation of iCCM in 19 districts, in addition to providing commodities for iCCM in Global Fund and Malaria Consortium-supported districts, and advocating for scale-up at the national level. In addition, with funding from DFID, UNICEF provided five public health specialists and procured ACTs, IV artesunate, and RDTs for effective malaria case management in ten northern Uganda districts in response to the malaria upsurge.

- **Clinton Health Access Initiative (CHAI)**: CHAI is providing technical assistance to the NMCP to develop a strategy for effective case management including diagnosis and appropriate treatment with ACTs in both the public and private sectors in Uganda.

- **United Nations High Commissioner for Refugees**: Uganda hosts more than half a million refugees and asylum-seekers. In 2015 alone, more than 100,000 people sought safety in Uganda, the vast majority fleeing war and human rights abuses in South Sudan, the Democratic Republic of Congo, and Burundi, providing unique challenges for malaria control. Uganda has a long history of providing sanctuary to refugees and its policy of integrating refugees within local communities, rather than in camps, is widely considered as an exemplary model. Acknowledging the outstanding generosity of local Ugandan communities in welcoming refugees, the humanitarian response in refugee-hosting areas ensures that at least 30% of their efforts goes towards assisting local Ugandans. Malaria continues to be the leading cause of death amongst people living in refugee-hosting districts in Uganda. One out of every four deaths amongst refugees are caused by malaria and one-third of all medical consultations at health centers in refugee settlements are people suffering from malaria. Efforts have been made to tackle the problem, including endeavoring to ensure new cases are diagnosed early, but by far the most

effective way to bring down deaths from malaria is to prevent people from becoming infected in the first place. In 2016, PMI donated 267,000 ITNs to refugees and Ugandans to protect against malaria.

- **Collaboration within the U.S. Government:** PMI works closely with other USG initiatives including PEPFAR, maternal and child health (MCH), the Global Health Security Agenda, and Feed the Future to leverage their resources to better achieve malaria control efforts. In addition, the Uganda Mission is focusing on integration in its health portfolio; PMI has contributed resources in these integrated projects that reach populations that PMI's malaria projects may not adequately reach, thus increasing the effectiveness of PMI funds.

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

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

- 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

Table 1. Evolution of Key Malaria Indicators in Uganda from 2006 to 2014

Indicator	2006 DHS	2009 MIS	2011 DHS	2014 MIS
% Households with at least one ITN	16%	47%	60%	90%
% Households with at least one ITN for every two people	N/A	N/A	28%	62%
% Children under five who slept under an ITN the previous night	10%	33%	43%	74%
% Pregnant women who slept under an ITN the previous night	10%	44%	47%	75%
% Households in targeted districts protected by IRS	N/A	N/A	N/A	N/A
% Children under five years old with fever in the last two weeks for whom advice or treatment was sought	N/A	70%	82%	82%
% Children under five with fever in the last two weeks who had a finger or heel stick	N/A	17%	26%	36%
% Children receiving an ACT among children under five years old with fever in the last two weeks who received any antimalarial drugs	N/A	23%	65%	87%
% Women who received two or more doses of IPTp during their last pregnancy in the last two years	16%	32%	25%	45%
Prevalence of parasitemia (by microscopy) in children 0–59 months	N/A	42%	N/A	19%
Prevalence of anemia in children 0–59 months (Hgb<10.9g/dl)[8,9]	73%*	62%	50%	N/A
Prevalence of severe anemia in children 0–59 months (Hgb<8 g/dl)	N/A	10%	5%	5%

*The Demographic and Health Survey (DHS) 2006 anemia measured children between 6–59 months.

9. Other relevant evidence on progress

Evaluation of the Universal ITN Coverage Campaign (UCC 2013/14):

An evaluation was carried out in 2015 assessing the effectiveness, efficiency, and impact of the UCC 2013/14 distribution to help inform future campaigns. The evaluation concluded that:

- By the end of 2014 Uganda had achieved impressive ownership of ITNs.

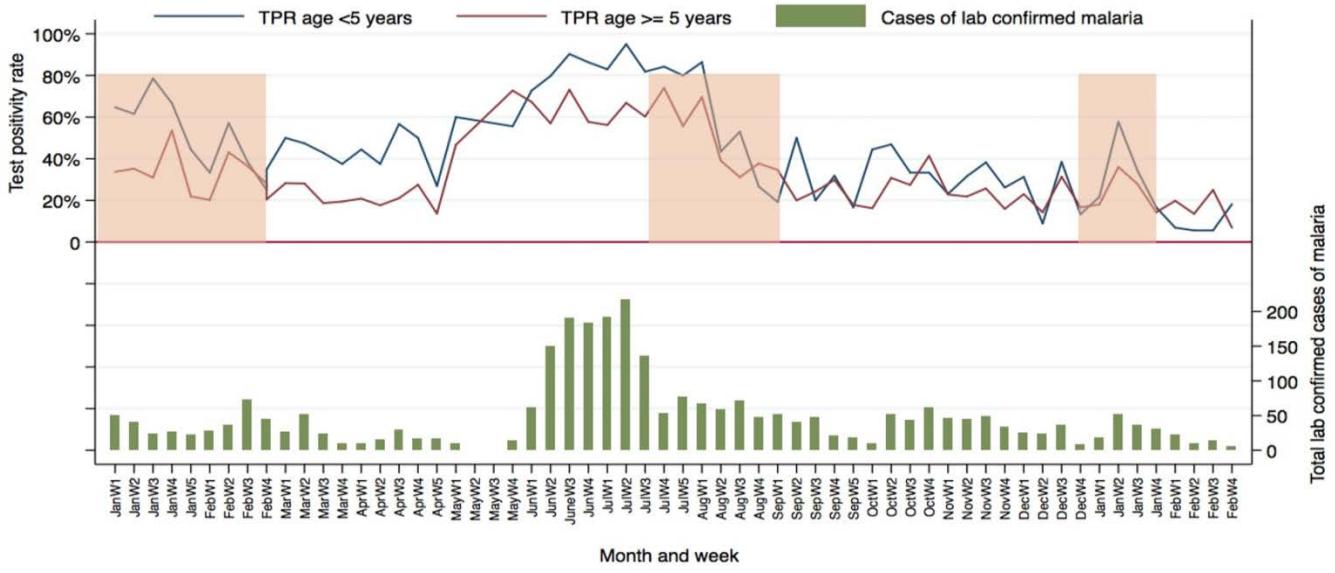
- There were issues with efficiency as some areas were over-supplied while others were under-supplied.
- Routine distribution of ITNs through health facilities was much lower than expected and this distribution system has not been sufficiently utilized.
- The average annual cost per ITN/year (USD $1.49) was very low compared to historical data, which was largely due to the low prices of ITNs. This made the UCC highly cost-effective with respect to the estimated cost per Disability-Adjusted Life Year (DALY) averted.
- Inaccurate household registrations were noted as an issue, which likely affected the campaign's efficiency.

Impact Evaluation 2000–2011:
The Uganda Impact Evaluation, which covers the period from 2000 to 2011, showed a substantial decrease in the proportion of children 6–59 months old with severe anemia (16.7% to 4.7%). All-cause under-five mortality declined from 152/1,000 (DHS 2000) to 90/1,000 (DHS 2011). The evaluation concluded that since a substantial increase in malaria intervention coverage occurred during this time, malaria interventions could have contributed to the observed 41% decline in under-five mortality, taking into account other factors that could also have contributed to the observed reduction such as vitamin A supplementation for both mothers and children, increased deliveries in health facilities, and increases in measles vaccinations.

Reference Center Data:
Malaria reference centers are strategically located across the country in different transmission zones, and in new and old IRS districts, providing high-quality malaria surveillance data that has been used to inform policy and evaluate the impact of ongoing interventions.

Data from malaria reference centers located in areas where IRS is ongoing show a considerable decline in malaria burden, measured by test positivity rates (TPRs) (see Figure 4). However, data from malaria reference centers in areas where IRS was withdrawn still show high numbers of malaria cases and high TPRs (see Figure 5). Similar upsurges are also seen in other parts of the country (see Figure 6).

Figure 4. Alebtong Health Center IV (Alebtong District, Current IRS district), January 2015 – February 2016



*Orange bars indicate when IRS was implemented.

Figure 5. Aduku Health Center (Apac District, IRS withdrawn May 2014), January 2015 – February 2016

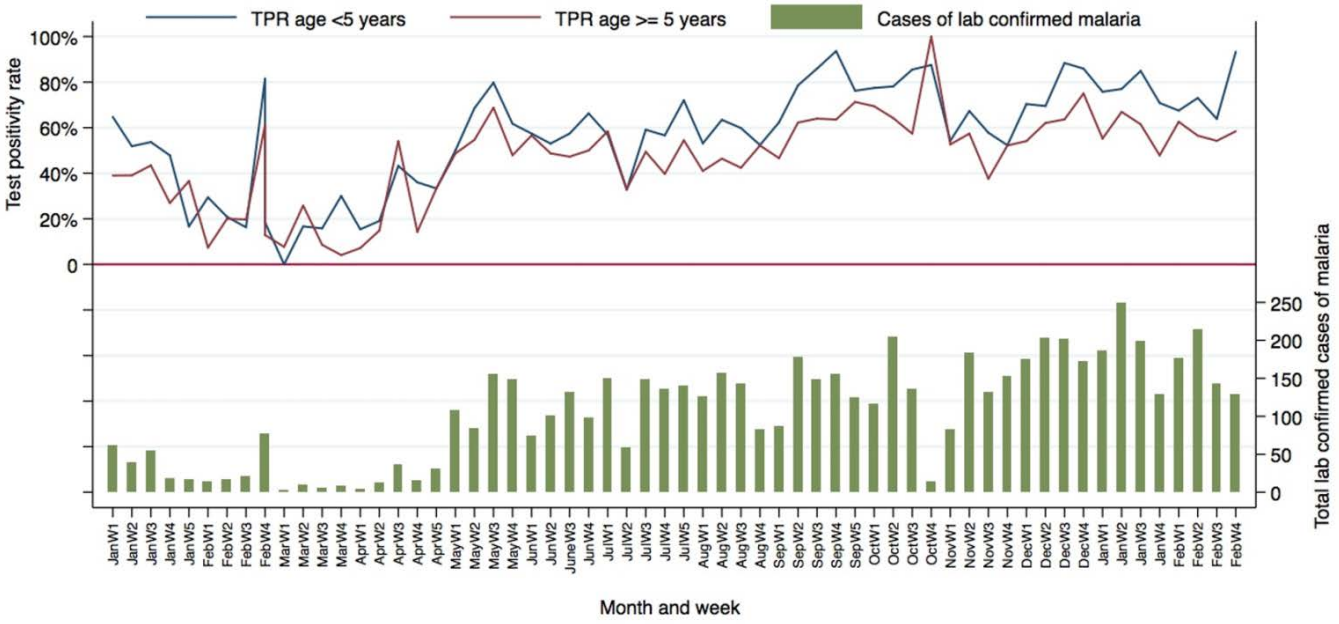
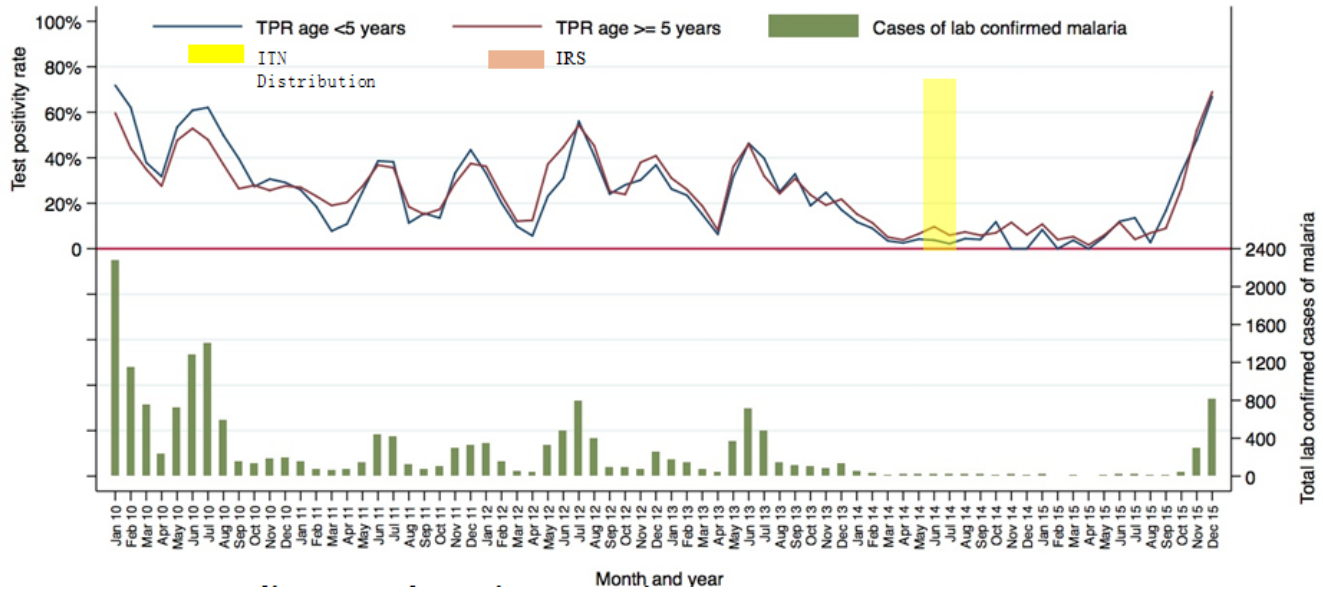


Figure 6. Kamwezi Health Center (Kabale District, South West sub-region, hypoendemic, no history of IRS), January 2010 – December 2015

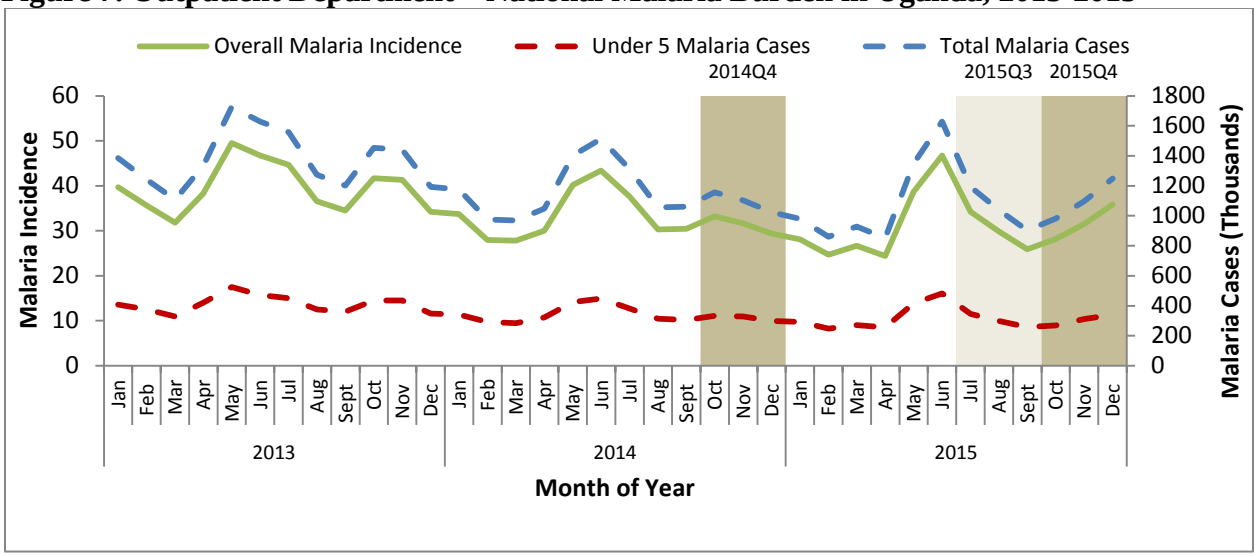


Heath Management Information System (HMIS)/District Health Information System 2 (DHIS2): The HMIS provides critical data on malaria-related indicators that are used to assess trends, highlight progress and challenges, and guide PMI's programmatic activities. Since 2013, there has been an improvement in the accuracy, completeness (with about 90% of public facilities reporting), and timeliness of malaria data contributing to the regular preparation of the Uganda malaria quarterly bulletin. The quarterly bulletin includes updates on malaria interventions, malaria burden (national, regional, and district level), and data on laboratory diagnosis, treatment practices, and special topics as

needed. The bulletin, which is developed through a collaborative process led by the NMCP, provides an opportunity for the NMCP and malaria stakeholders to monitor and review malaria program performance and to make informed decisions based on this data.

While the monthly data received from the HMIS/DHIS2 system has a high completeness rate, the weekly data is less complete (~60-70% completeness). The 2015 malaria upsurge in the north was detected by HMIS/DHIS2, but that detection was somewhat delayed because of the timeliness and incompleteness of weekly data. The DHIS2 system was rolled out in 2012, and continues to improve. However, at all levels, data quality is not always optimal, nor is timely data analysis and use. PMI has strengthened HMIS/DHIS2 at national and subnational levels with efforts such as the M&E TWG, the quarterly bulletin, and data analysis and use workshops; however, there is still room for improvement. PMI has spearheaded a change in the HMIS reporting forms to address some of these issues affecting the quality of data.

Figure 7. Outpatient Department – National Malaria Burden in Uganda, 2013-2015*



*Includes both confirmed and non-confirmed cases.

Randomized Control Trial on Dihydroartemisinin–Piperaquine (DP) for the Prevention of Malaria in Pregnancy:
Intermittent treatment with sulfadoxine-pyrimethamine (SP) is widely recommended for the prevention of malaria in pregnant women in Africa. However, with the spread of resistance to SP, alternative drugs may be needed in some settings. A study was undertaken in 2014 in Tororo district in Uganda, an area of high SP resistance, to compare the efficacy and safety of three IPTp regimens (SP, a three-dose regimen of DP, and monthly DP). The study found that "the burden of malaria in pregnancy was significantly lower among adolescent girls or women who received intermittent preventive treatment with dihydroartemisinin–piperaquine than among those who received sulfadoxine–pyrimethamine, and monthly treatment with dihydroartemisinin–piperaquine was superior to three-dose dihydroartemisinin–piperaquine with regard to several outcomes." The use of a higher dosing frequency of DP (every 4 weeks starting as early as 16 weeks of gestation) provided more protection, which is in line with updated WHO policy recommendations that IPTp should be given at every antenatal clinic visit if visits are at least one month apart. It is important to note that the more frequently dosed DP regimen was also started earlier, which may have contributed to the improved outcomes. Additional and larger evaluations in

different settings are needed to inform important questions regarding safety and the potential risks for selection of drug-resistant parasites as a result of an increase in drug pressure.[5]

Integrated community case management study:
Malaria Consortium carried out a cluster randomized household survey to evaluate the implementation of iCCM for malaria, pneumonia, diarrhea, and maternal and newborn health in eight districts of central Uganda in March 2013 with results made available in 2015/2016. It was found that the proportion of children under five with a fever who were treated the same day with an ACT improved from 19.4% at baseline to 44.7% at endline. In the intervention area, timeliness of treatment for fever and acute respiratory illness increased significantly higher in the intervention area than in the comparison area.[6]

Community Transport Referral System:
Malaria Consortium conducted a qualitative evaluation of the *Community Transport Referral System* in two health sub-districts in Mbale District, Uganda in June 2015. The study examined the extent to which the community transport referral system, which used local motorcycles to transport patients from the community to the health facility, has improved communities' access to health services for the management of severe malaria among children under-five and pregnant mothers. Key results include that treatment seeking within 24 hours of onset of fever improved from 42% at baseline to 61% at end line and of all children under five with severe malaria who sought treatment, the proportion that received treatment within 24 hours of onset of fever significantly improved from 48% to 70%. It was found that the community transport referral system has been a feasible and an acceptable innovation that is highly recommended because of its positive outcomes on the quality of life for the people of the two study areas. If it can be sustained, it could go a long way to improve child and maternal health outcomes.[7]

Effects of Deltamethrin Exposure on Pyrethroid Resistant Mosquitoes:
Malaria Consortium implemented a study in mid-western Uganda from 2013-2014 to investigate whether exposure to deltamethrin affects the development of *Plasmodium falciparum* inside wild, pyrethroid resistant *Anopheles gambiae* s.s. mosquitoes. The use of ITNs treated with pyrethroid insecticides has contributed to the prevention of millions of deaths due to malaria, but resistance to these insecticides is spreading rapidly in African malaria mosquitoes. The study showed that, with locally-sampled *P. falciparum* parasites and *An. gambiae* s.s. mosquitoes, doses of pyrethroids that are sub-lethal for resistant mosquitoes can interfere with parasite development, significantly reducing both the proportion of infected mosquitoes and the intensity of infection. This mechanism could enable pyrethroid-treated nets to prevent malaria transmission despite increasing vector resistance.[8]

Malaria program management review:
DFID's 2014 annual program management review showed that over 90% of the population had received ITNs by the end of the UCC. These results were confirmed by the findings of the 2014 MIS. Review of the malaria control program indicated that IRS implementation started late in 2014 and there were some management challenges at the beginning of the program. By June 2015, 184,638 households had been

[5] Abel Kakuru et al. 2016. Dihydroartemisinin–Piperaquine for the Prevention of Malaria in Pregnancy, N Engl J Med 2016;374:928-39
[6] Mubiru et al. 2015.Evaluation of Integrated Community Case Management in Eight Districts of Central Uganda, PLOS ONE | DOI:10.1371/journal.pone.0134767,August 12, 2015
[7] Malaria Consortium, Mbale Malaria Control Project, Uganda, Final Report, June 2015, under review
[8] Kristan et al. Parasites & Vectors (2016) 9:100 DOI 10.1186/s13071-016-1384-x, Exposure to deltamethrin affects development of Plasmodium falciparum inside wild pyrethroid resistant Anopheles gambiae s.s. mosquitoes in Uganda.

sprayed with DFID support in five districts. The review highlighted the need for concerted SBCC efforts after the UCC, with increased focus on interpersonal communication to ensure utilization and proper care of ITNs. In addition, the review called for a clear distribution plan that targets the poorest and most vulnerable for additional ITNs bought with DFID support. The review also mentioned a need for the development of clear selection criteria for VHTs to be trained in iCCM, possibly using a weighting system to prioritize those from rural sub-counties. In addition, there is need to institute measures to improve data quality and record-keeping by VHTs through focused supervision. These recommendations were further echoed in the MoH VHT assessment report and MoH's policy dialogue to consider changing VHTs to paid Community Health Extention Workers (CHEWs). If the MOH adopts these recommendations and deploys CHEWs, PMI will support training, supervision and other support activities in targeted areas.

III. OPERATIONAL PLAN

PMI supports all elements of the NMCP's national malaria strategy, with the exception of larviciding and environmental management.

1. Vector monitoring and control

NMCP/PMI objectives
IRS and ITNs are proven interventions and key components of the UMRSP. Both interventions rely heavily on monitoring entomological indices to assess progress and inform implementation. Vector biting can be impacted by IRS and ITN use, so it is highly important to monitor vector behavior with respect to indoor resting densities, place and time of biting, species composition, and the insecticide resistance status of mosquitoes as they become subjected to insecticide selection pressure presented by IRS and ITNs.

The UMRSP objective for vector control is to achieve and sustain protection of at least 85% of the population at risk through recommended malaria prevention measures (ITNs, IRS, and larval source management) by 2017. The UMRSP recommends that IRS coupled with routine entomological monitoring and vector susceptibility studies be scaled-up in a phased and contiguous manner in 50 districts with the highest transmission rates.

The UMRSP objective for nets is to maintain universal access to long-lasting ITNs in all transmission settings and control stages, resulting in a minimum of 85% of households with at least one long-lasting ITN for every two persons. Universal coverage is to be maintained through a continuous distribution system that employs a range of delivery channels, including: 1) free ITN distribution through ANC and EPI clinics, 2) free ITN distribution using schools as facility outreach distribution points for vulnerable populations in hard-to-reach areas, 3) sale of subsidized ITNs through the private sector (social marketing), and 4) commercial sale of ITNs at full cost. Despite the multiple continuous distribution channels proposed, selected schools, social marketing, and commercial sales have not been operational to date; distribution so far has been limited to mass campaign and ANC/EPI clinics.

a. Entomologic monitoring and insecticide resistance management

Progress since PMI was launched
PMI-supported IRS began in 2006, the year after PMI was launched, on a small scale in southwest Uganda. Monitoring of insecticide decay rates, human landing catch (HLC) counts indoors and outdoors, biting activity, pyrethrum spray catch (PSC) counts, species determination, and insecticide resistance monitoring began in earnest in 2007 as IRS transitioned to a block of ten districts in the Northern region that were experiencing the highest prevalence of malaria nationwide. Six eco-epidemiological zones from around Uganda began receiving biennial susceptibility monitoring to four classes of WHO-recommended IRS insecticides in 2009. Within the IRS operational area, an additional four districts received annual insecticide monitoring to closely monitor the impact of IRS on resistance and to alert NMCP of emerging problems so as to manage resistance through rotation. CDC bottle intensity bioassays and oxidase enzyme testing for resistance mechanisms began in these four sites in late 2014. Bionomics monitoring has been conducted at a single site in each of four districts: one district which has never received IRS, two currently implementing IRS, and one former IRS district.

Progress during the last 12–18 months

During the past year, PMI supported robust vector monitoring activities, including IRS wall bioassays to check for IRS quality and to monitor decay rates, PSCs to monitor indoor mosquito densities, and HLCs to check for indoor/outdoor biting activity and species composition. In addition, PMI supported light trap captures, insecticide susceptibility bioassays (at selected national and IRS zone sites) to determine the resistance status and intensities to selected insecticides, and testing for detoxification mechanisms. An overview of the locations and timing of PMI-supported entomological monitoring activities is found in Table 2 below.

Table 2. PMI-funded entomological monitoring, 2015

Activity	Location	Frequency
Bionomics monitoring[1]	Tororo (IRS)	Monthly
	Lira (IRS)	Monthly
	Apac (former IRS)	Monthly
	Soroti (never sprayed)	Monthly
Resistance monitoring in IRS areas	Tororo*, Lira, Soroti, Apac*	Yearly
Resistance monitoring nationally + intensity assays	Apac*, Hoima, Kanungu, Kitgum, Tororo*, Wakiso	Yearly
Insecticide quality assurance (QA)	All PMI-supported IRS districts	Yearly (2-3 weeks after IRS)
Decay rate monitoring	Kaberamaido, Lira, Pallisa, Tororo	Monthly

[1]Includes HLC, PSC, light trap collections, nightly (hourly) bite activity

*Indicates districts that overlap with "IRS zone" and national resistance monitoring surveys.

Entomologic Monitoring in IRS Areas:

a) Post-IRS wall bioassays

Post-IRS wall bioassays are conducted in each of the nine PMI-funded IRS districts 2-3 weeks after IRS to determine the quality of spraying. PMI supported 27 cone tests in both April and May 2015 in three sentinel sites in Kaberamaido, Lira, and Tororo Districts to assess the quality of bendiocarb IRS in those areas. In each district, all of the mosquitoes exposed to the different wall surfaces died after the 24-hour holding period, indicating effective spraying. In June 2015, a total of 63 cone tests in Bugiri, Butaleja, Kibuku, Namutumba, Pallisa, and Serere Districts were conducted on surfaces sprayed with bendiocarb. All of the mosquitoes exposed to all wall surface types (plastered painted, plain brick, mud, and wattle) were knocked down 20–60 minutes post-exposure. All of the mosquitoes exposed to the three wall surfaces in the six study districts died after the 24-hour holding period, indicating that the spraying was effective in these districts as well.

b) Pyrethrum Spray Catches

In June 2015, a total of 84 post-IRS PSCs were conducted in seven of the nine PMI-funded districts in the southeast. A sample of 12 houses was selected in each of the sentinel sites in each district where PSCs were conducted. A total of 130 indoor resting female vectors were caught (127 female *Anopheles gambiae* s.l. and 3 female *An. funestus*, 130/84 = mean of 1.5 mosquitoes per PSC), compared to 1,925 caught during the pre-IRS PSCs (1,925/84 = mean of 22.9 mosquitoes per PSC), indicating very

successful results with carbamate IRS and good spray coverage. A total of 36 unfed female *Anopheles gambiae s.l.* were dissected, 18 (50%) were parous, i.e., had taken a blood meal at least once and could have transmitted malaria, while none of the three unfed female *Anopheles funestus* examined were parous.

c) Insecticide decay rate monitoring

Bendiocarb decay rates were monitored on three different wall surface types to determine the longevity of the insecticide in four districts (Kaberamaido, Lira, Pallisa, and Tororo). Results showed high efficacy three months after spraying occurred, killing 100% of susceptible *An. gambiae* exposed to bendiocarb-treated plaster painted, plain brick, and mud and wattle walls. Additional data for subsequent months is being analyzed.

d) Bionomics monitoring

Bionomics monitoring, which included HLCs, PSCs, and light trap captures occurred in two sites in each of four districts. Surveillance districts included Lira and Tororo (active IRS), Soroti (never received IRS), and Apac (IRS withdrawn in 2014). Determinations were made as to indoor/outdoor biting activity, hours of activity, and species involved with malaria transmission. Pyrethrum spray catches are continuing at single sites in six northern districts to monitor indoor mosquito densities after withdrawal of IRS. This monitoring will continue through September 2016, approximately two years after the last northern districts were sprayed.

e) Susceptibility monitoring

Additional insecticide resistance monitoring in PMI's IRS areas occurred this past year to gain a reliable understanding of the resistance status of malaria vectors, including possible changes in their status, to inform NMCP and PMI of potential problems in a timely fashion, and to plan for future insecticide rotations. Districts monitored include two IRS districts (Tororo and Lira), one withdrawn district (Apac), and one never sprayed district (Soroti). Data indicated that mosquitoes are still fully susceptible to pirimiphos-methyl, the insecticide selected for use for the first time in the 2016 IRS campaign.

Additional Entomologic Monitoring:

a) National susceptibility surveys

PMI has supported comprehensive vector resistance monitoring in six different eco-epidemiological zones throughout Uganda biennially. Beginning in 2015, yearly surveys were planned in the six districts (Apac, Hoima, Kanungu, Kitgum, Tororo, Wakiso). The last survey occurred in September 2015 with the next one scheduled for September/October 2016. A decision was reached by NMCP and PMI to add two districts to the survey in unmonitored regions in the West Nile sub-region in the northwest and the Eastern region above Mbale District to gain a more comprehensive understanding of the extent of pyrethroid resistance in the country. Four zones will be monitored per year and alternated annually; each survey will be expanded from two weeks to three weeks to enable better quality testing with a wider array of insecticides while easing the manpower and logistical burden associated with surveying six zones every year in two weeks. Shifting weather patterns resulted in delayed rains in September 2015, which greatly hampered resistance testing; only three of six districts were assayed due to low/no rainfall in the affected zones. In addition, resistance intensity and synergist monitoring will be performed at each site. Survey results from 2013 and 2015 are shown in Table 3. Future testing will report *An. gambiae* or *An. arabiensis* when an in-country mechanism is developed to identify *An. gambiae* s.l. with PCR.

Table 3. Results of the 2013 and 2015 national susceptibility surveys of *Anopheles gambiae* s.l. against four classes of selected insecticides from six test zones around Uganda (mortality range)*

Insecticide	Year	Sites surveyed	# sites resistant, mortality <90% (%)	# suspected resistance, 90-97% (%)	# sites susceptible, ≥98%
Deltamethrin[1]	2013	6/6	6/6 (18-82)	0/6	0/6
Permethrin[1]	2013	4/6	4/4 (24-85)	0/4	0/4
Lambdacyhalothrin[1]	2013	4/6	4/4 (21-56)	0/4	0/4
DDT[2]	2013	6/6	5/6 (10-81)	1/6 (95)	0/6
Bendiocarb[3]	2013	6/6	1/6 (85)	2/6 (94,95)	3/6
Pirimiphos-methyl[4]	2013	6/6	0/6	0/6	6/6
Deltamethrin[1]	2015**	3/6	3/6 (51-73)	0/3	0/3
Permethrin[1]	2015	3/6	3/6 (4-40)	0/3	0/3
Lambdacyhalothrin[1]	2015	1/6	1/6 (9)	0/6	0/6
Alphacypermethrin[1]	2015	1/6	1/6 (33)	0/6	0/6
DDT[2]	2015	1/6	1/6 (77)	0/6	0/6
Bendiocarb[3]	2015	2/6	0/6	1/6 (95)	1/6
Pirimiphos-methyl[4]	2015	2/6	0/6	0/6	2/6

Insecticide classes: 1 = pyrethroid, 2 = organochlorine, 3 = carbamate, 4 = organophosphate

*Includes testing of adults reared from field-collected larvae

**3 of 6 zones tested in 2015 due to delayed rains and a lack of mosquitoes; surveyed zones included Apac, Kanungu, and Wakiso

b) Advanced entomologic monitoring

PMI conducted oxidase enzyme testing beginning in 2014 (Table 4). CDC bottle synergist bioassays using piperonyl butoxide (PBO) increased the mortality of *An. gambiae* in six districts *and An. funestus* in Apac District. These tests demonstrated the presence of oxidase activity in detoxification of pyrethroid insecticide.

Analysis of intensity bioassays conducted by PMI in 2015 show some resistance to high intensity (5x, 10x) insecticide dosing of *An. gambiae* to permethrin (5x: 19% survival; 10x: 14% survival) and deltamethrin (5x: 8% survival) in Tororo District. In Kanungu District, 17% of *An. gambiae* s.l. were found to survive permethrin at a 5x dose and 3% at a 10x dose while 11% survived exposure to a 5x dose of deltamethrin. Both insecticides are used on ITNs and the operational impact of high-intensity resistance on the effectiveness of ITNs to protect users has yet to be determined. Intensity assay results are shown below (Table 5).

Table 4. Results of synergist bioassays for mechanism testing of oxidase enzyme activity at selected sites, 2014 and 2015

Insecticide	Year	Site surveyed	Species	% mortality to insecticide and (insecticide + PBO)
Deltamethrin	2014	Lira	*An. funestus*	63 (100)
Deltamethrin	2014	Tororo	*An. gam.* s.l.	18 (98)
Permethrin	2015	Wakiso	*An. gam.* s.l.	40 (100)
Deltamethrin	2015	Wakiso	*An. gam.* s.l.	73 (100)
Permethrin	2015	Apac*	*An. gam.* s.l.	43 (79)
Permethrin	2015	Apac	*An. funestus*	4 (77)
Permethrin	2015	Kanungu	*An. gam.* s.l.	23 (84)
Deltamethrin	2015	Kanungu	*An. gam.* s.l.	51 (96)
Deltamethrin	2015	Soroti*	*An. gam.* s.l.	84 (100)
Deltamethrin	2015	Lira*	*An. gam.* s.l.	64 (100)
Deltamethrin	2015	Lira*	*An. gam.* s.l.	45 (95)
Permethrin	2015	Tororo	*An. gam.* s.l.	67 (99)
Deltamethrin	2015	Tororo	*An. gam.* s.l.	78 (98)

*Less than 100 mosquitoes tested

Table 5. CDC intensity bioassay showing percent survival of *An. gambiae* s.l. (Hoima, Kanungu, Kitgum, Tororo, and Wakiso Districts) and *An. funestus* (Apac District) exposed to permethrin and deltamethrin at different doses, September 2015

DISTRICT	INSECTICIDE	CDC Intensity Bioassay Doses*			
		1X	2X	5X	10X
Apac	Permethrin	44	24	11	0
	Deltamethrin	37	20	10	0
Hoima	Permethrin	52	14	5	0
Kanungu	Permethrin	81	68	17	3
	Deltamethrin	24	17	11	0
Kitgum	Deltamethrin	10	10	0	0
Wakiso	Permethrin	20	8	4	0
	Deltamethrin	12	4	0	0
Tororo	Permethrin	92	36	19	14
	Deltamethrin	22	12	8	0

*1X = diagnostic dose (DD), 2X = twice DD, 5X = five times DD, 10X = ten times DD (results taken at 30 min)

Plans and justification
PMI will continue to monitor malaria mosquito indoor and outdoor biting activity, time of feeding, indoor density, and species composition at one site in each of four districts associated with IRS (one non-IRS, two IRS, and one former IRS). Techniques including PSCs, light traps, and HLCs will occur monthly. PMI will seek an in-country collaborator to provide polymerase chain reaction (PCR)-based speciation and to survey for the presence and frequency of *kdr* resistance.

PMI will add two sites, one in northwest Uganda (Arua District, West Nile sub-region) and the other in eastern Uganda (Katakwi District, Eastern sub-region) to the six eco-epidemiological zones being monitored nationwide for insecticide resistance monitoring in Uganda. The addition of these sites is in response to a NMCP request to obtain more geographically representative data, thus providing a more comprehensive understanding of the extent of insecticide resistance in Uganda. These surveys will be altered yearly, four zones one year and the other four the next. Intensity and resistance mechanism testing will occur at all sites. Monitoring time will be increased from two to three weeks to allow adequate time to gather sufficient numbers of mosquitoes to maximize information gathering.

In addition, the four IRS zone districts (Tororo, Lira, Soroti, Apac) will be surveyed for resistance to an organophosphate, a carbamate, DDT, and three pyrethroid insecticides once a year. PMI will include resistance testing of new insecticides that may be recommended for use in IRS in the future. Intensity and resistance mechanism testing will be added to each site. Four IRS districts (Kaberamaido, Lira, Pallisa, and Tororo) will include monthly decay rate monitoring with laboratory susceptible mosquitoes on three types of wall surface until the mortality falls below 80% for two consecutive months.

Proposed activities with FY 2017 funding: ($600,000)
- **Entomological surveillance and monitoring**: Monitor malaria mosquito bionomics in each of four districts, one former IRS, one non-IRS and two IRS districts to include PSCs, light traps, and HLCs monthly. Monitor IRS insecticide decay rates in four IRS districts. Sub-sample mosquitoes for PCR identification to species for resistance-tested mosquitoes and those collected in bionomics studies. ($200,000)
- **Insecticide resistance monitoring**: Alternate yearly monitoring of four of eight eco-epidemiological zones for three weeks per year to test for insecticide resistance to WHO-recommended IRS insecticides. Include intensity and resistance mechanism testing. Monitor four IRS zone districts to four classes of insecticide along with resistance mechanism and intensity testing of pyrethroid insecticides once a year. ($400,000)

b. Insecticide-treated nets

Progress since PMI was launched
There was a strategic shift in Uganda in 2012 from targeted mass ITN distribution campaigns (focused on pregnant women and children under five) to UCCs where one ITN is distributed for every two persons. Uganda completed its first UCC in 2014 and plans to repeat a UCC every three years, with the next campaign taking place in 2016/2017.

Since 2006, PMI has procured 14,144,213 and distributed 12,247,177 ITNs. Distribution has mainly occurred through the UCC campaign of 2013/14 (7,050,000 ITNs, inclusive of DFID ITNs) and also to pregnant women and children under five years of age through targeted mass net distribution campaigns, and ANC/EPI clinics (5,197,177 ITNs). There has also been limited distribution by non-governmental

organizations (NGOs), civil service organizations, TASO, large company corporate social responsibility programs, and private donations as well. PMI has also supported SBCC efforts to increase demand for and promote correct and consistent use of ITNs. These efforts, combined with ITNs supported by the Global Fund and DFID, have increased the national household ownership and use of ITNs to 90% and 69% respectively (MIS 2014). In 2015, NMCP achieved its target of net ownership (85%) in Uganda. Now it is critical to maintain this achievement, and continue to increase net use.

With support from the Global Fund, PMI, and DFID, a UCC was launched in May 2013 and completed in August 2014. The campaign successfully distributed over 22 million ITNs reaching over 7 million households. The GoU provided security coverage to ensure the nets reached their intended distribution sites from the central, district, and sub-county warehouses, and that ITNs were distributed in a safe and secure manner at each point of distribution.

At the request of the NMCP/MoH and donors (Global Fund, DFID, WHO, and World Vision), PMI led the ITN distribution for the UCC. In this role, PMI mobilized 890 district leaders, 5,933 sub-county leaders, and 16,415 community leaders to provide support for the net distribution. PMI also trained 488 district task force members, 804 sub-county supervisors, and 32,830 VHTs to oversee and undertake the distribution activities. The distribution point approach used during the campaign significantly increased net ownership throughout Uganda.

Progress during the last 12-18 months

In FY 2015, PMI procured 2,427,720 ITNs and distributed 747,320 ITNs through ANC/EPI clinics. Nearly 65,000 of these ITNs were distributed through ANC/EPI and directly to communities in the north affected by the malaria upsurge. In addition to these ITNs procured with USG funds, 388,400 ITNs were procured in FY 2015 for Uganda with a donation from DFID.

In calendar year 2016, 2.1 million ITNs procured by PMI were provided to the Global Fund for distribution in public ANC/EPI facilities in geographic areas that PMI does not reach, highlighting the effective partnership that exists among the two largest donors in Uganda. In addition, 267,000 PMI-procured ITNs were distributed to refugees and Ugandan nationals in settlements nationwide in 2016. Malaria continues to be the leading cause of death amongst people living in refugee-hosting districts in Uganda, underscoring the importance of this contribution to protecting vulnerable populations in Uganda.

As outlined in previous MOPs, PMI planned to support selected schools as facility outreach distribution points for continuous distribution in hard-to-reach areas without a nearby health center, targeting pregnant women and children under five. This channel is currently being operationalized and is expected to be launched in early 2017.

Results from the 2014 MIS show that Uganda has surpassed its net ownership target of 85% of households with at least one ITN. Uganda has also made great progress in ITN use among vulnerable groups, with use among children under five years of age currently at 74% (MIS 2014) compared to 33% in the 2009 MIS.[9] The ITN use among pregnant women has reached 75% compared with 44% in 2009. PMI conducted a qualitative assessment of ITN care and repair in 2014 in two districts in central eastern Uganda. The study recommended that SBCC should continue to emphasize the importance of maintaining net integrity for malaria prevention purposes as well as for maintaining aesthetic appeal,

[9] The President's Malaria Initiative Eighth Annual Report to Congress 2014

and PMI's SBCC activities have been updated to reflect the findings of the study in order to prolong the useful life of nets.[10]

At the end of 2015, PMI began prospective ITN monitoring to determine the survivorship, attrition, and bio-efficacy of nets that were distributed in northern Uganda to assist with the malaria upsurge. Monitoring is being done on two ITN brands in three districts in the north. ITNs were tagged in October of 2015, with initial data collection beginning in March 2016.

A two-phase evaluation of the 2013/2014 UCC was conducted in 2015 assessing the effectiveness, efficiency, and impact of the distribution to inform future campaigns.

impressive decline in malaria incidence is significant. However, the data management, SBCC, and M&E at all levels were not adequately performed. As a result, strengthening these areas will be a key area of focus for the upcoming UCC.

Commodity gap analysis

Table 6. ITN Gap Analysis

Calendar Year	**2016**	**2017**	**2018**
Total targeted population[1]	36,831,040	37,891,774	38,983,057
Continuous Distribution Needs			
Channel #1: ANC[2]	1,841,552	1,894,589	1,949,153
Channel #2: EPI[3]	1,473,242	1,515,671	1,559,322
Channel #3: Facility outreach distribution points[4]	350,000	600,000	600,000
Channel #4: School-based distribution[5]	0	0	175,000
Estimated Total Need for Continuous	3,664,794	4,010,260	4,283,475
Mass Distribution Needs			
2016 mass distribution campaign	22,000,000	0	00
Estimated Total Need for Campaigns	22,000,000	0	0
Total Calculated Need: Routine and Campaign	**25,664,794**	**4,010,260**	**4,283,475**
Partner Contributions			
ITNs carried over from previous year	0	0	0
ITNs from MoH	0	0	0
ITNs from Global Fund (New Funding Model)	12,300,000	500,000[6]	500,000[6]
ITNs from DFID	1,350,000	1,000,000[7]	1,000,000[7]
ITNs from other donors (AMF)[8]	10,700,000	0	0
ITNs planned with PMI funding	1,000,000	1,991,632	1,575,000
Total ITNs Available	**25,350,000**	**3,491,632**	**3,075,000**
Total ITN Surplus (Gap)	**(314,794)**	**(518,628)**	**(1,208,475)**

[10] *It is about how the net looks:* a qualitative study of perceptions and practices related to mosquito net care and repair in two districts in eastern Uganda, Scandurra et al, *Malaria Journal*, 17 December 2014.

Footnotes: [1]Total targeted population is based on the 2014 national census data, adjusted for 2.88% annual population growth. [2]Assuming 5% of the population becomes pregnant. [3]Assuming 4% of the population are children under five years of age.[4]For facility outreach distributions to vulnerable populations in hard-to-reach schools, assuming approximately 3,000 ITNs/school. [5] Traditional school-based distribution of ITNs. [6,7]Exact figures for Global Fund and DFID's contributions in 2017 and 2018 are not yet known, but PMI expects both DFID and GF will contribute 500,000 and 1,000,000 in each year respectively. [8]Against Malaria Foundation is a new partner that is expected to contribute 10.7 million nets to the 2016 UCC.

Plans and justification

PMI plans to support the upcoming 2016/2017 UCC with approximately 1 million ITNs and robust technical assistance to support the planning, implementation and evaluation of the campaign. In total, approximately 22 million ITNs are estimated to be needed to achieve universal coverage, and multiple donors have come forward to meet this need (current projections indicate Global Fund will provide 12.3 million; Against Malaria Foundation (AMF), 10.7 million; PMI, 1 million), however funding gaps remain to support distribution of these ITNs. Included among these planned amounts are several million PBO ITNs, to be provided by AMF. Global stakeholders are working together with the NMCP to determine where best to deploy the PBO nets and how to monitor them.

PMI will continue to support the NMCP in maintaining high ITN ownership and use to stay at the 85% target through routine distribution of 1.6 million ITNs in 2018 through ANC, EPI, use of facility outreach distribution points in hard-to-reach areas, and schools. PMI will pilot traditional school-based distribution of ITNs for the first time in 2018, with plans to expand this distribution method in the future based on the results of the pilot. These ITNs will be targeted to high burden areas with good school enrollment and attendance. Schools will be used to promote consistent and correct use of ITNs at the household level using parent and teachers' associations, teachers, and students as change agents. Lessons learned from school-based distributions in other countries (Tanzania, Nigeria, and Senegal) on training and logistics are being taken into consideration. This complementary method will help to foster a robust continuous distribution system.

With FY 2017 funds, PMI will continue distributing ITNs through a novel "facility outreach distribution" methodology to hard-to-reach vulnerable populations (pregnant women and children under five) using schools. Schools will be selected in hard-to-reach areas where health facilities with ANC/EPI services are not available within the vicinity helping to solve the ANC access problem. Each target school will distribute approximately 3,000 ITNs per year. The schools will serve as ITN continuous distribution points and as a source of advocacy for consistent and correct use of ITNs. PMI will monitor/evaluate these pilots to determine the cost of distribution, the reach of different channels, and important criteria for where to target each channel in order to maintain ITN coverage.

PMI will continue its efforts to increase net usage through community-based SBCC at schools and health facilities, and will support the NMCP to strengthen the Integrated Vector Management (IVM) Thematic Working Group (TWG) to harmonize ITN programs across stakeholders. The existing Global Fund and DFID grants are ending prior to this MOP period. However, it is expected that both donors will continue to provide funds for ITNs in Uganda.

Lastly, the third and final year of durability monitoring of ITNs distributed in the north in 2015 will be supported, however, no additional funding is needed.

Proposed activities with FY 2017 funding: ($6,528,000)

- **Procurement of ITNs:** PMI will procure approximately 1,575,000ITNs for distribution through ANC and EPI clinics (800,000 ITNs), facility outreach distribution points for vulnerable populations (600,000 ITNs), and school-based distribution (175,000 ITNs). Costs include procurement, shipping, transportation, country clearances, and warehousing. ($4,536,000)
- **Mixed distribution of ITNs through multiple outlets:** PMI will support the continuous distribution of 1,096,000 ITNs through ANC and EPI clinics (496,000 ITNs), and facility outreach distribution points for vulnerable populations (600,000 ITNs) to maintain the high net ownership achieved and increase the use of nets by vulnerable groups. This support will be provided in 43 high burden districts. ($1,315,200)
- **School-based ITN distribution:** PMI will pilot school-based distribution of approximately 175,000 ITNs to maintain the high net ownership achieved and increase the use of nets by vulnerable groups. ($312,000)
- **Routine ITN distribution through ANC/EPI:** PMI will support the continuous distribution of approximately 304,000 ITNs through ANC and EPI clinics in five regions (North-Acholi, North-Lango, Eastern, East-Central, and South West). ($364,800)
- **Evaluation of facility outreach distribution points:** PMI will undertake an evaluation of the novel facility outreach distribution approach being piloted in Uganda to ensure it's accomplishing its objectives. *(See M&E section for details on activity and funding)*
- **SBCC on net utilization**: With FY 2017 funds, PMI will support community, school, and health facility level SBCC activities related to ITN care and use. Included among PMI's support will be deployment of targeted messages in IRS areas to ensure a strong net use culture is developed prior to (and maintained after) withdrawal. (*See SBCC section for details on activities and funding*)
- **Monitoring for net attrition, survival, physical integrity, and bioefficacy**: This will be the third and final year for this monitoring activity. ($0)

c. Indoor residual spraying

Progress since PMI was launched

The first IRS pilot project in Uganda began in the 1940's and consisted of spraying urban areas, particularly Kampala, resulting in a dramatic reduction of disease transmission.[11] IRS using DDT was conducted in Kigezi District in southwest Uganda from 1959-1961 and was highly successful in reducing transmission but unfortunately, IRS was only sporadically used through the 1960's.[12] In 2006, PMI supported a large-scale IRS program in the epidemic-prone southwestern highland district of Kabale and achieved good coverage and impact results. The following year, PMI shifted operations to Kabale's high-risk sub-counties and extended support to the neighboring district of Kanungu and northern districts (Lamwo, Kitgum, Padar, Agago, Gulu, Amuru, and Nwoya) to protect large populations of internally displaced persons.

From 2009 through 2014, PMI supported blanket IRS in the ten northern districts of Kitgum, Agago, Lamwo, Pader, Amuru, Nwoya, Gulu, Oyam, Kole, and Apac, achieving consistently high coverage

[11] WHO Regional Office for Africa. 2007. Implementation of Indoor Residual Spraying of Insecticides for Malaria Control in the WHO African Region Report. Vector Biology and Control Unit Division of Healthy Environments and Sustainable Development.

[12]The economic effects of malaria eradication: Evidence of an intervention in Uganda. 2011. Barofsky et al. Program on the Global Demography of Aging. PDGA Working Paper No. 70, Harvard.

(above 90%). IRS transitioned to carbamate insecticides in mid-2010 due to the emergence of widespread pyrethroid resistance. Resistance to carbamate insecticides was detected in one site and suspected resistance was found in another two sites during the 2013 national susceptibility survey, prompting a change to an organophosphate insecticide for the 2016 spray season.

Data from PMI-supported reference centers and HMIS (2010–2014) showed a strong downward trend of malaria cases in PMI's original ten northern IRS districts at the time of IRS transition. As further evidence of the impact of IRS in Uganda, the 2011 anemia and parasitemia survey comparing IRS to non-IRS districts showed significant improvements in both parasitemia (45% reduction) and anemia (32% reduction) in the IRS districts.[13]

PMI works with the NMCP to review and develop national malaria surveillance and control strategies and supports an IVM TWG tasked with improving IRS efforts in Uganda.

Progress during the last 12–18 months

In 2015, PMI transitioned to nine new IRS districts to the southeast (Lira, Tororo, Butaleja, Namutumba, Kibuku, Budaka, Pallisa, Bugiri, and Serere). Each district was blanket sprayed twice in 2015 with a carbamate insecticide (bendiocarb) covering 829,335 houses and protecting 2,913,304 people. The first spray round for the new districts occurred in two phases, and while low coverage was experienced in the first phase (December 2014–February 2015), coverage improved dramatically in the second phase. The initial low coverage was driven by strong resistance in several new districts due to interference from local politicians, certain religious sects, insufficient time to complete community mobilization, and resistance from a few organic farmers. Having learned first-hand of the benefits gained from receiving IRS, opposition to IRS in the new districts vanished and coverage during the second phase of 2015 increased to 97.4% of targeted structures.

A summary of the PMI-supported IRS campaigns is shown in Table 7. In addition, DFID funding in 2015 supported IRS operations in five contiguous districts (Alebtong, Dokolo, Amolatar, Kaberamaido, and Otuke) covering 301,293 houses and protecting 824,825 people. DFID will continue to support IRS in these same districts in 2016 and 2017. In addition, in 2015 the NMCP planned to spray two districts (Kumi and Ngora) contiguous with PMI-supported IRS districts with one round of carbamate IRS. The Kumi operation sprayed 63,894 houses at a coverage rate of 99.7% protecting 194,359 people, however, Ngora was not sprayed due to resource and logistical constraints. Total PMI-, DFID- and NMCP-supported IRS covered 1,194,522 houses and protected 3,932,488 people from malaria in 2015 (more than 10% of the total population).

PMI and NMCP decided to transition to new southeast districts after 2013/2014 HMIS data revealed a reduction of malaria cases in the Mid-North sub-region of 66% from 2008/2009 levels. In addition, the 2014 MIS showed that parasitemia in the 15 mid-north districts decreased from 63% in 2009 to 20% in 2014, a reduction of 68%. In the ten former IRS districts of the Mid-North sub-region, parasitemia was reduced to 7%. The new southeastern IRS districts were shown to have a prevalence of 36%, nearly twice the national average; this will serve as the baseline for the next MIS in 2018 after they have received several rounds of IRS. A UCC with ITNs was completed in August 2014 and results from the 2014 MIS indicated high ITN coverage (90%) and use (69%) nationally.

[13] Steinhardt LC, Adoke Y, Nasr S, Wiegand RE, Rubahika D, Serwanga A, Wanzira H, Lavoy G, Kamya M, Dorsey G, Filler S: The effect of indoor residual spraying on malaria and anaemia in a high transmission area of northern Uganda. Am Trop Med Hyg 2013, 88:855-861 doi:10.4269/ajtmh.12-0747.

The UCC coupled with SBCC for consistent and correct use of ITNs and adequate stocks of ACTs in the withdrawn IRS districts was expected to enable this area to maintain the low levels of parasitemia achieved at the end of the IRS period. Unfortunately, Uganda witnessed a resurgence of malaria cases in all former IRS districts and throughout the country in general. Fifty of Uganda's 112 districts averaged an 80% increase in malaria admissions during the April–June high transmission season of 2015 compared to the same quarter (averaged) from 2012–2014 (data retrieved from DHIS2). Twenty-six districts in total experienced epidemics (defined as at least one month in 2015 over the mean +1 standard deviation compared to previous years; preliminary CDC analysis). In response to the resurgence, NMCP with support from PMI provided 300,000 doses of ACTs with directly observed therapy as over 8,000 VHTs surveyed for fever cases in house-to-house inspections in NMCP-selected hotspot subcounties in the former IRS districts. VHTs passed additional information about proper ITN use, MIP, and early diagnosis and treatment to residents. Additional ITNs (34,000) were also provided to the area to help increase coverage. NMCP with Global Fund support is considering a single round of organophosphate IRS in these ten districts later in 2016.

Table 7. PMI-supported IRS activities 2006 – 2018

Calendar Year	Number of Districts Sprayed	Insecticide Used	Number of Structures Sprayed	Coverage Rate	Population Protected
2006	1	Pyrethroid	103,329	96%	488,500
2007	5	Pyrethroid	446,117	98%	1,866,000
2008	6	DDT, Pyrethroid	416,452	93%	1,545,000
2009	6	Pyrethroid	850,000	95%	3,000,000
2010	10	Pyrethroid,	847,469	99%	2,679,000
2011	10	Carbamate	885,716	99%	2,805,000
2012	10	Carbamate	765,661	90%	2,338,000
2013	10	Carbamate	870,943	97%	2,582,000
2014	10	Carbamate	844,576	90%	2,532,000
2015	9	Carbamate	829,335	97.4%	2,913,304
2016[1]	9	Organophosphate	850,000	95%+	3,000,000
2017[2]	11	Organophosphate	TBD	95%+	TBD
2018[2]	11	Organophosphate	TBD	95%+	TBD

[1]Based on 2016 work plan targets; current campaign is ongoing.
[2] Projected targets based on national strategic plan and/or discussions with NMCP and proposed support from UNITAID.

The PMI-funded insectary in Gulu provides insecticide susceptible Kisumu strain *An. gambiae* mosquitoes for QA testing of spray operations and to determine the longevity of IRS-sprayed insecticides. The facility is used to rear field-collected mosquito larvae for adult identification and as a training space for Gulu University and MoH personnel for mosquito identification, bioassay training for resistance detection in malaria mosquitoes (WHO and CDC bottle bioassay), and for testing field-caught mosquitoes for insecticide susceptibility. An insectary in Tororo District was supported by PMI to produce susceptible Kisumu strain *An. gambiae* mosquitoes for southeastern IRS operations in 2015, while providing mosquitoes for IRS QA testing of sprayed surfaces for several northern districts, reducing the logistical burden of support from Gulu. To further facilitate IRS QA testing and insecticide

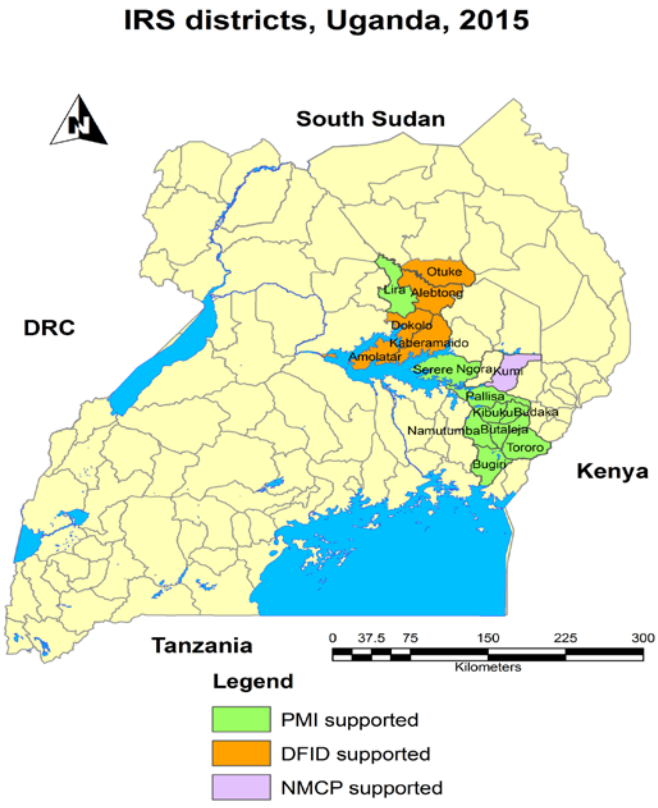
longevity investigations in southeastern Uganda, PMI is developing a new insectary near field headquarters in Tororo; however, this insectary is not yet functioning. The MoH's vector control division in Kampala also supplies susceptible *An. gambiae* mosquitoes for IRS QA checks and for monitoring of insecticide decay rates in IRS-sprayed houses. PMI is also working closely with the existing IRS districts to develop a transition strategy to prepare for the undetermined time when IRS is withdrawn. This district-led planning is using lessons learned from the 2015 resurgence.

Plans and justification

With FY 2017 funds, PMI will continue to support the NMCP to implement IRS in 9 eastern districts in Uganda, targeting approximately 850,000 structures and 3 million people to further drive down parasitemia rates. The current DFID support for five districts will finish after the 2017 spray round; it is unclear if DFID support for IRS will continue past 2017. Geographically, PMI-, DFID- and NMCP-funded districts connect Lira and Tororo which make a northwestern to southeastern transect forming an IRS corridor targeting high burden districts (Figure 8).

In an effort to mitigate insecticide resistance in Uganda, PMI is participating in the UNITAID-sponsored Next Generation Indoor Residual Spraying (NGenIRS) Project. Uganda has been proposed as a country for the UNITAID-funded NgenIRS Project in 2017. This market intervention project includes a short term co-payment to accelerate the reduction of price for long-lasting insecticides. The price reduction will enable Uganda to expand coverage of long-lasting IRS to another two districts in 2017 and 2018, bringing the number of PMI-supported IRS districts to 11. Two districts contiguous to the present IRS zone will be chosen based on NMCP input. Participation in the NGenIRS Project confirms Uganda's commitment to expand coverage.

Figure 8. Map showing PMI-, DFID-, and NMCP-funded IRS operations in the Mid-North Sub-Region and the Eastern Region of Uganda



Proposed activities with FY 2017 funding: ($12,132,000)

- **Support IRS**: PMI will continue IRS for a third year in nine eastern districts. PMI plans to use a long-lasting organophosphate to which *An. gambiae* s.l. is completely susceptible in all areas of Uganda, however final insecticide selection will be based on the latest susceptibility data and available insecticide options. If selected for the NgenIRS project, PMI will leverage UNITAID subsidies to offset insecticide costs and add two IRS districts with these savings, bringing IRS to a total of 11 districts. Cost includes all components of IRS: insecticide procurement, IRS equipment and supplies, logistics, environmental assessments, QA monitoring, and SBCC activities specific to IRS. ($12,073,000)
- **Environmental compliance monitoring:** External environmental compliance visit, conducted every other year. ($30,000)
- **Two TDYs from CDC/Atlanta**: CDC entomology staff will provide technical support for planning and monitoring IRS activities. Support includes testing and training for resistance mechanisms and resistance intensity in *An. gambiae* and *An. funestus*, training in CDC bottle assays, bionomics studies in IRS and former IRS districts, and mosquito surveillance and resistance training to MoH personnel. ($29,000)

2. Malaria in pregnancy

NMCP/PMI objectives

The objectives of the NMCP/PMI for the prevention of MIP are to:

- Ensure every pregnant woman sleeps under an ITN throughout her pregnancy and thereafter.
- Ensure pregnant women receive early diagnosis and prompt management of malaria episodes with an appropriate antimalarial medicine.
- Ensure pregnant women receive a minimum of three IPTp doses.

The recently updated MIP policy now calls for pregnant women to receive IPTp at every ANC visit, at least one month apart up to the time of delivery with the first dose starting at the beginning of the second trimester. The MoH's Reproductive Health Division (RHD) also recommends that women with a normal pregnancy make at least four visits to an ANC clinic prior to delivery and promotes the intake of IPTp, iron, and folic acid supplements among pregnant women according to the newly updated policy and guideline.

With PMI's support, Uganda's national policy has already aligned to the new WHO guidance that IPTp should be given at every scheduled ANC visit beginning with the second trimester, with doses administered at least one month apart.[14] In addition, the policy states that folic acid at a daily dose equal or above 5mg should not be given together with SP as this counteracts its efficacy as an antimalarial. In spite of all partners' efforts, this new policy, which includes revised daily iron (30-60mg) and folic acid (0.4mg) dosages, has not yet been fully implemented in Uganda. The delay in implementation is due to a lack of funding for the dissemination of the updated policy to districts, and issues with the procurement of the newly recommended doses of folic acid and iron supplements.

[14]Updated WHO Policy Recommendation (October 2012); Intermittent Preventive Treatment of malaria in pregnancy using Sulfadoxine-Pyrimethamine (IPTp-SP)

The 2014 midterm review reported the need for full integration of the IPTp program within the RHD, leaving the NMCP responsible for providing technical assistance to the RHD. The NMCP will train health workers on IPTp, ensure that the delivery of IPTp services at health facilities follows DOT, provide supportive supervision, and implement M&E, operational research (OR), and SBCC campaigns related to MIP at the community level. A policy for community level IPTp has not yet been developed. Village Health Teams, which work at the community level, can be used to mobilize pregnant women to attend ANC clinics early in their pregnancy. The RHD is now responsible for IPTp implementation, and activities are integrated within the focused antenatal care (FANC) policy and procedures. With partners including PMI support, a well-functioning national MIP TWG, which includes the RHD and all MIP stakeholders meets regularly to coordinate and discuss all MIP-related issues in the country. The TWG forum has helped partners to come together to address the challenges of MIP implementation in Uganda, share information, and propose solutions.

Progress since PMI was launched

In Uganda, malaria infection in pregnancy is a major threat to the lives of mothers, fetuses, and infants. In line with WHO guidelines, PMI supports a three-pronged approach to reducing malaria in pregnancy: 1) provision and promotion of ITN use, 2) administration of IPTp, and 3) prompt diagnosis and appropriate treatment of malaria and anemia.

PMI supported strengthening and expanding preventive activities for malaria in pregnancy as part of a partnership among NMCP, RHD and maternal and child health programs. PMI supported NMCP and RHD to strengthen the ANC delivery platform to fully implement SBCC activities to improve the uptake of IPTp and ITNs by pregnant women, and for early diagnosis and treatment when they are febrile, along with the implementation of supportive supervision.

Since 2006, PMI has supported the development of a comprehensive MIP training module that was incorporated into the FANC training. PMI has also supported training and on-the-job supervision of 16,609 health workers on IPTp. Additionally, PMI has provided job aids such as pregnancy wall charts and gestational wheels in all facilities providing antenatal care, and supported the adoption of a MoH nationwide advocacy plan for IPTp. PMI has purchased and distributed 171,033 and 107,270 SP treatments, respectively, since the start of PMI for use in PNFP facilities. The GoU has taken over responsibility for supplying SP to all health facilities in the country for IPTp, however some stockouts have been cited, therefore, PMI will consider supplying SP as a short-term solution in limited areas in 2016 while continuing to advocate that the GoU ensure full availability of this commodity in the future in order to ensure IPTp efforts are successful.

In collaboration with PEPFAR, PMI has focused on integrating IPTp services with prevention of mother-to-child transmission (PMTCT) and extended this support to private health facilities. PMI continued to provide safe water and drinking cups for DOT. Antenatal attendance by pregnant women in Uganda was high, according to the 2011 DHS results, which showed that 94% of pregnant women made at least one ANC visit, and 48% made four or more visits. However, only 21% of women made their first ANC visit before the fourth month of pregnancy, highlighting the missed opportunity to administer IPTp early in pregnancy. The 2014/2015 MIS revealed that the IPTp2 uptake nationally increased from 25% (DHS 2011) to 45%. Even though the progress made is significant, with an increase of 20 percentage points within three years, this still falls well short of the PMI target of 85%. In addition, IPTp3 coverage in Uganda is low, recorded at 25% in the 2014/2015 MIS. In addition, the 2014/2015 MIS showed that ITN use among pregnant women in Uganda is very encouraging; 75% of pregnant women slept under an ITN the previous night of the survey.

A study done by Malaria Consortium in 2014 that assessed the barriers to IPTp uptake in Uganda concluded that, despite a range of minor concerns (e.g. taking IPTp on an empty stomach), women and communities have largely positive views of ANC and IPTp. Refusal rates of IPTp are low and given the high ANC attendance figures, the main obstacles to the provision of IPTp are therefore likely to be supply-side challenges. It was found that a key reason for not receiving IPTp "was that it was not offered by ANC staff." One likely limiting supply-side factor is health workers' inadequate knowledge of up-to-date IPTp guidelines, particularly with regard to the correct timing and frequency of IPTp administration. Poor data management is also likely to play an important role. The review of records found that sources of data had inaccuracies along the recording and reporting chain, suggesting that available IPTp uptake figures are unreliable.

Malaria Consortium carried out a pilot intervention in 2014-15 in two districts (Moyo and Adjumani), which aimed to improve IPTp coverage by improving health worker adherence to IPTp protocol through text message alerts. Despite variations in health worker knowledge, the pilot found that: 1) text messages providing important reminders after training in IPTp increased health worker knowledge and IPTp coverage much better than a standalone training, and 2) text messages are found to be feasible, acceptable, and cheap.[15]

The African Strategies for Health Project also supported a formative study in January 2015 to understand why IPTp coverage falls far behind the antenatal coverage reported in the HMIS. The study was carried out in two districts (Buyende and Kabeiramaido) and sampled 25 public facilities. Analysis was done on the service delivery practices, quality of care, missed opportunities, and bottlenecks at the facility level that impeded the provision and uptake of IPTp including the perspectives of the staff, clients, and district health officials and looked at possible areas of improvement. The findings of the study contributed to the design of a quality assurance tool that aims at enabling providers and facility managers to track facility-level trends and incorporate quality improvement (QI) and performance improvement strategies on an ongoing basis. The major recommendations from the study agree with the findings by Malaria Consortium: 1) strengthen SBCC messaging by utilizing the time patients are waiting at ANC for health education sessions, 2) promote effective communication between providers and clients during one-on-one sessions, 3) include appropriate counseling for IPTp using community outreach and VHTs, and 4) address misperceptions on male involvement such as turning pregnant women away when not accompanied by their spouses. The findings of the study were disseminated and the QI tool is currently being piloted in two districts, with results expected at the end of 2016.

In the past, many health facilities struggled with frequent stockouts of SP, although this has been improving as the MoH works diligently to meet its commitment to provide all SP to meet the nationwide need in the public sector. Private facilities on the other hand have to buy their own supplies, which mean stockouts are still a problem. PMI will consider supplying SP as a short-term solution in limited areas in 2016 while continuing to advocate that the GoU ensure full availability of this commodity in the future in order to ensure IPTp efforts are successful.

PMI supported the NMCP to organize a MIP stakeholders' workshop to present and finalize the updated MIP documents in 2014/15. The workshop was instrumental in updating the policy. All relevant

[15] Assessing and addressing barriers to IPTp uptake in Uganda by Malaria Consortium 2015

documents were updated and enriched through workshops and the policy has been recently endorsed by MoH.

Progress during the last 12-18 months

Through PMI support, NMCP and RHD supported the MIP TWG to advocate for: 1) the dissemination of the updated policy; 2) the training and retraining of health workers at all levels; 3) regular supportive supervision at all levels; and 4) ensuring that 0.4mg folic acid, and 30-60 mg iron are included in the essential medicine lists to be procured and distributed by GoU/MoH to ANC facilities.

PMI distributed over 120,000 ITNs to all PNFP ANC facilities and an additional 32,000 ITNs through public ANC clinics in 10 districts in northern Uganda in response to the malaria upsurge of 2015. With PMI support, the NMCP in collaboration with the 10 northern districts trained about 8,000 VHTs (mostly female) who moved door-to-door and promoted: 1) correct and consistent net use, 2) visitation of health facilities for IPTp, and 3) early diagnosis and treatment when febrile among pregnant women. These efforts helped to stabilize the malaria upsurge and prevented excessive deaths in these districts.

A successful partnership was arranged between PMI and Global Fund to distribute 2.1 million PMI/DFID-procured ITNs to all public ANC facilities in the country, for which Global Fund provided the operational costs for distribution. This partnership ensured sufficient supplies of ITNs in both public and PNFP ANC facilities.

PMI has also supported quarterly monitoring of SP stock levels in PNFP facilities to maintain adequate supplies for IPTp. Stock results were shared with the NMCP to encourage the replenishment of low stocks at the NMS.

Table 8. Status of IPTp policy in Uganda

WHO policy updated to reflect 2012 guidance	Updated 2014 and approved by senior management of MoH in July 2015
Status of training on updated IPTp policy	Not yet begun, since the mechanism for this activity has not yet been awarded. Expected to begin in 2016.
Number of health care workers trained on new policy in the last year	None
Are the revised guidelines available at the facility level?	Not yet begun as the mechanism for the dissemination of the guidelines has not been awarded. Expected to begin in 2016.
ANC registers updated to capture 3 doses of IPTp-SP?[16]	No
HMIS/DHIS updated to capture 3 doses of IPTp-SP?	No

Commodity gap analysis

[16] Over the next several months, PMI will engage NMCP/DHMTs to update ANC registers and HMIS/DHIS2 to capture three doses of IPTp-SP and to update facility records to document the total number of doses of SP given to ANC clients.

Table 9. SP Gap Analysis for Malaria in Pregnancy

Calendar Year	2016	2017	2018
Total population	36,831,040	37,891,774	38,983,057
SP Needs			
Total number of pregnant women*	1,841,552	1,894,589	1,949,153
Total number of ANC visits**	3,498,948	3,599,719	3,703,390
Total SP Need (in treatments)	**3,498,948**	**3,599,719**	**3,703,390**
Partner Contributions			
SP carried over (deficit) from previous year	0	0	0
SP from MoH***	3,498,948	3,599,719	3,703,390
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	**3,498,948**	**3,599,719**	**3,703,390**
Total SP Surplus (Gap)	**0**	**0**	**0**

*Assuming 5% of the population will be pregnant each year
**Assuming 80%, 60% and 50% of all pregnant women will attend ANC1,ANC2, and ANC3 respectively
***The Government of Uganda is committed to procuring and distributing the total amount of SP doses required for each year (2016-2018).
****PMI may procure a limited amount of SP in 2016 to ensure availability of stock while continuing to advocate for the GoU to provide the full supply in future years.

Plans and justification

With FY 2017 funds, PMI will continue to provide assistance in strengthening the MoH's capacity to coordinate and implement MIP programs, including supporting the full implementation of the revised MIP policies in all ANC facilities and support for the MIP TWG. With PMI support, NMCP/DHMTs will continue to train health workers in the PMI focus districts (43) in the newly developed MIP policy documents. There will also be a renewed focus on strengthening health worker performance related to MIP as a comprehensive component of FANC services. This includes providing supportive supervision specifically for MIP, and integrating MIP trainings with other programs (MCH, HIV, etc.). PMI will also invest in data quality and management improvement activities to help address issues with data accuracy and management.

With FY 2017 funds, PMI will continue to: 1) strengthen the delivery of MIP services, increasing ITN use, IPTp uptake, and early diagnosis and treatment in both the public and private sectors; and 2) coordinate with the NMCP/DHMTs to bring onboard all RBM partners to fully implement the feasible recommendations of the 2014-2015 studies by Malaria Consortium[17] and African Strategies for Health[18].

[17]Assessing and addressing barriers to IPTp uptake in Uganda by Malaria Consortium 2015.
[18] The African Strategies for Health Project report on a formative assessment conducted in Uganda: Facility level factors influencing the uptake of intermittent preventative therapy for malaria in pregnant women, February 2015.

PMI will support the NMCP and DHMTs to continue ensuring the correct dose of 0.4mg folic acid, and 30-60mg iron supplementations are procured and distributed by GoU/MoH; and promote the recommended dosage by pregnant women at ANC clinics. The MoH is expected to procure and distribute the required quantity of SP, folic acid, and iron supplementation for 2016, 2017, and 2018. This drug is included in the list of the MoH's supply of essential medicines and PMI will support NMCP to advocate that the new recommended dosage of folic acid and iron supplementation be included in this list as well.

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

- **Strengthen delivery of comprehensive IPTp services as part of an integrated FANC approach at public and PNFP ANC clinics.** PMI will support NMCP/DHMTs to address factors contributing to low IPTp uptake; train newly recruited and retrain the previous health workers; enhance SBCC to ensure pregnant women understand that taking three or more doses of IPTp is safe; advocate for the availability of all MIP commodities in all ANC facilities; provide clean water and cups to facilitate DOT of IPTp; and encourage pregnant women to utilize the ANC services available to them. PMI will also assist with integrated supportive supervision for ANC health workers with an emphasis on IPTp, ITNs, and case management of pregnant women. PMI will continue supporting professional associations to improve the level of communication between ANC providers (midwives, nurses, and doctors) and their clients during ANC visits. PMI will also support integrating service delivery with other treatments such as PMTCT. Furthermore, PMI will support the NMCP to continue providing the full package of MIP activities in focus districts, including correct and consistent net use, IPTp uptake, early diagnosis and treatment, and proper folic acid and iron supplementation at ANC clinics. These funds will cover 43 high burden districts in West Nile, Mid-west and Central regions, in addition to 63 districts in North-Acholi, North-Lango, Eastern, East-Central, and South West regions. ($450,000)
- **Support for comprehensive IPTp services for ANC in private-for-profit (PFP) health facilities:** A considerable number of pregnant women use PFP health facilities due to better service delivery and geographic location. PMI will continue to promote IPTp by training and re-training health workers in small- to medium-sized PFP health facilities in order to promote a comprehensive package of IPTp services. These services will include DOT, early detection of MIP, and encourage regular reporting of the services provided. PMI also seeks to leverage ongoing support from PEPFAR and MCH funds for the private sector. ($100,000)
- **SBCC**: *See cross-cutting SBCC section for details on activities and funding.*

3. Case management

a. Diagnosis and treatment

NMCP/PMI objectives

The UMRSP recommends parasitological diagnosis and prompt treatment with ACTs to reduce malaria-related morbidity and mortality. Parasite-based diagnosis with microscopy or RDTs is prioritized in all health facilities and at the community level through iCCM for all age groups. However, 40–60% of people with fever seek treatment from private providers, including drug shops, vendors, and medicine sellers that are not registered and do not report through the HMIS system. In 2010, Uganda adopted an iCCM strategy that indicates that two of the five VHT members are responsible for diagnosis and treatment of common childhood illnesses, including malaria. Substantial work has gone into updating

the 2010 iCCM training manual with the inclusion of RDT training at the community level[19]; the Child Health Division at the MOH is currently revising the iCCM manual to incorporate community tuberculosis management. The national review of iCCM conducted in 2013 documented the implementation of iCCM describing the successes, shortfalls and possible recommendations for scaling-up. The review noted that while there was substantial coverage of districts by various partners carrying out iCCM, the national financial planning for iCCM was inadequate and the costed plans were incomplete and lacked a clear plan for sustainability.

The UMRSP calls for:

- All suspected malaria cases to be subjected to parasite-based diagnosis.
- Microscopy to remain the "reference or gold standard" for malaria diagnosis in case management and to be the diagnostic method of choice for all HC III's (that have microscopes) and above.
- RDTs to be used at HC III's that do not have microscopes, all HC II's, at the community level, and to fill the gaps at higher level HCs where microscopy is not possible.
- The type of RDT to be deployed in Uganda to be guided by evidence on sensitivity, specificity, ease of use, and stability in the field, as determined by the performance evaluation and pre-qualification schemes of the WHO coupled with in-country testing. Multiple RDT brands are allowed according to this national policy.
- iCCM to be rolled out to all villages across the country in a phased manner to facilitate access to and reduce the treatment gap for malaria, pneumonia, and diarrhea.
- The Test, Treat, and Track initiative to be rapidly scaled up to ensure early detection and appropriate treatment, and to promote good surveillance for accurate reporting of cases.
- Supportive supervision and clinical audits to be strengthened to improve adherence to policies and guidelines.
- Referral systems from lower level HCs, the community, and the private sector to be strengthened to improve management of severe malaria.

Overall, this policy is consistent with WHO guidance on the need for parasitological confirmation of fevers in all groups before treatment with antimalarial drugs.[20] Even though improvements in malaria diagnostic practices have been made, adherence to the policy is suboptimal. Per 2015 HMIS data (which is biased toward the public and PNFP sectors and thus toward increased testing), of all the malaria cases reported, 54% were confirmed. The UMRSP objective for diagnostics by 2018 is to ensure at least 90% of malaria cases in the public and private sectors and at the community level receive prompt diagnosis and treatment according to national policy. However, field observations during site visits and facility record reviews suggest limited practice by either health workers or patients to request testing prior to treatment or to adhere to test results. This challenge has been further exacerbated by the lack of adequate laboratory diagnostic capacity, especially the inadequate number of laboratory technicians in many health facilities. Consistent with the field observations of diagnostic practices, the 2014 MIS found that only 36% of children with a fever were tested for malaria before receiving treatment. Future efforts will require ongoing education of health workers and other cadres of health staff to base treatment on parasitological test results, and to educate communities to request a malaria test as a component of good medical care for fever.

[19] UNICEF, WHO, Uganda adaptation 2010. Facilitator Guide caring for Newborns and Children in the Community.
[20] WHO. 2015. Guidelines for the treatment of malaria –3rd edition.

The responsibility for the coordination, monitoring, and supervision of all HC III and IV laboratories resides with the Central Public Health Laboratory (CPHL). The CPHL is grossly understaffed resulting in irregular supervision and limited ability to improve laboratory performance for malaria diagnostics, in particular, quality assurance of microscopy. PMI and PEPFAR will continue their collaboration in laboratory strengthening by supporting the CPHL and the NMCP to conduct regular supervision of facilities for sustained quality diagnostic services.

The UMRSP also plans for a phased rollout of iCCM to all villages across the country, emphasizing support for a consistent supply of malaria commodities to improve prompt and correct malaria diagnosis and treatment at the community level. This policy is in line with WHO and UNICEF recommendations that countries implement iCCM for children less than five years of age as an essential method for improving access to malaria diagnosis and treatment. The iCCM approach provides diagnosis and treatment of pneumonia, diarrhea, and malaria through VHTs using standard algorithms. It also provides a platform for facilitating referral of severe illness, including the use of pre-referral rectal artesunate.

In line with WHO recommendations and as a means of ensuring that the national policy for the recommended first-line drugs are appropriate, the UMRSP provides strategic guidance for studies to routinely monitor ACT efficacy. Current first-line drugs for uncomplicated malaria are AS/AQ and AL, while the second-line is DP. However, it is important to note that DP is frequently used in the private sector. Injectable artesunate has been the drug of choice for treatment of severe malaria since the national policy shift in 2011; however, artesunate supplies were inadequate until 2015. Currently, injectable quinine is largely phased out; this complicates treatment of severe malaria when there are stockouts of artesunate.

Progress since PMI was launched

PMI has invested in the training and supervision of health workers on malaria diagnosis and treatment, procurement of RDTs and ACTs, and drug quality testing to improve malaria case management in Uganda. On average, over 85% of public and PNFPs have benefited from PMI supported training for case management. PMI-supported sentinel sites and reference centers have consistently shown both improved data quality and significantly better case management.[21]

Starting in 2011, PMI supported training of private health practitioners in the revised (2010) antimalarial drug policy. This training is often integrated with sessions on HIV/AIDS, family planning, and child survival. In addition, PMI has supported small-to-medium-sized private clinics and has worked with large private corporations to leverage additional funds for malaria control through their corporate social responsibility programs. These corporations provide free or subsidized health services to their employees and surrounding communities. PMI works with these businesses on a cost-sharing basis for ITNs, IPTp, and laboratory diagnostics. The NMCP also provides refresher trainings in case management and diagnostics with support from PMI. In turn, clinical audit approaches have been adopted to promote high quality and operational efficiency at all levels of health service provision. Even though there is still a considerable amount of work to be done to improve the quality of care for patients with malaria, PMI has been addressing these weaknesses through the implementation of supportive supervision, clinical audits, and training.

[21] Sserwanga A, Harris JC, Kigozi R, Menon M, Bukirwa H, et al. (2011) Improved Malaria Case Management through the Implementation of a Health Facility-Based Sentinel Site Surveillance System in Uganda. PLoS ONE 6(1): e16316. doi:10.1371/journal.pone.0016316

Since 2006, PMI purchased over 7.5 million ACT treatments and 5.1 million RDTs. PMI has supported the rollout and use of RDTs in health facilities without laboratory services, microscopy training at health facilities with laboratory services, and both types of training to facilities with limited laboratory services. Although PMI support for commodities has included both the public and PNFP sectors in previous years, currently USG-supported commodities are only permitted through the JMS (the PNFP distribution mechanism).

To address not only the availability of malaria diagnostics but also the quality of diagnostic tests, in particular microscopy, PMI has supported the development and implementation of quality assurance procedures. In 2012, the quality and validity of the malaria slides stained and read at the sentinel sites were assessed. Based on the findings, PMI supported the shift of the malaria staining technique from Field stain to Giemsa stain at all surveillance sites (supported at the time). This shift allowed for quality assurance measures by allowing re-readings of slides kept over time. A monthly slide rechecking program was also introduced at all of the sites to help monitor the quality of preparation and accuracy of reading smears. As a result, the majority of the sites scored above 85% for sensitivity, specificity, and percentage agreement. Because of this experience, NMCP has also recommended a national shift to Giemsa stain; however, uptake has been slow due to the additional cost and extra time needed per slide at the health facility level. Technical support for QA activities for diagnostics previously consisted of conducting microscopy training and follow-up, testing retention of proficiency achieved after training, developing the RDT and the microscopy QA manual, and working with the national program to officially approve these QA programs. Although there was progress made in the development of the QA program, implementation was limited because of the lack of ability to finalize the policy document at the national level. Moving forward, PMI will support QA activities in health facilities, and ensure that QA of diagnostic services is scaled-up.

Uganda has monitored first-line antimalarials since 2001, and PMI has supported this work since 2006. As of 2009, evidence showed that all formulations of ACTs tested were still highly efficacious in Uganda.[22,23] Studies conducted in 2006 and 2009 have compared AL, AS/AQ, and DP. The most recent therapeutic efficacy study from 2014 comparing AS/AQ and AL found that both ACT regimens were efficacious in treating uncomplicated malaria, with AS/AQ treatment being associated with a slightly lower risk of recurrent parasitemia than AL treatment.[24]

To improve access to diagnosis and treatment of malaria, Uganda has developed considerable experience in using iCCM, which was first implemented in Uganda in nine districts of the Mid-West region in 2009 with funding from the Canadian International Development Agency (CIDA). This pilot was subject to three evaluations that informed the planning that allowed for expansion. The pilot was used as a model for scale-up of iCCM activities in the country, with the complete package of iCCM

[22] The Four Artemisinin-Based Combinations (4ABC) Study Group (2011) *A Head-to-Head Comparison of Four Artemisinin-Based Combinations for Treating Uncomplicated Malaria in African Children: A Randomized Trial.* PLoS Med 8(11): e1001119. doi:10.1371/journal.pmed.1001119

[23] Emmanuel Arinaitwe,Taylor G. Sandison Humphrey Wanzira, Abel Kakuru, Jaco Homsy, Julius Kalamya, Moses R. Kamya,Neil Vora, Bryan Greenhouse, Philip J. Rosenthal, Jordan Tappero, and Grant Dorsey. **"***Artemether-Lumefantrine versus Dihydroartemisinin-Piperaquine for Falciparum Malaria: A Longitudinal, Randomized Trial in Young Ugandan Children,"* Clinical Infectious Diseases 2009; 49:1629–37

[24] Adoke Yeka, Ruth Kigozi, Melissa D. Conrad, Myers Lugemwa, Peter Okui, Charles Katureebe, Kassahun Belay, Bryan K. Kapella, Michelle A. Chang, Moses R. Kamya, Sarah G. Staedke, Grant Dorsey, and Philip J. Rosenthal. *"Artesunate/Amodiaquine Versus Artemether/ Lumefantrine for the Treatment of Uncomplicated Malaria in Uganda: A Randomized Trial,"* The Journal of Infectious Diseases 2016 Apr 1;213(7):1134-42.

covering malaria, pneumonia and diarrheal diseases. The funding from CIDA ended in 2011 and was followed by funding from DFID and UNICEF that expanded the program to cover an additional eight districts that still runs, to date. With this experience, Uganda was able to demonstrate the feasibility of iCCM in the Mid-West and Central regions covering an estimated population of about 5 million people. Despite the great promise shown by iCCM in increasing health coverage especially for children living in remote areas, iCCM scale-up in other regions has been slow, partly because of the uncertainty of funds. Global Fund supported iCCM began in 2010 in 45 districts with plans for sequential scale up. However, several challenges were encountered, including a temporary suspension of the grant that led to a delay in program implementation. Other challenges include delays by the Government of Uganda in providing compensation for VHTs, leading to a lack of motivation of VHTs. This appears to be the largest impediment to successful national-scale implementation. The Government of Uganda has promised to develop a cadre of community health extension workers (CHEWs) similar to those in Ethiopia that would be paid government employees. The process of transition from VHTs to CHEWs has been slow.

Overall, one of the major barriers to scaling up case management in Uganda has been sporadic availability of RDTs and ACTs at the facility level. In addition, inadequate staffing, low productivity, high levels of absenteeism of health workers, and poorly motivated VHTs remain a serious challenge in provision of case management services. The 2011 and 2013 Health Facility Assessments conducted by PMI revealed that staffing levels have stagnated and even regressed at lower-level facilities. PMI supports NMCP in updating policies, guidelines and manuals for case management activities.

The NMCP has a case management TWG which meets regularly as a valuable forum for technical experts to: 1) discuss key issues that support the NMCP in expanding access to effective treatment, 2) monitor the implementation of case management strategies and methods for scaling up, 3) identify and document best practices from studies in case management within and outside Uganda, 4) disseminate information and implementation updates, and 5) identify key scale-up gaps and priorities for action. The working group consists of members from the NMCP, PMI, DFID, CHAI, Foundation for Innovative New Diagnostics, Infectious Diseases Research Collaboration, Malaria Consortium, UNICEF, WHO and other malaria stakeholders. The availability of RDTs, ACTs, laboratory supplies, and trained staff at all levels are also discussed and actions are taken accordingly.

Progress during the last 12-18 months

PMI supported the NMCP to improve the capacity of health workers in diagnosis and treatment of malaria over the past 12–18 months. This included supporting the revision of the country's IMM training manual. In addition, PMI supported the NMCP to update the country's guidelines for diagnosis with microscopy and RDTs, and the associated QA. Notably, these guidelines specifically recognize the necessity of supporting both the public and private sector, in order to increase the proportion of suspected malaria cases receiving testing prior to treatment. These national parasite-based diagnosis implementation guidelines are currently being reviewed for approval at the MOH senior management level.

In FY 2015, PMI supported the training of 8,917 health workers in malaria case management. The curriculum for IMM includes management of both uncomplicated and severe malaria (with proper administration of IV artesunate), management of MIP, and parasite-based diagnosis with RDTs, including how to manage a patient with a negative RDT and fever.

In FY 2015, PMI procured 1,195,850 RDTs, 1,326,840 ACT treatments, and 450,000 artesunate injections. Commodity supply to public sector health facilities remains a major challenge. Serious issues

with the NMS' capacity, accountability, and transparency have been documented, leading to the prohibition of supplying malaria and non-malaria USG-procured commodities to the NMS over the past several years. However, due to the overwhelming need for health commodities in the public sector, the USG is exploring placing PEPFAR commodities through this system. The USG is conducting high-level discussions with the MoH regarding strengthening the public supply chain system. PMI intends to contribute along with PEPFAR and other USG resources to strengthen the accountability and effective management of the public sector supply chain. Areas of focus will also include installing a web-based ordering system, harmonized coding of malaria commodities, procurement planning, and budget tracking. PMI will continue to supply limited commodities to the public sector through the JMS in hard-to-reach areas and in times of outbreaks until issues with the NMS are resolved. In addition, the Global Fund continues to distribute commodities through the NMS.

Currently, beyond the support planned by PMI, iCCM scale up is supported by Global Fund, UNICEF, DFID, WHO, Malaria Consortium, World Vision, Clinton Health Access Initiative (CHAI), Save the Children, International Rescue Committee, and the AVSI Foundation. Global Fund plans to support the further expansion of iCCM activities in 33 additional districts, however planned expansion has progressed slower than expected. In 2015, the Global Fund supported new districts in the Mid-Western sub-region (6), West Nile sub-region (5), and East Central sub-region (4). The Global Fund planned expansion for 2016 has been modified to incorporate the Northern region, including ten former IRS districts which experienced a malaria upsurge. Partners that support iCCM are responsible for supporting supervision of VHTs by nearby health facility staff. VHT data is collected by the supporting health facility and captured through the HMIS.

A UNITAID-funded private sector RDT project was implemented in nine districts, in which RDTs were distributed to registered private-for-profit facilities. SBCC campaigns were targeted to providers and consumers, and combined with IMM training to providers. Preliminary results indicate a drastic increase in RDT sales, and levels of appropriate treatment improved. While the pilot has ended, Malaria Consortium was able to continue these activities, with a plan to hand them over to the government by the end of 2016. UNITAID has also started to fund lot testing of private sector RDTs. Given that there are approximately 60 types of RDTs in country currently, and many of them of questionable quality, lot testing should improve the quality of and trust in RDTs by patients and providers. There remains, however, some ambiguity in policy regarding who can conduct RDTs (and where); this affects access and availability of RDTs. Lot testing of RDTs for the public sector is carried out by the Uganda National Drug Authority upon arrival into the country and any bad lots will be refused entry. Lot testing of RDTs in the private sector is not yet streamlined although NMCP is considering the expanded use of positive control wells (PCWs) at the community level. Previous work piloting PCWs in lower level health facilities and at the community level in two districts in Uganda showed that PCWs are scalable and feasible to be used at health facilities and by VHTs, and that PCWs improved provider confidence in RDTs. Results from OR in Kenya and Tanzania on PCWs may help inform future implementation.

PMI facilitated an independent evaluation of its case management activities in June 2015. Key recommendations included:

1) Revision of the IMM manual to separate guidance and training for lower level and higher level health providers, to include guidance for management of RDT negative febrile patients with no localizing signs or symptoms, and to include less complex guidance for the management of severe malaria.

2) Strengthening the financial and technical support for integrated supportive supervision through facilitating collaboration between implementing partners to strengthen the overall training and supportive supervision process.
3) Exploring options to expand support for appropriate case management in the private sector (clinics and hospitals, pharmacies, and drug shops).

The report highlights challenges with the overall health system, supply chain, governance and NMCP leadership that continue to undermine the effective performance of case management.

Commodity gap analysis

Table 10. RDT Gap Analysis

Calendar Year	2016	2017	2018
RDT Needs			
Total country population[1]	36,831,040	37,891,774	38,983,057
Population at risk for malaria	36,831,040	37,891,774	38,983,057
PMI-targeted at-risk population[2]	20,625,382	22,356,147	23,389,834
Total number of projected fever cases[3]	28,138,178	28,705,292	26,278,479
Percent of fever cases tested with an RDT. (The remaining percentage is tested with microscopy.)	40%	46%	51%
Total RDT Needs[4]	**14,069,089**	**16,379,957**	**16,752,530**
Partner Contributions (to PMI target population if not entire area at risk)[5]			
RDTs carried over from previous year	0	14,728,243	4,038,549
RDTs from Government	0	0	0
RDTs from Global Fund	23,203,337	0	0
RDTs from other donors	2,257,517	2,736,377	0
RDTs planned with PMI funding	3,336,478	2,953,886	2,000,000
Total RDTs Available	**28,797,332**	**20,418,506**	**6,038,549**
Total RDT Surplus (Gap)			

[1]Population percentages per age category based on UBOS 2014 Population Projection Trends.
[2]At-risk population based on population seeking healthcare at public, PNFP, and in community (not the private sector). If PMI continues to only be able to supply the PNFP sector, then the at-risk population and thus the commodity needs will be 15% of the numbers shown in the tables.
[3]Fever episodes for each age group was based on WHO & country context assumptions. Figure also represents a decrease in fever/malaria cases due to vector control.
[4]RDT needs are calculated based on fever episodes (above), and factor in a) exclusion of the private sector (since they are not a PMI-targeted at-risk population), b) testing rates, and c) proportion of testing that is with RDTs (not microscopy). RDT needs also include enough for a 3 month pipeline at the central warehouse.
[5]Global Fund grants are expected to include RDTs in 2017 and 2018, but amounts are not yet known; estimates provided for Global Fund 2017 contributions are based on value of expected spill-over commodities per adjusted 2016 supply plan. DFID and UNICEF funding levels are also not yet known.

Table 11. ACT Gap Analysis

Calendar Year	2016	2017	2018
ACT Needs			
Total country population[1]	36,831,040	37,891,774	38,983,057
Population at risk for malaria	36,831,040	37,891,774	38,983,057
PMI-targeted at-risk population[2]	20,625,382	22,356,147	23,389,834
Total projected number of malaria cases[3]	23,108,479	21,837,551	18,079,593
Total ACT Needs[4]	**28,885,598**	**27,296,939**	**22,599,492**
Partner Contributions (to PMI target population if not entire area at risk)[5]			
ACTs carried over from previous year	0	0	0
ACTs from Government	1,571,885	1,571,885	1,571,885
ACTs from Global Fund	16,845,525	1,338,571	0
ACTs from other donors	1,124,177	1,379,134	0
ACTs planned with PMI funding	3,060,760	2,383,996	1,600,000
Total ACTs Available	**22,602,347**	**6,673,586**	**3,171,885**
Total ACT Gap	**(6,283,251)**	**(20,623,353)**	**(19,427,607)**

[1]Population percentages per age category based on UBOS 2014 Population Projection Trends.
[2]At-risk population based on population seeking healthcare at public, PNFP, and in community (not the private sector). If PMI continues to only be able to supply the PNFP sector, then the at-risk population and thus the commodity needs will be 15% of the numbers shown in the tables.
[3]Projected number of malaria cases starts with projected fever cases (suspect malaria cases), and subtracts out those that do not get treated. The formula takes into account the testing rate (first multiplier), percent negative tests (second multiplier), and compliance rates (third multiplier). These numbers come from the national quantification exercise.
[4]ACT needs include enough for a 3 month pipeline at the central warehouse.
[5]Global Fund grants and redline funding are expected to cover ACTs in 2017 and 2018, but amounts are not yet final; estimates provided for Global Fund 2017 contributions are based on value of expected spill-over commodities per adjusted 2016 supply plan. DFID and UNICEF funding levels are also not yet known.

Plans and justification

PMI and the NMCP will work closely with WHO to support the scale-up of an appropriate quality assurance/quality control (QA/QC) system for diagnostics and continue to support strengthening treatment for uncomplicated and severe malaria through training, supportive supervision, clinical audits and on-the-job mentoring. This will be done in both public and private facilities. PMI support will complement Global Fund and PEFPAR funding for general laboratory and microscopy strengthening.

PMI will conduct QA activities within 43 focus districts, with NMCP covering the remaining districts with the help of Global Fund grants. PMI will expand the QA platform based on the experience of the previously-supported reference centers. PMI leverages PEPFAR lab supervision throughout Uganda to assist with QA at all levels through participation in an external quality assurance scheme in collaboration with the Central Public Health Laboratory (CPHL) and the Uganda Virus Research

Institute In addition, all public health facilities are expected to have malaria slide checks performed quarterly by the MOH and CPHL, however this is currently limited to 12 districts through Global Fund support.

PMI will support the scale up of case management activities in a phased approach: QA/QC activities will be implemented in 220 high-volume health facilities in 22 districts and 100 iCCM sites in 2 districts in 2016/2017; a total of 350 high-volume health facilities in 35 districts and a total of 200 iCCM sites in 4 districts in 2017/2018; and a total of 700 high-volume health facilities in 43 districts and 400 iCCM sites in 8 districts in 2018/2019. The end goal is to support 1,500 health facilities in 43 districts and 600 iCCM sites in 12 districts by 2021. The total number of health facilities in the 43 targeted districts is approximately 2,250. These efforts will be complemented by similar activities in an additional 63 districts, which have a total of approximately 2,160 health facilities. Non-malaria commodities for PMI-supported iCCM will be provided by UNICEF.

Due to current USG restrictions on supplying commodities to NMS, which supplies the public sector, PMI provides commodities only to the PNFP sector, and has quantified commodities based on PNFP needs. As seen in the commodities tables (Tables 10 and 11), there is a potential surplus for RDTs (and gap for ACTs) on the public sector side, largely driven by Global Fund. PMI will work with the Global Fund to coordinate the procurement of malaria supplies and commodities (including RDTs, ACTs, and artesunate) to be distributed to PNFP facilities through the JMS, and can adjust procurements dependent upon needs).

There are current plans to evaluate the efficacy and safety of AL and DP (commonly used in the private sector) for treatment of uncomplicated malaria in children in Uganda. The results will inform stakeholders in the region of the current level of efficacy of AL and DP. Given the recent findings with AS/AQ, PMI plans to include all three drugs in future testing.

Of recent concern is a new molecular marker for artemisinin resistance found on the Kelch gene on chromosome 13 (K13). This resistance is now reported in the entire Mekong region including Cambodia, Thailand, Vietnam, Laos, and Myanmar and more recently near the Indian-Myanmar border. However, the K13 molecular marker has only been shown to be associated with slow clearance in South East Asia. Additional studies have found mutations in the K13 gene in Africa, but it is not yet clear if those new mutations are associated with slow clearance. Nevertheless, it is important to assess the prevalence and the spread of those mutations, as artemisinin resistance has been shown to have emerged independently in different places. Uganda will therefore seek to be included in a core-funded study covering several other countries.

In addition, PMI will implement clinical audits, focusing on facilities at all levels with the highest volume of patients, ensuring that commodities are available in PMI-supported facilities, and using updated outpatient registers. PMI will also work to tailor the current IMM guidelines for the health facility level, and focus more on fever management than malaria management, which should improve quality of care, and increase testing compliance per the recommendations from PMI's independent evaluation. At the community level, expanding iCCM efforts should improve access to care, and shorten the time between symptoms, testing, and treatment. Other stakeholders, including CHAI and Malaria Consortium have focused interventions to improve case management diagnostics in the private sector through training health workers on diagnostics, and promoting testing suspected malaria cases before antimalarials are dispensed

Proposed activities with FY 2017 funding: ($7,190,000)

- **Procure 2 million RDTs to support iCCM efforts and PNFPs** ($1,000,000)
- **Procure 1.6 million ACTs to support iCCM efforts and PNFPs** ($2,000,000)
- **Support QA/QC and supportive supervision for diagnostics at health centers:** PMI will support case management trainings that focus on appropriate diagnosis, QA/QC (including regular slide rechecking, and consideration for RDT QA/QC using new technology as it becomes standardized and approved), and supportive supervision for diagnostics. Activities will be implemented in 43 districts in West Nile, Mid-west, and Central regions, in addition to 63 districts in North-Acholi, North-Lango, Eastern, East-Central, and South West regions. Activities will be targeted to high volume district hospitals and health facilities within the target districts. ($1,500,000)
- **Support improved diagnostics in the for-profit private sector:** PMI will support training on the use of RDTs, supervision, and quality assurance (for both RDTs and microscopy) in the for-profit corporate private sector through existing partnerships with 18 private companies through the 1:1 matching contribution program for malaria. Through the matching program, for each dollar invested, an equivalent amount is matched by the supported private facility. This program encourages private sector contributions that contribute to realizing PMI's desired objective. For instance, PMI may support health worker training in private health facilities on the condition that the private facilities report promptly in the DHIS2. PMI commodities are not provided to PFP facilities. ($160,000)
- **Strengthen case management in public health facilities:** PMI will provide funds for strengthening treatment of uncomplicated and severe malaria in public and PNFP health facilities in most parts of Uganda. This support includes clinical audits, supportive supervision, pre and in-service training, iCCM in eight districts, provision of job aids to health workers, and enhancing collaboration between NMCP and the national professional councils (doctors, nurses, midwives, laboratory technologists/technicians, and pharmacists). PMI will also provide funds for strengthening collaboration between district health teams and district-level professional associations to promote the correct diagnosis, and early and prompt treatment. Health care workers who are new to the system, practice in areas with a high burden of malaria, and/or who have shown poor performance will be prioritized. These funds will cover 43 high burden districts. PMI will ensure case management and SM&E activities are coordinated at regional, district and facility levels. In all areas, strengthening case management and supportive supervision at the health facility level will support the NMCP malaria reduction strategy and SM&E plan. ($2,000,000)
- **Support private sector providers and their networks to strengthen malaria treatment and increase the role of district health officials in providing support and supervision:** PMI will continue supporting private clinics and drug shops that are the closest sources of care for children with fever in many communities. PMI together with PEPFAR and the USAID family health team, will provide support to over 300 facilities and drug shops located across the country, with specific a emphasis on: promoting the use of LLINs, promoting treatment seeking within the first 24 hours from the onset of symptoms, strengthening private providers' and drug shops' capacity to diagnose malaria, and minimizing chances of over-treatment with ACTs. This support enhances collaboration between the public sector district health teams and private sector associations to ensure that health workers and drug shop owners receive routine supportive supervision for proper clinical care of children with fever, including treatment based on parasitological diagnosis, and support improvements in record-keeping and HMIS reporting to the national level. ($250,000)

- **Monitor drug resistance (efficacy) of antimalarial drugs:** Drug efficacy studies will continue to be conducted annually, alternating two to three sites every year, and FY 2017 funds will be used to study AS/AQ, AL, and DP. ($250,000)
- **TDYs from CDC/Atlanta:** With three TDYs, CDC staff will provide technical support for laboratory diagnostics scale-up and QA/QC policy implementation and technical support for quality of care issues for the management of severe and uncomplicated malaria within PMI and NMCP programs. ($30,000)

b. Pharmaceutical management

NMCP/PMI objectives
Strategic objectives of pharmaceutical management are:
1. Procure the most cost-effective drugs in the right quantities
2. Select reliable suppliers of high-quality products
3. Ensure timely delivery
4. Monitor stockouts

The UMRSP provides strategic guidance to strengthen the NMCP's capacity for procurement and supply chain management of malaria commodities. The quantification of malaria commodities is a primary role of the Quantification and Planning Unit in the Pharmacy Division of the MoH. The NMCP works in conjunction with the Quantification and Planning Unit to increase commodity availability and improve national forecasting of supplies. The NMCP and district health teams conduct integrated supervision and inspection of the supply and distribution process in the public, private, and PNFP sectors. The NMS and JMS procure and distribute these commodities to all levels of care through both the 'pull' and 'push' basic kit system. However, commodity supply to public sector health facilities remains a major challenge. This past year, stockouts of major malaria commodities continued to be an issue in public facilities. It was also observed that the number of ACTs provided were higher than the number of malaria cases captured in the health information system.

Serious concerns have been raised about the NMS' capacity, accountability, and transparency. Therefore, USG programs including PMI, PEPFAR, Saving Mothers Giving Life, and reproductive health/family planning do not currently supply commodities to the NMS. The NMS manages the procurement and distribution of essential medicines and health supplies for the public sector from other donors, including the Global Fund, while the JMS manages similar activities for the PFP and PNFP sector. However, during the malaria upsurge in the north, PMI successfully advocated for the MoH to authorize the JMS to distribute ITNs and ACTs to public facilities in these districts.

The USG is currently exploring placing PEPFAR commodities through the public sector. USG is conducting high-level discussions with the MoH regarding strengthening the public supply chain system. In Uganda's FY 2017 Country Operational Plan PEPFAR is proposing a number of measures to increase internal controls in the NMS including placing fiduciary agents throughout the supply chain, upgrading the Enterprise Resource Planning system, an electronic base for the Logistics Management Information System (LMIS), as well as reforming the governance structures. By the time MOP FY2017-funded activities are underway, PMI may be in a position to distribute malaria commodities through the public system. If this is the case, PMI intends to contribute to an integrated approach with PEPFAR and other USG resources in order to continue strengthening the accountability and effectiveness of the NMS. FY 2016 funds would support strengthening the linkage that will be expected between the fiduciary agent and the District Medicine Management Supervisors in monitoring, tracking, and accounting for

commodities. Support to NMS is contingent upon their agreeing to have an independent monitoring mechanism in place that will ensure commodity tracking and accountability throughout the supply chain.

Progress since PMI was launched

Together with PEPFAR and other USG health programs, PMI has strengthened the national pharmaceutical management system by improving performance and financial management, clarifying pharmaceutical policy, and increasing the transparency of the logistics management information system. However, improvements are still needed, especially in the supply of ACTs and other commodities to districts and lower level health facilities.

National ACT supplies have been more stable in the last four years due to procurements from the Global Fund, DFID, and the GoU. The 'push' kit introduced by the MoH and the NMS three years ago has helped to improve stock levels of ACTs routinely available at all lower level public health facilities. The 'push' kit, however, does not take into account the actual needs of individual health facilities, particularly in the case of the upsurge in malaria cases the country recently experienced, thus some facilities have stockouts while others have overstock. Efforts have been made by the districts, MoH, and PMI partners to redistribute supplies in these cases as well as document the under- and over-supply of ACTs to assist the central commodity store in revising the contents of the kits.

Quality of antimalarial drugs is a concern worldwide. Uganda's National Drug Authority (NDA) conducts quality control at ports of entry as well as post-marketing surveillance. Multiple partners provide support including the Global Fund and PMI through a wider USG partnership.

The National Pharmaceutical Sector Strategic Plan 2015 – 2020 and the National Medicines Policy, which was updated in July 2015, addresses the medicine supply chain, financing, pricing and appropriate use of medicines in Uganda. This package will be used to advocate to the Ministry of Finance and Economic Development, the MOH, and Parliament, for increased financial commitments from the GOU, to ensure that essential health commodities are accessible to all Ugandans. The policy is expected to provide a sustainable platform for accessing quality medicines.

Progress during the last 12-18 months

PMI provided technical assistance to the NMCP, district health teams, and facilities to improve supply chain management and develop accurate stock inventories of AL, RDTs, SP, and severe malaria drugs. Progress has been seen in the past 12–18 months in ensuring stable supplies of malaria commodities at health facilities and improving stock management and reporting.

PMI supports bi-annual EUV surveys. The most recently conducted survey occurred in June 2015 in 75 randomly selected facilities, of which 55 were public and 20 were PNFPs. The survey indicated a low testing rate of 61% despite high RDT availability, which was at 93% on the day of the visit. In addition, the survey also found that 81% of children less than five with a negative diagnostic test for malaria were still given ACTs on the day of the survey. The study found at least one ACT pack available in all facilities; 31% of the facilities visited were stocked out of SP on the day of the suvey. Additional findings of the survey are presented in the *Surveillance, Monitoring & Evaluation* section.

A 2016 Global Fund audit found that the supply chain system remains ineffective in distributing and accounting for medicines and commodities received from the Global Fund. Of the 50 health facilities audited, 40 were public facilities, which PMI does not support, and 10 were PFPs. There were reported cases of commodity theft including 40 cartons of ACTs delivered to the national referral hospital in

October 2015. The audit also noted unexplained stock differences along different levels of the supply chain. These unexplained stock differences amounted to a $1.9 million cost differential between commodities received and commodities dispensed to patients during the period January 2014 to June 2015 in the eight high-volume facilities visited. Expired drugs, stockouts, under/over reporting, and treatment provided without a confirmatory diagnosis were also common findings in the facilities visited by the auditors.[25] The Global Fund audit found in visited facilities:

- 68% of facilities reported stockouts of antimalarial medicines and test kits in the previous six-month period
- 30% of facilities visited had either under or over-reported results related to malaria cases and/or stock levels.
- 43% of patients were treated for malaria without a confirmed diagnosis and/or with negative results.

In response to the Global Fund audit, PMI along with other USG programs have participated in a number of consultations with the Global Fund and the GoU regarding the audit findings. The MoH has developed a detailed plan to resolve the situation and there is discussion of more in-depth assessments by donor partners to understand the specific weaknesses and leakage points in the system. PMI is also coordinating with the NMCP and CHAI to provide technical assistance in their study to examine the underpinning causes for the disconnect in the ACT consumption data versus the number of malaria cases in the HMIS.

Plans and justification

PMI will continue to support the NMCP in strengthening: 1) the quantification of malaria commodities, timely delivery, and monitoring of stockouts, 2) the NDA through an integrated health sector program that focuses on improving their strategy and capability in information management, and 3) the quality control and inspection programs for malaria commodities. PMI will distribute malaria commodities through the JMS until the efforts of the USG toward addressing the challenges with the NMS are resolved.

PMI, in collaboration with other partners, will also support NMCP to assess the determinant factors for high consumption of ACTs and artesunate. The PMI investment in supply chain management leverages more than $5 million from other health funding streams (including PEPFAR) to strengthen the entire supply chain system.

Proposed activities with FY 2017 funding: ($300,000)

- **Strengthen pharmaceutical supply chain management and monitor drug quality of antimalarials**: PMI will continue to provide technical assistance to the NMCP/MoH to forecast national requirements for essential medicines, and coordinate national supply planning among the various suppliers. Malaria-specific activities will include: forecasting and quantification of malaria commodity needs including ACTs, SP, RDTs, and other antimalarial medicines; reporting on these commodities when distributed to the PNFP sector; and supporting monitoring of ACT stockouts in all facilities. PMI will work with the JMS to continue monitoring and improving the ordering and distribution system for PMI-procured ACTs and RDTs. At the same time PMI is working with PEPFAR and other USG partners on necessary reforms to the NMS's supply chain operations. PMI will consider in the future distributing

[25] The Global Fund OIG Audit 2016.

malaria commodities through the public system once improvements are made. PMI is also looking towards offering support to the overall strengthening of the NMS, improving not only their technical capacity to implement an effective LMIS, but also ensure systems are transparent and accountable. In addition, technical assistance will be provided to the district and health facility levels to strengthen the lower level supply chain system. PMI in collaboration with the Global Fund and DFID will provide support to the NDA to improve their quality control activities for priority and high-risk medicines, including antimalarials that are supplied to the country. ($300,000)

4. Health system strengthening and capacity building

PMI supports comprehensive health system strengthening (HSS) activities which cut across intervention areas, such as health workforce, including community health workers strengthening and supportive supervision, supply chain management and health information systems strengthening, drug quality monitoring, and NMCP capacity building.

NMCP/PMI objectives
Health system strengthening is the cornerstone of Uganda's health sector development plan 2015–2020. PMI support covers the following components of the strategy: 1) increase in health human capital for wealth creation; 2) increase in financial risk protection of households; and 3) enhanced health sector competitiveness in the region and globally by focusing on health governance, service delivery systems, health information, health products and technologies, health workforce, and health infrastructure.

Progress since PMI was launched
Over the last several years, PMI has provided over $7 million to complement the efforts of other USG programs supported by USAID, CDC, PEPFAR, and the GoU. PMI provides support to heath system strengthening through its implementing partners and the integrated USAID/Uganda health system approach. In collaboration with PEPFAR and other USAID health programs, PMI supports improvement in workforce policy, planning, and management through: 1) strengthening human resource units and information systems in the ministries of health, education, and sports, in health professional councils, and in districts; 2) development and implementation of evidence-based human resource strategies; 3) advocating for increased funding and support for health workforce that has increased staffing levels, retention and productivity; and 4) developing in-service and pre-service training plans.

The availability of human resources for health (HRH) has significantly increased from 58% of positions filled in 2012 to 70% in 2015. To sustain and catalyze the HRH achievements, the USG conducts quarterly joint USG/MoH meetings on HRH to provide leadership and technical guidance on achievement of HRH priorities. Quarterly meetings negotiated for a bill to support recruitment of 2,504 health care workers for HC IIIs and HC IVs in 96 districts and absorption of 421 USG-supported health care workers; development and approval of Performance Management Guidelines to improve productivity of health care workers including reducing absenteeism and development of district HRH recruitment plans. As a result HRH staffing is projected to increase to 75% by the end of 2016.

Capacity building of the NMCP has been continuously supported by the two PMI RAs and two malaria program management specialists on all aspects of malaria control activities and programming. These advisors have played key roles in the country's malaria technical working groups, RBM partners' forums, and coordination taskforces. Since 2008, PMI has also equipped the NMCP with computers and accessories, scanners, and photocopiers.

As part of the wider health system, the private sector continues to play an important role in the delivery of health services in Uganda; per the 2014/15 MIS, among children under age five with fever for whom advice or treatment was sought, 49% were taken to a private source, and 8% were taken to other sources such as shops, traditional practitioners, or markets. PMI has been supporting the private sector and increased private sector involvement in malaria control and has engaged at least 15 major corporations that invested their own funds to provide malaria services to both their workers and surrounding communities.

Progress during the last 12-18 months

PMI supported the NMCP to strengthen coordination with malaria stakeholders through the RBM forum, technical working groups, malaria scientific sessions, review meetings, assessments (capacity and VHTs) and surveys (e.g. MIS 2014), and review of policies, guidelines, manuals, and job aids (e.g. MIP). PMI provided technical assistance to revitalize five major technical working groups focused on M&E, IVM, case management, MIP, and SBCC. PMI also supported the USAID/Uganda sector-wide initiative to address human resource shortages and develop the capacity of the health workforce at national and district levels.

Re-emphasizing the importance of systems strengthening across the vertical programs, USAID/Uganda has recently strengthened its health systems strengthening team and appointed a member to be a part of the PMI/Uganda team. PMI contributed greatly to formulating the HSS strategy for USAID/Uganda, which will focus on four elements: HRH including formalizing community health extension workers, health financing, health information, and supply chain. In the last year, relationships with the Community Health Department to support the MoH Community Health Extension Worker Strategy (2015 – 2020) as well as with the Department of Planning at MoH contributed greatly to further strengthening the health financing strategy 2015 – 2016. Dialogue between the Ministry of Finance and MoH regarding increases to the overall health budget has also been fostered; improving absorption of released funds from the Global Fund, and modifying underspent line items in the malaria budget to shift them towards IRS. PMI is in the process of participating in the results-based financing technical working group, as well as the health sector budget working group. This past year negotiations have been underway to leverage resources on sustainable financing initiatives, which will have a positive impact on PMI activities (i.e. Global Financing Facility alignment for comprehensive, high impact MCH services and the sustainable finance initiative under PEPFAR).

PMI supported the NMCP to recruit two fellows under CDC's Public Health Fellows Program (PHFP) / Field Epidemiology and Training Program (FETP). This program offers training for the fellows in epidemiology and disease outbreak investigation. One fellow supports the NMCP's M&E unit and the second fellow supports multiple malaria activities, including coordinating with partners and districts at the subnational level.

As focus shifted from sentinel surveillance to HMIS strengthening, there has been an increasing emphasis on improving case management, data management, surveillance and reporting at the health facility, district, and national levels using GoU personnel, thus greatly increasing the sustainability of these efforts.

Wherever practical, PMI has implemented malaria control activities together with other major health programs, particularly those for MCH, immunizations, HIV/AIDS, tuberculosis, and other vector-borne diseases. PMI focused on the following areas:

- Strengthening health information systems.
- Building leadership and technical capacity in the NMCP.
- Linking and integrating malaria and MCH health services.
- Supporting pharmaceutical and supply chain management.
- Improving laboratory diagnostic services.
- Coordinating with the proposed HSS initiative to be supported by the Global Fund.
- Continuing to seek institutionalization of policies that support rollout of iCCM at the national level.
- Linking with the USG effort to advocate for local resources in order to increase national ownership of malaria programming.
- Exploring innovative financing that includes performance-based financing.
- Exploring more cost effective options for delivering malaria services at the community level.
- Institutionalizing a community health extension worker system in Uganda.

In addition, in the past year, PMI supported placement, training, and small scale malaria projects for Peace Corps volunteers (PCVs) and their counterparts at the community level. In the last 12-18 months, PCVs distributed 552 ITNs, helped in monitoring net use as a follow up to the recently concluded UCC, and participated in interpersonal communication, moving house to house in the 14 IRS districts as part of SBCC to increase IRS acceptance levels. Two PCVs also supported the Uganda IRS project in updating the district capacity building dashboard that informs decision-makers on where gaps exist at the district level.

Further, in the last year, DFID supported a capacity building assessment of the NMCP, resulting in the development of a costed capacity building plan. The assessment highlighted the need for necessary changes to improve performance and organizational effectiveness, solutions to improve alignment of the MoH-NMCP organizational structure, systems and strategies, and guidance on how best to implement current and future malaria strategies. As a result of the assessment, a capacity development plan was formulated and adopted by MoH with four main strategic objectives: i) strengthen human resource capacity at the NMCP, ii) strengthen planning, programming, supervision, monitoring and evaluation of malaria control activities, iii) improve coordination and implementation of activities, and iv) revamp the malaria research center to improve its ability to support evidence-based programming.

Plans and justification

PMI will continue to support the capacity of the NMCP to manage and coordinate multi-sectoral malaria reduction efforts at all levels, including the continuation of regular NMCP technical and management meetings, RBM in-country partnership coordination meetings, and review and planning meetings. PMI will also work with the NMCP to conduct an assessment and develop a long-term strategy for Uganda's HMIS strengthening activities to determine how PMI's investments can best contribute to improving surveillance capacity in Uganda.

In collaboration with PEPFAR and other USG health programs, PMI will continue to support regions and districts to improve health worker productivity, and staff training (pre-service and in-service). PMI will further engage the GoU to increase commitment, transparency, and accountability for resources for malaria control and to mainstream malaria activities into the health sector response. PMI will work with USAID's HSS team through PEPFAR funding to improve efficiency and transparency in the current MoH allocated resources. To enhance the responsiveness of the health infrastructure and increase access to services, PMI will strengthen systems through the expansion of VHTs and iCCM in selected hard-to-reach areas.

PMI will continue supporting the USAID/Uganda sector-wide initiative to address human resource shortages and develop the capacity of the health workforce at national and district levels. The evaluation of this initiative pointed to the need to enhance the performance of the health workforce in terms of quality health care provision and productivity. In addition, PMI will continue to support performance-based financing, strengthen leadership and management, and harness private sector pre-service training capacity to meet priority HRH needs for malaria control. Due to the heavy reliance on volunteer community health workers, PMI will shift its focus to the policy reforms necessary to operationalize a formal community health extension worker program in Uganda. USAID/Uganda's district-based programs will implement the HRH support package including leadership capacity development and performance management developed by the human resource initiative. PMI's investment leverages over $2 million of PEPFAR and other USG health investments for this area of HSS. This activity will also include support for national MoH leadership training.

Furthermore, PMI will support updating of the curriculum for malaria case management in key institutions that train clinical staff. This will include each cadre of health workers potentially addressing malaria (e.g. doctors, clinical officers, different levels of nurses, midwives). Once the curriculum is developed, it will be incorporated into the education curriculum in schools across Uganda. PMI also plans to support a platform for health teaching staff to share notes in formal and informal forums across both public and private health worker training institutions to increase the body of knowledge and encourage uniformity in training and practice around malaria case management, which anecdotal reports have shown to be a gap in the country.

PMI will also support the strengthening of national capacity for program planning, management, and monitoring through practical field placements of recent graduates in well-performing malaria programs where they can be mentored by experienced program managers in both GoU and NGO institutions. Through these placements, the graduates will receive on-the-job training. This initiative will fund two new students to follow the malaria track in the two-year PHFP/FETP.

PMI will continue to support placement, training, and small-scale malaria projects through PCVs at the community level. Small-scale projects enable PMI through PCVs to build and sustain local capacity at the community level. The projects usually meet a pressing community need such as a gap in net distribution or IRS acceptance, and the volunteers work with community members on how best to address the gap. The community usually identifies the gap and works with the volunteers to arrive at a solution. The projects implemented demonstrate sustainability with communities being involved in design and implementation and taking charge at project closure.

PMI will support the recruitment of two staff at the NMCP as part of its contribution to the implementation of the NMCP capacity development plan. In addition, UNICEF with funding from DFID will support the recruitment of an additional four staff at the NMCP, while the Global Fund will continue supporting another three staff. The long term plan is for these staff to be rolled into the mainstream GoU/MoH payroll after three years of external support.

Proposed activities with FY 2017 funding: ($630,000)

- **NMCP capacity building:** Capacity building support to the NMCP including recruitment of two staff, RBM partnership support, coordination of partner meetings, and support to pre-service training through updating pre-service training curriculum to ensure that it reflects the updated

malaria treatment guidelines and policies, and strengthening of a forum to share teaching notes across training institutions. ($100,000)

- **PHFP/FETP:** Two new PHFP/FETP students every year to support the NMCP's program planning, management, M&E unit, and strengthening malaria surveillance at the national and subnational levels. ($300,000)
- **Strengthen human resources for health:** PMI will leverage PEPFAR resources in the strengthening of human resources for health project to support regions and districts to improve health worker productivity, recruitment and retention, and staff training (pre-service and in-service). With FY 2017 funds, the focus will shift to strengthening policy reforms related to community health extension workers. To consolidate gains achieved over the years, PMI will work within the in-country interagency initiative to strengthen leadership and governance for HRH focusing on increasing the productivity of the available health workforce. ($200,000)
- **Peace Corps:** Support placement, training, and small-scale malaria projects for three PCVs and their counterparts at the community level. ($30,000)

Table 12. Health Systems Strengthening Activities

HSS Building Block	Technical Area	Description of Activity
Health Services	Case Management	Strengthen the quality of malaria diagnostic and treatment services through integrated management of malaria training, support supervision, and monitoring.
Health Workforce	Health Systems Strengthening	Build, through training and technical assistance, host country managerial and leadership capacity for effective malaria control from national level all the way to the communities.
Health Information	Monitoring and Evaluation	Strengthen malaria surveillance to guide PMI and NMCP decision-making, forecasting and program management; also, contribute to training and mentoring health facilities to improve data reporting using the new HMIS tools.
Essential Medical Products, Vaccines, and Technologies	Case Management	Support improved forecasting, procurement, quality control, storage and distribution of malaria commodities, such as ITNs, ACTs, and RDTs.
Health Finance	Health Systems Strengthening	Provide technical assistance to the MoH to reduce redundancies and efficiencies and increase absorption of current resources provided on budget. Provide support to long-term health financing initiatives such as national health insurance as well as support innovative financing initiatives to improve overall quality of performance.
Leadership and Governance	Health Systems Strengthening	Strengthen national coordinating and regulatory bodies to direct and manage malaria financial and commodity resources, develop guidelines, and improve quality of services, and support a national forum for sharing teaching notes across health worker training institutions.

5. Social and behavior change communication

NMCP/PMI objectives

The UMRSP 2014–2020 calls for the NMCP to incorporate SBCC into all malaria interventions to improve the access, appropriate use, and coverage at the community and household levels. The NMCP's main strategy for SBCC is to: 1) develop and implement national malaria SBCC guidelines, 2) implement comprehensive SBCC activities, and 3) monitor the impact of SBCC interventions supported by the NMCP. The UMRSP also calls for the development of high-quality communication materials for different communication platforms, identifying and engaging hard-to-reach populations, and improving advocacy for malaria control support in both the public and private sector. The strategy includes a target of at least 85% of the population at risk (all Ugandans) to undertake correct practices in malaria prevention and treatment by the end of 2017, including uptake of malaria prevention measures (LLINs and IRS), utilization of MIP services, seeking treatment within 24 hours of onset of signs and symptoms of malaria, and adherence to treatment. The Ministry of Health recently completed and launched the national communication strategy for Uganda (2014-2020), which specifically highlights the NMCP's SBCC strategy, and complements the implementation of the UMRSP SBCC strategy. In Uganda, funds that support malaria SBCC come from the Global Fund, PMI, as well as other RBM partners.

Progress since PMI was launched

Past PMI-supported SBCC activities have reached nearly all Ugandans with key malaria messages on the importance of net use, malaria testing, timely treatment, and prevention of malaria during pregnancy. PMI progress on SBCC to date includes the development of the NMCP's national SBCC strategy and training materials used by SBCC implementing partners working in malaria prevention and treatment. Case management training for health workers and VHTs includes an SBCC component and VHTs are given job aids and storyboards to conduct sensitization sessions on malaria prevention and treatment in their communities. The national SBCC strategy, training materials, and tools are used not only in the PMI target areas, but also by Global Fund implementers in the remaining areas of the country. PMI has also supported training of NGO staff on SBCC related to malaria prevention, and supported PCVs to work with local NGOs on implementing malaria SBCC activities in various districts.

Since 2006, PMI has provided support for the establishment and functioning of the national SBCC TWG. The TWG was established in 2008 to coordinate SBCC activities across partners, and is responsible for reviewing the technical content of all SBCC messages pertaining to malaria, ensuring the accuracy and harmonization of messages. The main audiences for focused PMI SBCC programs have been beneficiary communities, opinion leaders, elders, pregnant women, children's caretakers, health workers, and drug dispensers.

SBCC messages are disseminated through a variety of complementary channels, including interpersonal communications (IPC), radio, and print. Results from the MIS 2014 show that, of women aged 15–49 years who had heard or seen a malaria message within six months before the survey, 82% got the message from radio and 34% from community health workers.

Progress during the last 12-18 months

PMI supported SBCC as a cross-cutting activity focusing on all interventions: case management, ITNs, IRS, and MIP. In the past year, PMI supported the finalization of Uganda's national SBCC strategy, which received final MoH approval and was launched during the World Malaria Day 2016 celebrations. The strategy is based on the UMRSP and incorporates available technical evidence on SBCC and findings of the midterm review. In the last 12–18 months, PMI supported the NMCP to continue to

reach approximately 4 million Ugandans with key messages around net use, care seeking behavior, and IPTp through radio talk shows, school activities, and community mobilization through village health workers. Their outreach included more than 600 schools and approximately 484,000 school children. In total, 28,783 malaria champions were trained in 2015 and deployed throughout the country.

SBCC is a critical component of PMI's IRS campaigns. Prior to the transition of IRS out of ten districts in the north, PMI implemented focused SBCC campaigns to promote correct and consistent net use and appropriate case management of malaria. In addition, PMI undertook enhanced SBCC in the 14 current IRS districts focusing on IPC, radio, and information, education, communication (IEC) to encourage people to open their houses for spraying, continue to sleep under ITNs, and seek prompt diagnosis and treatment in the event of a fever. These messages help to ensure a strong net culture is built in all IRS areas and households are aware of their risk for malaria when IRS is withdrawn and the need for prompt treatment seeking.

PMI intensified SBCC in northern Uganda in the last year to counter the malaria upsurge that started in the spring of 2015 by training approximately 8,000 VHTs to conduct home visits, and conducting 1,073 small group discussions and 138 large-group educational shows. PMI also printed nearly 20,000 IPC cards and talking points for village health workers and local council leaders, 30,000 posters on net use and MIP, and 5,000 IPTp job aids. In addition, radio spots promoting malaria messages aired on five radio stations in the north. As a result of these efforts, the IPC efforts of the malaria champions, and efforts of other malaria stakeholders, the malaria upsurge in the north was brought under control by early 2016. HMIS outpatient data shows a reduction in malaria incidence in the country from a peak of about 60% in June 2015 (1,600 cases a month) to about 30% in September 2015 (800 cases a month). Although the cases went up again to about 1,300 in December 2015, this was still below the June 2015 peak of 1,600 cases pointing to effective control efforts, including SBCC.

In the last year, PMI also supported an integrated communication strategy that targets audiences nationwide through IPC, radio, and print materials. This integrated SBCC mechanism leverages resources from other USG initiatives, particularly from PEPFAR as well as MCH, and utilizes consistent design and messaging tailored using a life stage approach. There are four stages in this approach. Life stages one and four target all household members, particularly youth and adolescents, and focus on correct and consistent net use, care of nets, prompt diagnosis and treatment, and IRS acceptance/adherence in selected districts. Life stage two targets pregnant women and their partners and focuses on MIP (e.g. sleeping under ITNs, IPTp uptake and prompt diagnosis and treatment). Life stage three focuses on the caretakers of children under five and in addition focuses on sleeping under nets, recognizing malaria symptoms, and seeking prompt diagnosis and treatment. An evaluation of the life stage approach is planned for the end of the project in late 2017 and PMI will ensure the evaluation includes malaria specific questions.

PMI, working with DFID, also supported an evaluation of the recent universal coverage campaign in the country. The evaluation concluded that "while knowledge on malaria transmission and the preventive potential of ITNs was very high, neither this knowledge nor recent exposure to BCC messages was associated with increased ITN use, supporting the notion that over the past 10 years a strong net use culture has developed in Uganda that does not depend on a single message but is rather a result of positive experiences with net use, reduced morbidity, and a gradual change of social norm." In addition, the evaluation noted that approximately 45% of women regardless of education or wealth quintile had not been exposed to any BCC pointing to the need for more focused BCC in future UCCs. Lessons learned from this evaluation will be used to inform the 2016/2017 UCC.

Plans and justification

PMI will continue supporting targeted and evidence-based SBCC interventions at the national, district, and community levels for correct and consistent use of ITNs, increased IPTp uptake, acceptance of IRS where applicable, and early diagnosis and treatment of malaria. As the malaria epidemiology in Uganda shifts, PMI will tailor its messages as appropriate (i.e. increased focus on fever management by providers when malaria burden is low). With the shift of IRS to high burden northern and eastern districts, PMI will continue enhancing SBCC in the districts from where IRS has recently been withdrawn, in addition to the current northern and eastern region districts, by promoting the correct and consistent use of ITNs, IPTp uptake, and prompt malaria diagnosis and effective treatment.

PMI will increase focus on IPC from the current 60% of available SBCC resources to 70%, encourage malaria messaging in PEPFAR programs, improve coordination and scale-up of SBCC by implementing partners, and ensure a strong SBCC technical working group at the national level with the objective of using SBCC to drive down malaria prevalence in Uganda. Messages will be targeted to enhance the existing net use culture and further encourage net care, with primary emphasis on promoting preventive behaviors that protect the net from damage.

PMI will continue to use community mobilization and mass media approaches, including integrated health outreach, radio talk shows, radio spots, community meetings, and IPC. These interventions will address existing barriers to uptake of malaria prevention and treatment services related to limited knowledge and skills and social and gender norms as well as target the interventions to get the right exposure and intensity required to achieve behavior change.

PMI will also continue supporting targeted community outreach in areas with high prevalence and low uptake of services and will print, distribute, and orient health workers and VHTs on the use of IPTp job aids and informational materials to increase demand and utilization of IPTp. Promotion of prompt care-seeking behaviors for suspected malaria, recognition of symptoms of severe malaria, parasitological-based diagnosis, and appropriate treatment for those with confirmed malaria will also be emphasized. Focus will be placed on creating demand for diagnostics by health workers and patients, appropriate treatment, and adherence to prescribed treatment by health care providers. PMI will continue to support the NMCP's prevent, test, treat, and track campaign to increase demand for testing for malaria followed by appropriate treatment. In addition, PMI will support effective communication on iCCM in districts where iCCM will be added. This activity will also leverage resources from the private sector.

Overall, the bulk of PMI's SBCC funding will go towards district and lower level SBCC activities, with a heavy focus on IPC. Support provided at the national level will allow PMI to have a broader impact, particularly as this level has been traditionally weak with respect to SBCC. SBCC materials developed at the national level will be rolled out to all implementing partners to help facilitate malaria prevention and treatment seeking behaviors, not just to increase knowledge. To ensure that national level SBCC activities are addressing the appropriate barriers and facilitators of malaria behaviors, PMI uses globally recognized messages that have been translated as appropriate to reflect the Ugandan context.

A baseline, midpoint, and end-line assessment will be done in 16 districts nationwide (focused heavily in the north) to look at community's comprehensive knowledge of malaria, including awareness of IPTp, and net use. The assessments are intended to monitor general levels of knowledge on the different malaria interventions, and will not be focused on a single SBCC intervention. PMI will continue to

discuss with other stakeholders to see if there are other factors that can be included in these assessments. The results of these assessments will be used to inform PMI's future SBCC activities.

Proposed activities with FY 2017 funding: ($800,000)
PMI SBCC activities will continue to focus on key behaviors that need to be emphasized e.g. regular use of ITNs and prompt diagnosis and treatment with ACTs for patients with fever, patient adherence to ACT treatment, and community IRS acceptance. SBCC activities will be actively monitored and evaluated to ensure they're appropriate and effective. Specific activities will be implemented using community IPC, radio, and print. Key activities are outlined below:

- **Support comprehensive SBCC in 43 high burden districts**: for correct and consistent use and care of ITNs, increasing IPTp uptake, and improving early and accurate diagnosis of malaria at facility and community levels. This activity will support the linkage of SBCC with overall SM&E activities. These funds will cover 43 high burden districts predominantly in Central, Mid-west and West Nile regions. ($300,000)
- **Support comprehensive SBCC in 63 districts**: for correct and consistent use and care of ITNs, increasing IPTp uptake, and improving early and accurate diagnosis of malaria at facility and community levels. These funds will cover districts in North-Acholi, North-Lango, Eastern, and East-Central regions, which do not geographically overlap with support provided in the 43 high burden districts noted above. ($100,000)
- **Support SBCC campaign in the private sector**: at district level to reinforce the role of small and medium private health providers (including drug shops, medical councils, and private midwives associations); work through mass media and IPC to create demand for malaria prevention and treatment services; improve net use, and promote case management by providers in the iCCM districts. ($100,000)
- **National level SBCC activities and IPC and social mobilization at lower levels**: increase adoption of healthy behaviors for malaria prevention and treatment through coordination, revision, and production of essential SBCC materials for districts, and all implementing partners. Strengthen health communication at the national level, leveraging existing resources from HIV/AIDS and other funding streams. Support includes limited implementation of activities, including IPC and social mobilization, at the lower levels, including in the South West region. ($300,000)

6. Surveillance, monitoring, and evaluation

NMCP/PMI objectives
The primary aim of the 2014 Monitoring & Evaluation Plan within the UMRSP 2014-2020 is to provide a joint framework for a well-coordinated, systematic, and holistic tracking of progress in malaria control, informing refinement and guiding decision-making for program improvement. The goals of the plan are to: 1) describe the types of data and data sources, and how data will flow from the primary source to a central repository through appropriate decision making layers, and to all relevant stakeholders; 2) provide a framework for the collection, processing, reporting, analysis, and use of malaria data in Uganda; 3) provide standard indicators, targets, and frequency of reporting in a standardized format for all malaria implementers and stakeholders; 4) guide the routine and periodic documentation of planned activities and measure expected outputs, outcomes and impact; and 5) define implementation arrangements with clear responsibility centers.

Progress since PMI was launched

Population-based Surveys

PMI has supported the use of the following tools to measure malaria burden as a result of ongoing control and prevention efforts:

- 2010 Anemia and Parasitemia Survey: This survey provided information on anemia and parasitemia in children under five years of age and district-level coverage data in two districts with and without IRS in northern Uganda, with a similar distribution of ITNs and case management support.
- 2011 ITN Coverage Survey: This survey provided information on net coverage at the district level in the Central region of Uganda after the targeted mass ITN distribution campaign in early 2010.
- 2011 Uganda DHS: The DHS provided data comparable to the 2006 DHS which assessed anemia levels in children under five years of age.
- 2014 MIS: This survey, which was designed to ensure comparability with the previous MIS (2009) and DHS (2011), provided data on the status of net ownership and use after the UCC among children under five years of age and pregnant women, as well as IPTp uptake in ANCs. Through oversampling the 10 previous IRS districts in the north and the 14 new IRS districts in the east, the MIS demonstrated the impact of IRS in the north, and provided a pre-spray baseline for the new IRS districts.

Evaluation

In 2014, an Impact Evaluation looking at the plausible contribution of malaria interventions to under-five mortality was completed. This evaluation looked at the time period 2000 to 2011, during which the under-five mortality dropped by 41% in Uganda. During the same time period, Uganda made substantial progress towards implementing malaria control interventions, particularly distribution of ITNs, IRS, and IPTp for prevention and ACTs for case management. The results showed that malaria interventions plausibly contributed to the reduction of mortality among children under five years of age during this time period. Of note is that the largest part of the scale-up corresponded to the biggest drop in the under-five mortality (2006–2011).

Sentinel Surveillance

From 2006-2015, PMI supported the establishment and maintenance of malaria sentinel surveillance sites in different malaria transmission zones. In addition to central level use for programmatic decision-making and dissemination, such as the 2000–2011 Impact Evaluation, the data from the surveillance sites have positively influenced case management practices by health workers at health center IVs and hospitals through regular monitoring, supervision, and data dissemination workshops. A robust quality control system for microscopists has been initiated in these sites and the results indicate excellent performance in the accuracy of blood slide readings across all sites. Although these sentinel surveillance sites are no longer supported by PMI, they continue to serve as a resource that provide high quality longitudinal data used by PMI, NMCP, and other malaria stakeholders to facilitate therapeutic efficacy studies, and conduct OR to improve case management and pilot methodologies to improve surveillance.

Routine Health Information System Strengthening

In 2014 PMI implemented a targeted HMIS strengthening activity to improve HMIS malaria data quality and use by building cost-effective, sustainable, data collection and reporting capacity at 26 level IV health centers (formerly known as “malaria reference centers”). In this first step of a targeted, phased approach to improve national and district level HMIS surveillance capacity, facilities in districts

receiving IRS were prioritized in order to monitor and inform IRS decisions, including selection of sites and timing of spray rounds. The 26 facilities were provided with additional resources and supervision to ensure high levels of testing for suspected cases and adherence to test results. The facilities received computers, and staff received training and supervision on data collection, management and reporting. These centers developed and piloted the enhanced outpatient registers that captured for the first time suspected malaria cases, testing, testing results, and treatment in the same place.

PMI-supported HMIS strengthening efforts also include district level support in the targeted districts by working with District Health Officers, district biostatisticians, and district malaria focal persons in data analysis and use workshops.

PMI also supports national level surveillance capacity building and HMIS strengthening. Since 2013 PMI has funded an FETP fellow to be assigned to the M&E unit at NMCP; part of their duties included drafting Uganda's Quarterly Malaria Bulletin. The Malaria Bulletin has proved to be a useful tool for reviewing malaria data reported through HMIS, and has been well received by RBM partners at the international, national, and district levels. Another FETP project is to map HMIS data (incidence and TPRs) for the MoH to better visualize data, especially for monitoring trends over time in order to better direct public health resources.

Progress during the last 12-18 months

HMIS Strengthening

PMI-supported HMIS strengthening efforts assisted the NMCP and the MoH's National Resource Center to update HMIS data collection forms to include the improved malaria indicators (fever, malaria test, test results, and treatment) in outpatient health facilities across the country. While these indicators are included in the DHIS2, completeness at the facility level have been poor; efforts on assessing and promoting these indicators will greatly improve the national HMIS system to collect and report standardized malaria-related indicators which were not previously captured. National dissemination of these improved outpatient registers began in 2015; however, the extent to which they have been disseminated and properly used has not yet been fully analyzed.

Despite PFP facilities contributing to HMIS data, the proportion remains small, but growing. Large donors, such as CHAI, have been actively engaged in pushing private sector data into the HMIS through various methods including tying registration/accreditation to reporting. Given the continued support from other partners, efforts by PMI continue to include data quality support at district-level private facilities. Currently, the district health information system 2 (DHIS2) covers all districts in Uganda. HMIS reports are entered at district level for onward submission to the national level. Weekly text-based data collected at the facility level now feed directly into the DHIS2. Thus far, surveillance data from previous HMIS strengthening efforts have been used to monitor the effect of a UCC, to evaluate the effect of a shifting IRS strategy, and to make evidence-based decisions in the face of an upsurge.

PMI is supporting the implementation of an operational research study (see OR section) to assess the usefulness of the Collaborative Improvement approach for HMIS strengthening. Based on findings, a package will be disseminated outlining the specific recommended interventions that can be a resource for health facilities aiming to improve HMIS strenghthing activities by the NMCP. PMI has initiated the development of a plan to build on the success to date of the targeted HMIS strengthening and continue to strengthen HMIS/DHIS2 data collection and analysis at facility, district, and national levels. PMI is currently working with the NMCP and partners to develop a long-term strategy for Uganda's HMIS to

determine how PMI investments can best contribute to improving surveillance capacity in Uganda. Additional detail on the strategy will be added, once an agreement has been reached and approved.

Data Use

PMI continues to promote and support HMIS data use by supporting and mentoring FETP fellows to analyze HMIS data to produce Uganda's Quarterly Malaria Bulletins. In February 2016, the twelfth Quarterly Malaria Bulletin was published and disseminated to key stakeholders at the national and district levels. During the upsurge in malaria in 2015, data from sites receiving PMI support for HMIS strengthening (both sentinel sites and malaria reference centers) and data analysis from the PMI-supported FETP fellow was crucial for MoH's National Task Force to determine trends and allocate resources to address the increase in cases. Reference center data from the PMI-supported facilities was shown to be representative of the entire surrounding districts, and because of the high testing and reporting rates, it was often praised by the MoH as the most reliable and informative malaria data in the country. Only approximately half of the cases reported to HMIS from health facilities not receiving PMI support are confirmed malaria cases. However, PMI-supported facilities, in addition to reporting on malaria cases, regularly reported TPRs that proved to be more stable than case data.

The national M&E TWG meets monthly, with regular participation from NMCP, PMI, and partners, to discuss pertinent issues; these meetings inform the NMCP Program Manager, the Resource Center, and the quarterly RBM meetings.

Table 13. Routine Surveillance Indicators, January – December 2015

Indicators	Value and Data Source	Comments
1. Total number of reported malaria cases	**13,741,593** DHIS2	The cases in DHIS2 were cleaned and adjusted with reporting rates. NB. For Total Malaria cases we consider outpatient department (OPD) cases since all cases are initially registered at OPD. This minimizes double counting.
Total diagnostically confirmed cases	**7,766,579** DHIS2	The confirmed cases were adjusted by reporting rates.
Total clinical/presumed/unconfirmed cases	**5,975,014**	
Outpatient number of reported malaria cases	**13,741,593** DHIS2	The cases in DHIS2 were cleaned and adjusted with reporting rates.
Diagnostically confirmed	**7,766,579** DHIS2	The confirmed cases were adjusted by reporting rates.

Clinical/presumed/unconfirmed	**5,975,014**	
Inpatient number of reported malaria cases	**787,748** DHIS2	The inpatient numbers were adjusted by reporting rates.
Diagnostically confirmed	N/A	Not reported in HMIS.
Clinical/presumed/unconfirmed	N/A	Not reported in HMIS.
2. Total number of reported malaria deaths	**5,678** DHIS2	Malaria deaths are not divided into diagnostically confirmed/unconfirmed.
Diagnostically confirmed	N/A	Not reported in HMIS.
Clinical/presumed/unconfirmed	N/A	Not reported in HMIS.
3. Malaria test positivity rate (outpatients)	**54.3%** DHIS2	
Numerator: Number of outpatient confirmed malaria cases	**7,766,579**	The confirmed cases were adjusted by reporting rates.
Denominator: Number of outpatients receiving a diagnostic test for malaria (RDT or microscopy)	**14,521,443**	Total tests done were adjusted by reporting rates.
4. Completeness of monthly health facility reporting	**94.5%** DHIS2	
Numerator: Number of monthly reports received from health facilities	**51,472** DHIS2	
Denominator: Number of health facility reports expected (i.e., number of facilities expected to report multiplied by the number of months considered)	**54,468** DHIS2	(4,539*12)

Implementing partner monitoring and evaluation
PMI contributes to a USAID/Uganda Mission-wide data collection mechanism for all implementing partners. This project assists partners in developing performance management plans, collecting and tracking data on key program indicators and conducting data quality assessments. The project also provides continuous external monitoring and evaluation of all Mission projects.

End-use verification survey

PMI, working with the NMCP, supported an EUV survey in early 2015. The EUV was conducted in 15 districts sampled from across the country. Results from the survey indicated a 13-point reduction in the percentage of OPD cases that are attributed to malaria from 36% in the 2014 EUV compared to 23% in the 2015 EUV. The survey also indicated a low testing rate of 61% despite high RDT availability, which was at 93% on the day of the visit. In addition, the survey also found that 81% of negative under-five cases were still given ACTs on the day of the survey, indicating that a large proportion of negative test patients are still treated for malaria. Further, the study found that at least one ACT pack was available on the day of the survey indicating that although pack sizes varied from facility to facility, patients could still be treated with an ACT. According to this EUV, 31% of the facilities visited were stocked out of SP on the day of the suvey. The EUV recommended enhanced support supervision, mentorship, and training of health workers on IMM and additional SBCC. PMI plans to incorporate these recommendations into the implementation of the new TBD malaria flagship project, the ongoing national SBCC mechanism, and regional integrated health programs.

Table 14. Surveillance, Monitoring, and Evaluation Data Sources

Data Source	Survey Activities	Calendar Year								
		2010	2011	2012	2013	2014	2015	2016	2017	2018
National-level household surveys	Demographic Health Survey (DHS)		X					(X)		
	Malaria Indicator Survey (MIS)					X				(X)
Health facility and other surveys	EUV survey	X	X			X	X	(X)	(X)	(X)
Malaria surveillance and routine system support	Support to malaria sentinel surveillance	X	X	X	X	X	X			
	Support to HMIS	X	X	X	X	X	X	(X)	(X)	(X)
Therapeutic efficacy monitoring	*In vivo* efficacy testing		X		X	X		(X)	(X)	(X)
Entomology	Entomological surveillance and resistance monitoring		X	X	X	X	X	(X)	(X)	(X)
	ITN durability monitoring						X	(X)	(X)	(X)
Other malaria-related evaluations	Northern Uganda Anemia and Parasitemia study				X					
Other data sources	Malaria Impact Evaluation					X				

*(X) indicates an activity is planned.

Plans and justification

PMI support will focus on improving the quality, completeness, timeliness, and use of HMIS malaria data at all levels—national, district, and facility. There are challenges in collecting data from a number of PFP facilities as there are no updated records either at central or district levels to locate and identify the PFP facilities, as they frequently change their names and locations. It has been reported by the Resource Center of the MoH that small and medium level PFP facilities are reluctant to report. However, PMI in collaboration with RBM partners will continue to support the Resource Center to update its database on PFP facilities. PMI funds will also support training of the persons involved in collection and analysis of malaria data at the subnational and health facility levels, as well as supportive supervision and data audits for malaria focal persons at the regional and district levels, and district

biostatisticians to strengthen HMIS/DHIS2 to include data from PFP as well. The district health management team is responsible for monitoring data collection, and analyzing and reporting data for all health facilities including PFP and PNFP facilities.

Though the long-term vision is to achieve quality HMIS functionality in the entire country, the districts that are currently receiving IRS and those where IRS has recently been withdrawn should be prioritized due to the need to more closely monitor changes in malaria burden in areas with changing vector control strategies. This is complicated, however, by the status of PMI mechanisms in Uganda (See Figure 3, Page 14).

As a result, PMI envisions that the activities will be carried out by a combination of mechanisms:

- In 43 (of 112) districts, primarily in the Central, Mid-West, and West Nile regions of the country where there is currently no IRS ongoing or planned in these districts, and which in general are considered to be high burden.
- Through five regional integrated health projects operating collectively in 63 districts in North-Acholi, North-Lango, Eastern, East-Central, and South West regions.

While it makes most sense technically and strategically to prioritize and launch HMIS strengthening activities in the regions where IRS is ongoing or has recently been withdrawn, the new implementation mechanisms in these regions are not yet in place. As a result, the Central, Mid-West, and West Nile regions will be the first areas to which these activities are targeted.

Proposed activities with FY 2017 funding: ($2,220,000)

- **Program monitoring and tracking system development at subnational level (*focus in 43 high burden districts in West Nile, Mid-west, and Central regions)***: PMI will continue to support the HMIS at subnational and health facility levels, in coordination with the overall USG support from USAID, PEPFAR, and CDC. PMI support will focus on collecting complete, accurate, and timely malaria data for public, PNFP and PFP facilities through the HMIS/DHIS2 at the district level. PMI funds will also support training of the persons involved in collection and analysis of malaria data at the subnational and health facility levels, as well as supportive supervision and data audits for malaria focal persons at the regional and district levels, and for district biostatisticians. ($600,000)
    - PMI will facilitate the scaling up of support to build malaria surveillance capacity using the experience of the current HMIS strengthening activities.
    - PMI will scale up malaria surveillance in additional facilities and provide support to districts.
    - PMI will pilot providing computers at the facility level for electronic HMIS data transfer from facilities to the district and continue to expand the use of electronic data at the facility level.
    - PMI will assess the status of new malaria indicators and identify barriers to inclusion.

  SM&E and case management activities will be linked together and implemented uniformly across all regions and will also link the scale up of the HMIS strengthening strategy with the scale up of case management activities in a phased approach.
- **Program monitoring and tracking system development at regional and district levels (*focus in 63 districts in North-Acholi, North-Lango, Eastern, East-Central, and South West regions)*:** With no overlap with the strengthening activities in the previously mentioned 43 high burden districts, PMI will support SM&E of malaria activities in five focus regions. This will be

achieved through coordinated training of health workers in integrated case management and SM&E. The case management and SM&E will be offered as a package during training, reporting and supportive supervision. Data managers and health workers will be trained to routinely collect malaria specific data, analyze, and utilize data for programmatic decision making. Health facilities will also be encouraged to supervise other lower level health facilities to ensure data reported is timely, accurate and valid, and encourage analysis, verification and feedback to reporing health facilities to bolster data owndership and improve data quality. PMI will ensure activities in the 43 districts and 63 districts respectively are harmonized and coordinated to the greatest extent possible. ($500,000)

- **Program monitoring and tracking system development at the national level:** PMI will continue to support the NMCP to improve their capacity to ensure data is being collected, analyzed and reported using HMIS/DHIS2 data. PMI will also continue to support and actively participate in the NMCP's M&E TWG to ensure coordination of data collection across partners. PMI in collaboration with RBM partners will support the Resource Center to update its database on PNFP and PFP facilities. PMI will continue to ensure that the NMCP's M&E Unit develops a strategic focus and use for decision-making and reporting. PMI will continue to support the quarterly malaria bulletin and M&E activities at the national level and provide technical assistance to strengthen malaria SM&E. In addition, PMI will provide supportive supervision, maintain and analyze databases for NMCP to track programmatic progress in key malaria intervention areas. ($250,000)
- **Malaria Indicator Survey 2018:** PMI will support a Malaria Indicator Survey in 2018, which will be funded over two years. FY 2017 funding will provide the initial proportion of funds for this activity. As was the case for the previous MIS, which benefited from DFID support, additional funding is anticipated from other donors. ($600,000)
- **Support for USG M&E Systems**: PMI will continue to support the USAID/Uganda Mission-wide M&E project that serves as the central data collection point for all implementing partners. ($50,000)
- **End-use verification survey**: PMI will conduct EUV surveys twice yearly in 75 randomly selected health facilities in ten districts to determine the availability of antimalarials at the end user level and how effective supply chain systems are in managing malaria commodities. The EUV surveys provide useful data on supply chain management and malaria case management, which can be used to strengthen the health care system through informed decision-making. ($100,000)
- **Evaluation of novel facility outreach based bednet distribution approach:** PMI will undertake an evaluation of the novel facility outreach bednet distribution approach being piloted in Uganda to ensure it is accomplishing its objectives. In hard to reach areas where there are no health facilities in proximity; schools will serve as facility outreach sites to distribute nets for routine net distribution. The evaluation will focus on issues such as coverage levels in the targeted communities, whether or not ITNs distributed through this channel are filling the necessary gaps, and determining whether or not this channel has an impact on ANC attendance in these areas. ($100,000)
- **Two TDYs from CDC/Atlanta**: CDC staff will provide technical support for SM&E activities including the HMIS. Two visits are planned to ensure adequate follow up of planned activities. ($20,000)

7. Operational research

NMCP/PMI objectives

The national M&E plan for malaria control in Uganda reinforces the need for OR, with an emphasis on therapeutic efficacy testing and insecticide susceptibility studies. Understanding the importance of OR as an integral strategy to identify gaps and weaknesses to improve program implementation and measure impact of malaria interventions, the NMCP restarted the Uganda Malaria Research Center (UMRC) in 2014. Although not fully organized and funded, PMI and partners continue to work with the NMCP and UMRC to collaborate and develop a prioritized OR list for Uganda. Despite this, studies completed and proposed with PMI support are identified jointly by the NMCP and have focused not only on identifying and assessing insecticide and drug resistance, but on improving effectiveness and scale-up of existing interventions, and improving program efficiency to address bottlenecks in malaria program interventions.

Progress since PMI was launched

Since 2006, Uganda has been involved in various OR studies that have helped inform malaria prevention and control programmatic policies. Prior to 2006, Uganda was implementing a home-based malaria treatment package, called Homapak, consisting of a combination of choloroquine and SP. The package was distributed through community drug distributors for treatment of fever in children under five within 24 hours of onset at home. With the change to AL as the first-line treatment for malaria, PMI supported a study to evaluate the process of rolling out community ACTs in one district. Results showed that there were some problems with the change in treatment schedule for AL and issues surrounding packaging for age groups. As a result, PMI supported the scale-up of supportive training and supervision and comprehensive monitoring of drug distributions.

Early OR done in Uganda on verbal autopsy was influential in PMI's decision to no longer use verbal autopsies to determine malaria-specific mortality. In 2007, PMI supported a prospective study to examine the validity of verbal autopsies for determining deaths due to malaria in children under five in three different epidemiological settings in Uganda. The cause of death was compared using results of a verbal autopsy survey (a follow-on to the 2006 DHS), and the "gold standard" of health facility medical records. Results showed the sensitivity of verbal autopsy procedures were variable. Sensitivity was 63% (95% CI: 46-80) in the high transmission setting of Tororo and 57% (95% CI: 43-71) in the medium transmission setting of Kampala. Specificity was high at both sites (89% and 90%, respectively). The positive predictive value for verbal autopsies was very different in Tororo and Kampala (83% vs 34%; difference 49% [95% CI: 31-67], $p<0.001$). In the low transmission setting of Kisoro, no deaths were attributable to malaria on review of the medical records. These results reiterated that verbal autopsies are not useful for all settings, and should not be used to determine malaria-specific mortality within acceptable bounds.

A PMI-core funded study was completed in 2011 to evaluate the effectiveness of a post-campaign door-to-door hang-up and communication intervention to increase net usage. The three-arm study compared net hang-up and utilization after: 1) two visits to households by a village health team; 2) three visits to households by a village health team; and 3) no visits. All three study arms showed an increase in net deployment from 56-63% at baseline to 67-74% at follow-up. Likewise, the three arms showed increases in the proportion of household members sleeping under the net the previous night of the follow-up survey. However, there was no statistical effect of household visits post-campaign on the hang-up or use of nets.

In 2014, a core-funded PMI study was conducted to understand the knowledge, attitudes, beliefs, and practices that motivate or impede net care and repair behaviors and to use these finding to inform an SBCC intervention. The evaluation showed that the SBCC program resulted in improved knowledge and attitudes of respondents, which impacted positively on net condition. This was likely the result of overall better care for the nets, as repairing did not contribute to improved net condition.

Progress during the last 12-18 months

During the past 12–18 months, an OR pilot study began to evaluate the improvement collaborative (IC) methodology applied to improving malaria surveillance data quality in five health facilities in Kayunga district in eastern Uganda. The IC methodology is an innovative, internally-driven, iterative quality improvement method that consists of the following major components: 1) formation of the internal quality improvement (QI) team at each participating health facility; 2) ongoing and diminishing over time mentoring to enhance the QI team's mastery of the QI methodology; and 3) shared learning to expedite the spread of the ideas and changes that work to other facilities.

In October 2015, with the receipt of final Institutional Review Board approvals, the OR pilot of the IC methodology began. PMI has completed the pre-intervention focus group discussions to explore perceptions of data reporting and use, and barriers for data quality. Pre-intervention, retrospective data abstraction has been conducted; as well as the first two of three learning sessions and implementation of the first two cycles of the IC intervention. Early results are already showing improved quality of data accuracy, validity and timeliness at the health facilities participating in the IC intervention. Quantitative and qualitative data analyses and coaching/mentoring of the facilities' QI teams is ongoing. The third and final learning session will be completed by December 2016.

Remaining activities focus on data collection and analysis for the post-intervention period which includes in-depth interviews and post-intervention focus group discussions. A harvest meeting in August 2016 is planned to develop the recommendations from the study. Expected outcomes include: 1) malaria control intervention stakeholders having a generalizable knowledge of the key barriers to quality malaria health facility-based data, and how IC can be used to improve the quality of malaria data reported through HMIS; 2) added insight into how the IC process works and identification of determinants of successful implementation of the IC approach; 3) higher quality health facility data reported through the HMIS, resulting in increased data usage by health facility workers and decision-makers.

Table 15. PMI-funded Operational Research Studies

Completed OR Studies			
Title	**Start date**	**End date**	
Home-based management of fever	2007	2007	$100,000
Validation of verbal autopsies	2007	2007	$300,000
Effectiveness of post-campaign door-to-door hang-up and communication interventions to increase ITN utilization	12/2010	07/2011	$230,000
Net Care and Repair Behaviors: Formative Research in Uganda	03/2013	04/2014	$175,000
Ongoing OR Studies	**Start date**	**End date**	
Title			
Improving the quality of health facility data to monitor trends in malaria burden: Effectiveness of the Improvement Collaborative Approach	05/2015	09/2016	$500,000
Title	**Start date (est.)**	**End date (est.)**	
A pilot intervention to assess the impact and cost-effectiveness of Proactive Community Treatment (ProAct) as a post-IRS withdrawal strategy.	2018	2020	$300,000

Plans and justification

Uganda's malaria epidemiology is undergoing rapid changes. As effective interventions were scaled up, the results of MIS 2014 showed an enormous reduction of malaria prevalence among children under five years of age compared to the 2009 MIS, and provided an opportunity to demonstrate the impact of IRS and other malaria interventions. Test positivity rate (by microscopy) in children under five decreased from 63% in 2009 to 7% in 2014 in 10 districts in northern Uganda that received PMI-supported IRS from 2010–2014, prompting transition of IRS to new high-burden districts in east-central Uganda. However, in April 2015, an upsurge in malaria cases occurred across Uganda that was particularly pronounced in the ten northern districts that had recently transitioned away from IRS. Despite the 2014 MIS reporting 90% ITN ownership and over 70% use (in addition to continuation of other malaria interventions), the malaria burden in many of the post-IRS districts returned to or exceeded pre-IRS levels. The factors for this post-IRS resurgence remain unclear. Few studies have systematically assessed the transition of IRS to ITNs and other control measures.

Given that several of the 14 current IRS districts (including the 5 that are DFID-supported) will likely conclude their IRS campaigns in the next several years (due to lack of funding, competing interests, etc.), more effective IRS transition strategies remain a critical need. To meet this need, PMI is proposing to pilot an intervention to assess the impact and cost effectiveness of Proactive Community Treatment (ProAct). Through ProAct, village health teams will conduct weekly door-to-door sweeps to identify people with fever, test them with RDTs, and treat positive cases. The primary research question will address whether or not implementing ProAct will maintain malaria incidence following withdrawal of IRS, compared to the implementation of standard iCCM. The secondary research question will evaluate the feasibility and cost effectiveness of this approach compared to implementing IRS. The prosposed study will be conducted in two districts scheduled for IRS withdrawal in calendar year 2018; with one district receiving the intervention (ProAct), while another district will serve as the control (standard

iCCM). ProAct will be performed using weekly "sweeps" by trained village health teams during the months of the traditional two seasonal peaks. Data will be collected for the last 12 months of IRS effectiveness (longevity to be determined by ongoing studies evaluating the insecticide Actellic CS), and the subsequent 12 months to compare the malaria incidence percent change in 2018 with the previous intervention and the control district annual incidences to measure effectiveness. Results from this study will help determine if a strategy based on ProAct is feasible and cost effective to maintain gains in malaria incidence compared to IRS.

Proposed activities with FY 2017 funding: ($300,000)

- **Support pilot of ProAct as an IRS transition strategy:** FY 2017 funds will support the first year of this pilot research study to assess the impact and cost effectiveness of ProAct compared to standard iCCM on malaria incidence as an IRS transition package. ($300,000)

8. Staffing and administration

Two health professionals serve as RAs to oversee PMI in Uganda, one representing CDC and one representing USAID. In addition, three Foreign Service Nationals (FSNs) work as part of the PMI team. All PMI staff members are part of a single interagency team led by the USAID Mission Director or his/her designee in country. The PMI team shares responsibility for development and implementation of PMI strategies and work plans, coordination with national authorities, managing collaborating agencies and supervising day-to-day activities. Candidates for RA positions (whether initial hires or replacements) will be evaluated and/or interviewed jointly by USAID and CDC, and both agencies will be involved in hiring decisions, with the final decision made by the individual agency.

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

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

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

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

Proposed activities with FY 2017 funding: ($1,750,000)

- **CDC staffing and administration**: Management costs and CDC resident advisor's salary. ($550,000)

- **USAID staffing and administration**: ($1,200,000)
    - Management and administration costs, USAID resident advisor and three FSN salaries, CDC and USAID resident advisors' ICASS costs. ($540,000)
    - Two percent program development and learning costs. ($660,000)

Table 1: Budget Breakdown by Mechanism

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

Mechanism	Geographic Area	Activity	Budget ($)	%
TBD - IRS Project	National	Entomological surveillance and monitoring	200,000	38.4%
		Insecticide resistance monitoring	400,000	
	Eastern, East Central, Northern	Support for IRS	12,073,000	
GHSC - PSM	National	Procurement of ITNs	4,536,000	22.8%
		Procurement of RDTs	1,000,000	
		Procurement of ACTs	2,000,000	
MAPD	43 high burden districts in Central, West Nile, and Mid-west regions	Distribution of ITNs through EPI/ANC and facility distribution	1,315,200	16.7%
		Distribution of ITNs through school-based pilot program	312,000	
		Strengthen delivery of comprehensive IPTp services as part of integrated FANC at ANC	300,000	
		Strenthen malaria diagnostic capacity in the public sector	1,000,000	
		Strengthening case management in public sector	1,000,000	
		Capacity building support to NMCP	100,000	
		Comprehensive SBCC in high burden districts	300,000	
		Program monitoring and tracking system development at subnational level	600,000	

		Program monitoring and tracking system development at the national level	250,000	
		Evaluation of novel facility outreach based distribution approach	100,000	
	Three Sites	Monitor drug resistance (efficacy) of antimalarial drugs	250,000	
EGPAF - South West regional project	South West region	Routine ITN distribution	84,000	1.0%
		Strengthen delivery of comprehensive IPTp services as part of integrated FANC at ANC	18,000	
		Strenthen malaria diagnostic capacity in the public sector	60,000	
		Strengthening case management in public sector	120,000	
		Program monitoring and tracking system development at subnational level	60,000	
TBD - Regional health projects	East, East Central, Northern (Acholi & Lango)	Routine ITN distribution	280,800	6.9%
		Strengthen delivery of comprehensive IPTp services as part of integrated FANC at ANC	132,000	
		Strenthen malaria diagnostic capacity in the public sector	440,000	
		Strengthening case management in public sector	880,000	
		Comprehensive SBCC in high burden districts	100,000	
		Program monitoring and tracking system development at subnational level	440,000	
GEMS-II	Eastern, East Central, Northern	External environmental compliance assessment	30,000	0.09%

CDC IAA	National	Two technical assistance visits by CDC entomology staff for planning and monitoring IRS activities.	29,000	2.8%
		Three TDYs for priority focus on case management and iCCM including 1 program review visit.	30,000	
		Training of two new PHFP/FETP students every year to support the NMCP's program planning, management, M&E unit	300,000	
		Management, CDC Resident Advisor's salary.	550,000	
		Two TDYs by CDC staff to provide technical support for SM&E activities including the HMIS.	20,000	
UHMG	National	Support for comprehensive IPTp services in private sector	100,000	1.4%
		Support private sector providers and their networks to strengthen malaria treatment	250,000	
		Comprehensive SBCC in the private sector	100,000	
Cardo Emerging Markets - PHS Project	East Central	Support improved diagnostics in the private sector (large companies)	160,000	0.48%
MSH - UHSC	National	Strengthen pharmaceutical supply chain management	300,000	1.2%
		End-use verification survey	100,000	
Intrahealth - SHRH	National	Strenthen HRH systems for improved health care quality and health workforce management practices at NMCP, DHMTs and facility levels.	200,000	1.6%
Peace Corps	National	Support placement, training, and small-scale malaria projects for three PCVs and their counterparts at the community level.	30,000	

FHI 360/Communication for Health Commodities	National	Strengthen health communication at the national level. Includes coordination, revision, and production of essential SBCC materials for districts, and all implementing partners. IPC and social mobilization at lower levels.	300,000	
TBD - MIS	National	Initial funding for 2018 MIS	600,000	1.8%
QED - the learning contract	National	Support for USG M&E Systems including PMI data collection, dissemination, reporting, DQAs and partner meetings, and track IEC/BCC implmenetation status	50,000	0.15%
TBD - OR IRS Study	Select IRS districts	One year of pilot research study to assess the impact of an intensive IRS transition package on test positivity rates.	300,000	0.91%
USAID		USAID staffing, management, CDC Resident Advisor's ICASS costs.	540,000	3.6%
		2% program development and learning costs.	660,000	
Total			**33,000,000**	**100%**

Table 2: Budget Breakdown by Activity

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

Proposed Activity	Mechanism	Budget		Geographic Area	Description
		Total $	Commodity $		
PREVENTIVE ACTIVITIES					
VECTOR MONITORING AND CONTROL					
Entomologic monitoring and insecticide resistance management					
Entomological surveillance and monitoring	TBD - IRS Project	200,000	20,000	National	Procure entomological supplies and monitor malaria mosquito bionomics in each of four districts, one former IRS, one non-IRS and two IRS districts to include PSCs, light traps, and HLCs monthly. Monitor IRS insecticide decay rates in four IRS districts. Sub-sample mosquitoes for PCR identification to species.

Insecticide resistance monitoring	TBD - IRS Project	400,000	20,000	National	Alternate yearly monitoring of four of eight eco-epidemiological zones to test for insecticide resistance to WHO-recommended IRS insecticides. Include intensity and resistance mechanism testing. Monitor four IRS zone districts to four classes of insecticide along with resistance mechanism and intensity testing of pyrethroid insecticides once a year and procure resistance monitoring supplies.
Subtotal Ento monitoring		600,000	40,000		
Insecticide-treated Nets					
Procurement of ITNs	GHSC - PSM	4,536,000	4,536,000	National	Procurement of 1.575 million ITNs (800,000 for delivery through ANC and EPI; 175,000 school-based distribution; and 600,000 facility outreach distribution). Costs include procurement, shipping, transportation, country clearances, and warehousing.
Mixed distribution of ITNs through multiple outlets	MAPD	1,315,200	0	43 high burden districts in Central, Mid-west, and West Nile regions	Distribution of 1,096,000 ITNs (496,000 ITNs through ANC/EPI; and 600,000 ITNs through facility outreach)

School-based ITN distribution	MAPD	312,000	0	43 high burden districts in Central, Mid-west, and West Nile regions	Distribution of approximately 175,000 ITNs through school-based program pilot
Routine ITN distribution	EGPAF - South West regional project	84,000	0	South West	Distribution of 70,000 ITNs through ANC/EPI.
Routine ITN distribution	TBD - Regional health projects	280,800	0	East, East Central, Northern (North Acholi and North Lango)	Distribution of approximately 234,000 ITNs through ANC/EPI.
Subtotal ITNs		**6,528,000**	**4,536,000**		
Indoor Residual Spraying					

Support for IRS	TBD - IRS Project	12,073,000	8,500,000	East, East Central, Northern (North Acholi and North Lango)	One round of long lasting indoor residual spraying in nine eastern districts in Uganda, targeting approximately 850,000 structures and three million people. If selected for the NgenIRS project, PMI will add two IRS districts bringing IRS to a total of 11 districts. Cost includes all components of IRS: insecticide procurement, IRS equipment and supplies, logistics, environmental assessments, QA monitoring, and SBCC activities specific to IRS.
External environmental compliance assessment	GEMS-II	30,000	0	East, East Central, Northern (North Acholi and North Lango)	External environmental compliance inspection visit
Technical assistance	CDC IAA	29,000	0	National	Two technical assistance visits by CDC entomology staff for planning and monitoring IRS activities. Support includes testing and training for resistance mechanisms and resistance intensity in An. gambiae and An. funestus, training in CDC bottle assays, bionomics studies in IRS and former IRS districts, and mosquito surveillance and resistance training to MoH personnel.

Subtotal IRS		**12,132,000**	**8,500,000**		
SUBTOTAL VECTOR MONITORING AND CONTROL		**19,260,000**	**13,076,000**		
Malaria in Pregnancy					
Strengthen delivery of comprehensive IPTp services as part of integrated FANC at ANC	MAPD	300,000	0	43 high burden districts in Central, Mid-west, and West Nile regions	Support NMCP and DHTs in the implementation of the new IPTp policy guidelines; training of newly recruited health workers in MIP; support to address barriers in the low IPTp uptake; continuing IPTp focused supportive supervision.
Strengthen delivery of comprehensive IPTp services as part of integrated FANC at ANC	EGPAF - South West regional project	18,000	0	South West	Support DHTs in the implementation of the new IPTp policy guidelines; training of newly recruited health workers in MIP; support to address barriers in the low IPTp uptake; continuing IPTp focused supportive supervision.
Strengthen delivery of comprehensive IPTp services as part of integrated FANC at ANC	TBD - Regional health projects	132,000	0	East, East Central, Northern (North Acholi and North Lango)	Support DHTs in the implementation of the new IPTp policy guidelines; training of newly recruited health workers in MIP; support to address barriers in the low IPTp uptake; continuing IPTp focused supportive supervision.

Support for comprehensive IPTp services in private sector	UHMG	100,000	0	National	Promote IPTp by training of health workers in small- to medium-sized PFPs in order to promote a comprehensive package of IPTp services. These services will include DOT, early detection of MIP, and encourage regular reporting of services provided.
Subtotal Malaria in Pregnancy		**550,000**	**0**		
SUBTOTAL PREVENTIVE		**19,810,000**	**13,076,000**		
CASE MANAGEMENT					
Diagnosis and Treatment					
Procurement of RDTs	GHSC - PSM	1,000,000	1,000,000	National	Procure 2 million RDTs (1,800,000 RDTs for PNFP and 200,000 for iCCM in 8 districts).
Procurement of ACTs	GHSC - PSM	2,000,000	2,000,000	National	Procure 1.6 million ACTs (1,475,000 ACTs for PNFP and 125,000 for iCCM in 8 districts).
Strenthen malaria diagnostic capacity in the public sector	MAPD	1,000,000	0	43 high burden districts in Central, Mid-west, and West Nile regions	Suppport case management trainings that focus on appropriate diagnosis, QA/QC, and supportive supervision for diagnostics.

Strenthen malaria diagnostic capacity in the public sector	EGPAF - South West regional project	60,000	0	South West	Support case management training on appropriate diagnosis and supportive supervision for diagnostics.
Strenthen malaria diagnostic capacity in the public sector	TBD - Regional health projects	440,000	0	East, East Central, Northern (North Acholi and North Lango)	Support case management training on appropriate diagnosis and supportive supervision for diagnostics.
Support improved diagnostics in the private sector (large companies)	Cardo Emerging Markets - PHS Project	160,000	0	East Central	PMI will support training on the use of RDTs, supervision, and quality assurance (for both RDTs and microscopy) in the for-profit corporate private sector through existing partnerships with 18 companies through the 1:1 matching contribution program for malaria.
Strengthening case management in public sector	MAPD	1,000,000	0	43 high burden districts in Central, Mid-west, and West Nile regions	Strengthening case management, including parasitological diagnosis of uncomplicated and severe malaria in public, and PNFP facilities. Provide supportive supervision, in collaboration with the NMCP and DHMTs, for case management, including in-service training in 43 districts. Includes support for iCCM in 8 districts.

Strengthening case management in public sector	EGPAF - South West regional project	120,000	0	South West	Strengthening case management, including parasitological diagnosis of uncomplicated and severe malaria in public, and PNFP facilities. Provide supportive supervision, in collaboration with the NMCP and DHMTs, for case management, including in-service training in the South West district.
Strengthening case management in public sector	TBD - Regional health projects	880,000	0	East, East Central, Northern (North Acholi and North Lango)	Strengthening case management, including parasitological diagnosis of uncomplicated and severe malaria in public, and PNFP facilities. Provide supportive supervision, in collaboration with the NMCP and DHMTs, for case management, including in-service training in the TBD districts.
Support private sector providers and their networks to strengthen malaria treatment	UHMG	250,000	0	National	Support private clinics and drug shops including enhanced collaboration between the public sector district health teams with the private sector associations to ensure that health workers and drug owners receive routine supportive supervision for proper clinical care of children with fever.
Monitor drug resistance (efficacy) of antimalarial drugs	MAPD	250,000	0	Three sites	Conduct TES in three sites, with three drugs (including DP) every year.

Technical assistance	CDC IAA	30,000	0	National	3 TDYs for priority focus on case management and iCCM including 1 program review visit.
Subtotal Diagnosis and Treatment		**7,190,000**	**3,000,000**		
Pharmaceutical Management					
Strengthen pharmaceutical supply chain management	MSH - UHSC	300,000	0	National	Technical assistance to forecast national requirements for essential medicines and coordinate national supply plan. Monitor and improve the ordering and distribution system for PMI-procured ACTs and RDTs. TA to strengthen the lower level supply chain. Leverage more than $5 million from other health funding streams (including PEPFAR) to strengthen the entire supply chain.
Subtotal Pharmaceutical Management		**300,000**	**0**		
SUBTOTAL CASE MANAGEMENT		**7,490,000**	**3,000,000**		
HEALTH SYSTEM STRENGTHENING / CAPACITY BUILDING					

Capacity building support to NMCP	MAPD	100,000	0	National	To complement DFID capacity building component to NMCP, RBM partnership support, coordination of partners meetings and support to pre-service training through updating pre-service training curriculum to ensure that it reflects the updated malaria treatment guidelines and policies, and strengthening of a forum to share teaching notes across training institutions.
PHFP/FETP	CDC IAA	300,000	0	National	Support training of two new PHFP/FETP students every year to support the NMCP's program planning, management, M&E unit, and strengthening malaria surveillance at the national and subnational levels.
Strengthen human resources for health	Intrahealth - SHRH	200,000	0	National	Strengthening HRH systems for improved health care quality and health workforce management practices at NMCP, DHMTs and facility levels.
Peace Corps	Peace Corps	30,000	0	National	Support placement, training, and small-scale malaria projects for three PCVs and their counterparts at the community level.
SUBTOTAL HSS & CAPACITY BUILDING		**630,000**	**0**		

SOCIAL AND BEHAVIOR CHANGE COMMUNICATION					
Comprehensive SBCC in high burden districts	MAPD	300,000	0	43 high burden districts in Central, Mid-west, and West Nile regions	Support comprehensive SBCC for correct and consistent use and care of ITNs, increasing IPTp uptake, and improving early and accurate diagnosis of malaria at facility and community levels.
Comprehensive SBCC in high burden districts	TBD - Regional health projects	100,000	0	East, East Central, Northern (North Acholi and North Lango)	Support comprehensive SBCC for correct and consistent use and care of ITNs, increasing IPTp uptake, and improving early and accurate diagnosis of malaria at facility and community levels.
Comprehensive SBCC in the private sector	UHMG	100,000	0	National	Support SBCC campaign to reinforce the role of small and medium private health providers; work through mass media and interpersonal communication to create demand for malaria prevention and treatment services; improving net use, and promote case management by providers in the iCCM districts

National level SBCC activities and IPC and social mobilization at lower levels	FHI 360/Communication for Health Commodities	300,000	0	National	Increase adoption of healthy behaviors for malaria prevention and treatment through coordination, revision, and production of essential SBCC materials for districts, and all implementing partners. Strengthen health communication at the national level in addition to limited IPC and social mobilization at lower levels, including in South West region.
SUBTOTAL SBCC		**800,000**	**0**		
SURVEILLANCE, MONITORING, AND EVALUATION					
Program monitoring and tracking system development at subnational level	MAPD	600,000	0	43 high burden districts in Central, Mid-west, and West Nile regions	Support HMIS at subnational and health facility levels. Support training of the persons involved in collection and analysis of malaria data at the subnational and health facility levels, as well as supportive supervision and data audits for malaria focal persons at the regional and district levels, and for district biostatisticians.
Program monitoring and tracking system development at regional and district levels	EGPAF - South West regional project	60,000	0	South West	Support M&E of malaria activities in the South West; specifically data analysis at facility and district levels.

Program monitoring and tracking system development at regional and district levels	TBD - Regional health projects	440,000	0	East, East Central, Northern (North Acholi and North Lango)	Support SM&E of malaria activities in the TBD/Regional health projects; specifically data analysis at facility and district levels.
Program monitoring and tracking system development at the national level	MAPD	250,000	0	National	PMI will continue to support the M&E unit at the NMCP and the HMIS/DHIS2 systems related to malaria to improve their capacity for data collection, analysis, and reporting. Supportive supervision, sustain databases for NMCP to track programmatic progress in key malaria intervention areas.
2018 Malaria Indicator Survey	TBD - MIS	600,000	0	National	Initial funding for 2018 MIS.
Support for USG M&E Systems	QED - the learning contract	50,000	0	National	PMI data collection, dissemination, reporting, DQAs and partner meetings, and track IEC/BCC implmenetation status.

End-use verification survey	MSH - UHSC	100,000	0	National	Conduct health facility surveys to monitor the availability of key malaria commodities at end user level. Review available data from existing health facility surveys to rationalize the data colected by various partners. Explore the potential for harmonizing the data collection tools and avoid duplicated efforts.
Evaluation of novel facility outreach based distribution approach	MAPD	100,000	0	Select districts	Evaluation of the novel facility outreach distribution approach being piloted in Uganda to ensure it is accomplishing its objectives.
Technical assistance	CDC IAA	20,000	0	National	Two TDYs by CDC staff to provide technical support for SM&E activities including the HMIS.
SUBTOTAL SM&E		**2,220,000**	**0**		
OPERATIONAL RESEARCH					
OR study to evaluate an innovative IRS transition strategy	TBD - OR IRS Study	300,000	0	Select districts	PMI will support year one of this pilot research study to assess the impact of two IRS transition strategies on malaria incidence.
SUBTOTAL OR		300,000	0		
IN-COUNTRY STAFFING AND ADMINISTRATION					
CDC	CDC IAA	550,000	0		Management, CDC Resident Advisor's salary.
USAID staffing and administration	USAID	540,000	0		USAID staffing, management, CDC Resident Advisor's ICASS costs.

USAID 2% program development and learning costs	USAID	660,000	0		2% Mission requirement for program development and learning costs.
SUBTOTAL IN-COUNTRY STAFFING		**1,750,000**	**0**		
GRAND TOTAL		**33,000,000**	**16,076,000**		