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

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PRESIDENT'S MALARIA INITIATIVE

ZAMBIA

Malaria Operational Plan FY 2017

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ABBREVIATIONS and ACRONYMS

ACT	Artemisinin-based combination therapy
AIDS	Acquired Immuno-Deficiency Syndrome
AL	Artemether-lumefantrine
ANC	Antenatal care
CDC	Centers for Disease Control and Prevention
CCT	Clinical care teams
CHA	Community health assistant
CHAZ	Churches Health Association of Zambia
CHW	Community health worker
DCHO	District Community Health Office
DCMO	District Community Medical Offices
DDT	Dichloro-diphenyl-trichloroethane
DFID	U.K. Department for International Development
DHA-PQ	Dihydroartemisinin-piperaquine
DHIS2	District Health Information System 2
DHS	Demographic and Health Survey
EMLIP	Essential Medicines Logistics Improvement Program
EPI	Expanded Program on Immunizations
EUV	End-use verification
FANC	Focused antenatal care
FBO	Faith-based organization
FY	Fiscal year
GHI	Global Health Initiative
Global Fund	Global Fund to Fight AIDS, Tuberculosis and Malaria
GRZ	Government of the Republic of Zambia
HIV	Human Immunodeficiency Virus
HMIS	Health management information system
iCCM	Integrated community case management
IEC	Information, education, communication
IMCI	Integrated management of childhood illnesses
IPTp	Intermittent preventive treatment for pregnant women
IRS	Indoor residual spraying
ITN	Insecticide-treated mosquito net
IVM	Integrated Vector Management
LMU	Logistics Management Unit
M&E	Monitoring and evaluation
MACEPA	Malaria Control and Evaluation Partnership in Africa
MIP	Malaria in pregnancy
MIS	Malaria indicator survey
MoH	Ministry of Health
MOP	Malaria Operational Plan
MSL	Medical Stores Limited
NMCC	National Malaria Control Centre

NMCP	National Malaria Control Program
NMSP	National Malaria Strategic Plan
NGO	Non-governmental organization
OPD	Outpatient department
OR	Operational research
OTSS	Outreach training and supportive supervision
PEPFAR	President's Emergency Plan for AIDS Relief
PMI	President's Malaria Initiative
RDT	Rapid diagnostic test
SBCC	Social behavior change communication
SM&E	Surveillance, monitoring, and evaluation
SMAG	Safe Motherhood Action Groups
SP	Sulfadoxine-pyrimethamine
UNDP	United Nations Development Program
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization
WHOPES	World Health Organization Pesticide Evaluation Scheme

I. EXECUTIVE SUMMARY

When it was launched in 2005, the goal of the President's Malaria Initiative (PMI) was to reduce malaria-related mortality by 50% across 15 high-burden countries in sub-Saharan Africa through a rapid scale-up of four proven and highly effective malaria prevention and treatment measures: insecticide-treated mosquito nets (ITNs); indoor residual spraying (IRS); accurate diagnosis and prompt treatment with artemisinin-based combination therapies (ACTs); and intermittent preventive treatment for 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.

Zambia was selected as a PMI focus country in fiscal year (FY) 2007.

This FY 2017 Malaria Operational Plan presents a detailed implementation plan for Zambia, based on the strategies of PMI and the National Malaria Control Program (NMCP). It was developed in consultation with the NMCP and with the participation of national and international partners involved in malaria prevention and control in the country. The activities that PMI is proposing to support fit in well with the National Malaria Control strategy and plan and build on investments made by PMI and other partners to improve and expand malaria-related services, including the Global Fund to Fight AIDS, Tuberculosis, and Malaria (Global Fund) malaria grants. This document briefly reviews the current status of malaria control policies and interventions in Zambia, 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 Zambia is $25 million. PMI will support the following intervention areas with these funds:

Entomologic monitoring and insecticide resistance management:

PMI supported the NMCP to develop a National Insecticide Resistance Management Plan (2014–2017) that calls for periodic, evidence-based, scheduled rotation of insecticides used in the IRS program. Previous insecticide resistance surveys have reported resistance in the two major malaria vector species, *An. gambiae* and *An. funestus*. The most recent susceptibility tests conducted in 2016 showed both vectors are still mostly resistant to pyrethroids throughout Zambia. With FY 2017 funding, PMI will continue to support routine IRS entomologic monitoring in Zambia in six existing sites in five provinces and will use every opportunity to include other entomological monitoring activities being undertaken in Zambia.

Insecticide-treated nets (ITNs):

The NMCP plans to conduct a nationwide mass ITN distribution campaign in 2017 with the goal of achieving universal coverage. The previous mass campaign was conducted in 2013-2014. The mass distribution campaign will be a collaborative effort between the NMCP, PMI, Global Fund, and other partners. PMI also supports routine ITN distribution systems in Zambia through ANC and EPI clinics, as well as through the expansion of routine distribution channels to include school-based and community-based distribution. With FY 2017 funding, PMI will focus on the procurement and distribution of ITNs through ANC/EPI, to maintain high coverage that will be achieved by the mass ITN distribution campaign. Support will also be provided to expand the school-based and community routine distribution channels in the four target provinces. PMI will continue to monitor the durability of ITNs distributed during the 2017 mass campaign. In order to maximize ITN usage, PMI will continue to support SBCC activities, prioritizing local over national activities.

Indoor residual spraying (IRS):

In FY 2015, PMI supported the NMCP Indoor Residual Spraying (IRS) operations in 25 PMI focus districts (9 in Eastern Province, 7 in Muchinga Province, and 9 in Northern Province). PMI supported an additional 14 districts, with funding from U.K. Department for International Development (DFID) (10 in Luapula and 4 in Central Province). Approximately 519,598 structures were sprayed using organophosphate insecticide out of the targeted 547,548 structures (95% coverage), protecting more than 2 million people (approximately 10% of the Zambian population). DFID support for IRS in the 15 districts culminated at the end of calendar year 2015. Through the UNITAID grant, PMI will support IRS in Luapula Province in addition to the three other provinces. With funding from the Zambian government and the Global Fund, the NMCP conducted IRS in 43 non-PMI supported districts using organophosphates. In 2015, PMI supported enumeration of IRS eligible structures using satellite mapping and targeting IRS using HMIS data in four provinces (Eastern, Luapula, Muchinga, and Northern Provinces). In 2016, targeted IRS will continue in those four provinces. With FY 2017 funding, PMI will cover the cost of IRS in the PMI-focus 4 provinces where approximately 542,184 structures will be targeted, protecting more than 2 million people.

Malaria in pregnancy (MIP):

PMI supports three main strategies to address malaria in pregnancy: IPTp, ITNs, and case management. The 79% national coverage of two doses of IPTp obscures substantially lower rates in rural areas and among poorer women. Two major barriers to increasing three-dose IPTp coverage are late attendance of

women for ANC and stockouts of SP. Because the availability of SP is critical for IPTp, PMI continues to invest in the Essential Medicines Logistics Improvement Program (EMLIP) to improve distribution of malaria commodities. PMI also supported training of provincial- and district-level clinical care teams in providing supervision for IPTp, training of healthcare workers in IPTp, and social and behavior change communication activities to encourage early and frequent ANC attendance to receive IPTp. With FY 2017 funding, PMI will support supervision and training of health workers in the updated NMCP guidelines for IPTp in four high malaria burden provinces and communication-related activities promote healthy and effective malaria control behaviors during pregnancy.

Case management:

Diagnosis and Treatment

NMCP Guidelines for the Diagnosis and Treatment of Malaria in Zambia recommend parasitological diagnosis for all suspected malaria cases where confirmatory capacity is available. Recently, diagnostic availability has increased with the procurement of over 17 million and 22 million rapid diagnostic tests (RDTs) in 2014 and 2015, respectively. In 2015, the Government of the Republic of Zambia (GRZ) procured 10 million RDTs. In addition PMI, DFID, Global Fund, and CHAZ supported procurement and distribution of 2.2 million, 4 million, 3.2 million, and 2.8 million RDTs, respectively. In 2016, PMI procured over 400,000 RDTs and reagents and supplies for microscopy. PMI also supported the training of clinical and laboratory personnel in the use of diagnostic tools, and training of national, provincial, and district level staff in providing outreach training and support supervision (OTSS) for quality assurance of malaria diagnostics. With FY 2017 funding, PMI will procure 3 million RDTs and reagents and supplies for microscopy. PMI will continue to strengthen OTSS of health workers, together with quality control of laboratory diagnosis.

In 2015, PMI procured over 4 million ACTs for the treatment of malaria in health facilities and in the community. In addition, 1.6 million ACTs were procured with DFID funding (using PMI's procurement mechanism). The GRZ procured over 4 million ACT treatments and Malaria No More procured 501,300 ACTs. In 2015 there was no central level stockout of RDTs or ACTs reported. However, facility level stockouts were reported in a number of health facilities.

In 2016, approximately 16 million ACTs are expected with PMI providing over 3 million, DFID 3.9 million, Global Fund 5.3 million, and GRZ 3.9 million. With FY 2016 funding, PMI will procure 3.3 million ACT treatments. In addition, PMI will provide support to increase prompt and effective treatment for uncomplicated malaria at the health facility level and support efforts to expand malaria treatment at the community level through integrated community case management (iCCM).

Pharmaceutical Management

PMI and other partners continued to provide support to the MOH, Medical Stores Limited (MSL), and other stakeholders to improve the collection, management, and use of logistics data through the roll-out of an electronic Logistics Management Information System (eLMIS). In 2016, the eLMIS facility version was rolled out to 250 health facilities. In addition the redesigned EMLIP system was rolled out to 38 additional districts bringing the total trained districts to 106 districts (100%). The Logistics Management Unit (LMU) at the Ministry of Health (MoH) recorded a 97% reporting rate and improved commodity facility level stock availability (100%) for malaria commodities in EMLIP districts for the period January to June 2016. In addition, according to monthly reports sent to the LMU from health facilities, the percentage of health facilities stocked out of all presentations of ACT fell from 3% in April 2015 to 0% in February 2016. PMI continued to provide technical assistance at the national level

through participation in working groups related to procurement and supply chain management. With FY 2017 funding, PMI will continue to support strengthening the GRZ's commodities supply and logistics systems at central, provincial, district, and health center level.

Health systems strengthening and capacity building:

PMI supports a broad array of health system strengthening activities which cut across intervention areas, such as training of health workers, supply chain management and health information systems strengthening, drug efficacy monitoring, and NMCP capacity building. PMI has been providing technical assistance and capacity building at the NMCP including surveillance, monitoring, and evaluation (SM&E) and community health worker training in iCCM. In addition, PMI used mapping technology, paired with health facility case data, to identify malaria hot spots within districts that were targeted for IRS. With FY 2017 funding, PMI will continue to support NMCP capacity building as well as support one Zambian national through the Field Epidemiology Training Program.

Social and behavior change communication (SBCC):

The NMCP is in the process of developing the 2017-2021 national malaria SBCC strategy in alignment with the National Malaria Strategic Plan and the National Health Strategic Plan. However, the NMCP'S SBCC strategy for 2011–2014 continues to be in effect until a new strategy document is developed. The NMCP's SBCC strategy for 2011–2014 has clear behavior change objectives for each of the malaria control interventions, and also identifies barriers to the desired behaviors. PMI supports an integrated community-based communications focusing on promotion of malaria prevention, diagnosis, appropriate treatment, and nutrition for pregnant women and children under five. In addition, PMI is supporting the MOHto strengthen malaria SBCC by developing and implementing community-level SBCC activities, which focus on malaria care seeking and prevention. With FY 2017 funding, PMI will support SBCC implementation for malaria at both the national level and four target provinces (Eastern, Luapula, Muchinga, and Northern Provinces) at health facility and community levels to increase acceptance of IRS, increase ANC attendance with higher IPTp uptake, to improve health care seeking behavior, and to increase demand for and acceptance of malaria diagnostics.

Surveillance, monitoring and evaluation (SM&E):

Nationwide, the health information management system (HMIS) has been upgraded to the District Health Information System 2 (DHIS2) platform. Malaria surveillance systems were developed for Southern Province at the facility level using the malaria rapid reporting system, mobile phones, and geographic information system. Health care workers report malaria cases, laboratory testing, and drug availability by web-enabled cell phones on a weekly basis. PMI will support the restart of the enhanced surveillance in Lusaka District; although it was transitioned over to the Lusaka District Health Office, additional PMI funding is needed. The end-use verification survey collects data on malaria commodities every month from facilities to assess availability. Surveillance, monitoring, and evaluating malaria prevention and control activities will rely on a combination of routine malaria data through the HMIS and surveys. With FY 2017 funds, PMI will provide support to strengthen routine malaria data collection at the community, health facility, district, and provincial levels through the HMIS. PMI will also support the next MIS, which will be conducted in 2018.

Operational research (OR):

The NMCP in Zambia has many ongoing and planned research activities with a number of different partners. In FY 2015, PMI supported the NMCP to develop an operational research roadmap to better map out current and future operational research activities and goals. The roadmap will be used to help coordinate current research activities and to align future research activities with the goals of the NMCP. PMI is currently supporting a comparison-control trial to determine optimal IRS strategies in the limited-resource environment of Muchinga Province. As of 2011, Zambia emphasizes universal coverage of ITNs with targeted IRS. Historically, vector control was split, with IRS reserved for urban and peri-urban areas while ITNs were targeted to rural areas. An OR study would seek to shed light on how to determine where IRS would be best targeted in combination with universal ITN coverage.

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 for 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 Zambia

Zambia has a 2016 estimated population of approximately 15.9 million people (Central Statistics Office), with 40% residing in urban and 60% residing in rural areas. The country consists of 10 provinces and 106 districts (redistricting in 2015 increased the number of districts from 72 original districts). According to the 2014 Zambia Demographic and Health Survey (DHS), under-five mortality has fallen from 192 deaths per 1,000 live births in 1992 to 75 deaths per 1,000 live births in 2014. The literacy rate of 15 to 24 year olds stands at 81%. Despite these positive trends, Zambia continues to face major challenges. There continues to be an economic divide between the urban and rural populations, with the proportion of population living in extreme poverty at 13.1% for urban and 57.7% for rural areas (MDG Progress Report, Zambia, 2013).

Malaria transmission in Zambia occurs year-round with peak transmission during the rainy season, between November and April. Malaria remains endemic but with wide variation in prevalence of infection across districts (2015 Malaria Indicator Survey (MIS)). In Zambia, malaria is caused by the four main *Plasmodium* species that infect humans, with *Plasmodium falciparum* accounting for 98% of all infections. *Anopheles (An.) gambiae s.i.,* and *An. funestus* are the major vectors. All ten provinces of Zambia are endemic for malaria with over 90% of the population at risk.

Overall, the number of reported malaria cases (clinical and confirmed) to the National Health Management Information System (HMIS) increased from 4,260,235 to 5,094,073 (2010-2015) with HMIS reporting rates averaging about 70%. The reported number of outpatient department (OPD) visits increased from 13,697,003 in 2009 to 21,668,763 in 2012 and 19,006,047 in 2015. Between 2010 and 2015, substantial declines were recorded with reported inpatient malaria deaths (Figure 1) with the annual case fatality rate approximately 2%. Zambia has a large cadre of active CHWs that provide treatment for malaria at community level particularly in the rural areas, although the treatment data from CHW are generally not reported in the national HMIS. A 2014 PMI-supported review showed that data challenges were the main reasons for the mismatch between reported cases in HMIS and antimalarial and RDT consumption data. Therefore, the real annual malaria burden is higher than that reported in the HMIS. The MoH and partners including PMI are making efforts to strengthen HMIS reporting.

Malaria parasite prevalence by smear microscopy from national Malaria Indicator Surveys (MIS) declined from 22% in 2006 to 15% in 2012, but has increased slightly during the period of 2012 – 2015 (15%–19%) (Table A and Figure 2). Severe anemia for children under the age of five years (measured at <8 g/dL) also declined from 14% in 2006 to 7% in 2012 and 6.4% in 2015. This was most notable in the provinces that reported higher ITN coverage compared to 2010, and in the higher prevalence area of Luapula Province. It is important to note that these national-level numbers are not representative of all the trends across the country and there are documented variations between provinces and districts. For instance, between 2012 and 2015 the largest relative decline in parasite prevalence by microscopy was observed in Eastern Province (25%–13%). The declines in microscopy prevalence in Southern Province (8% to 0.6%) were also encouraging. However, between 2012 and 2015 increases in microscopy prevalence was observed in seven provinces (Central, Copperbelt, Lusaka, Muchinga, Northern, North-Western, and Western) while Luapula Province remained relatively unchanged (32%).

Figure 1. Health Management Information System Malaria Deaths (all ages) by province, Zambia, 2009-2015

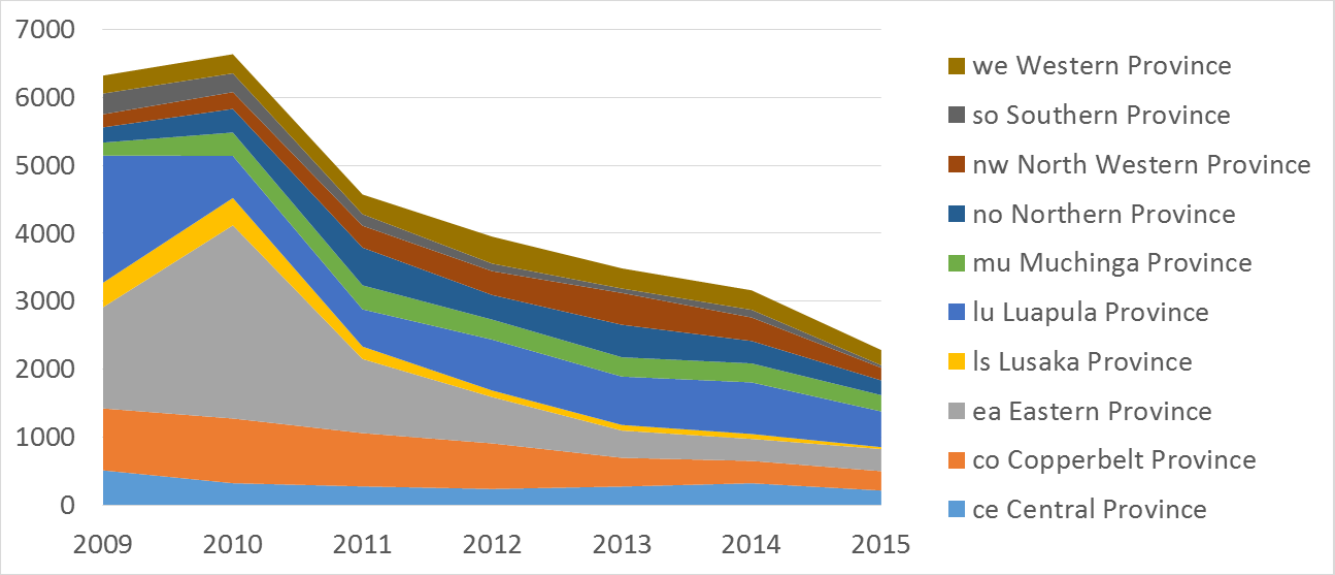


Figure 2. Map showing percentage malaria parasite prevalence (microscopy), among children under five years of age, by province (2015 MIS)

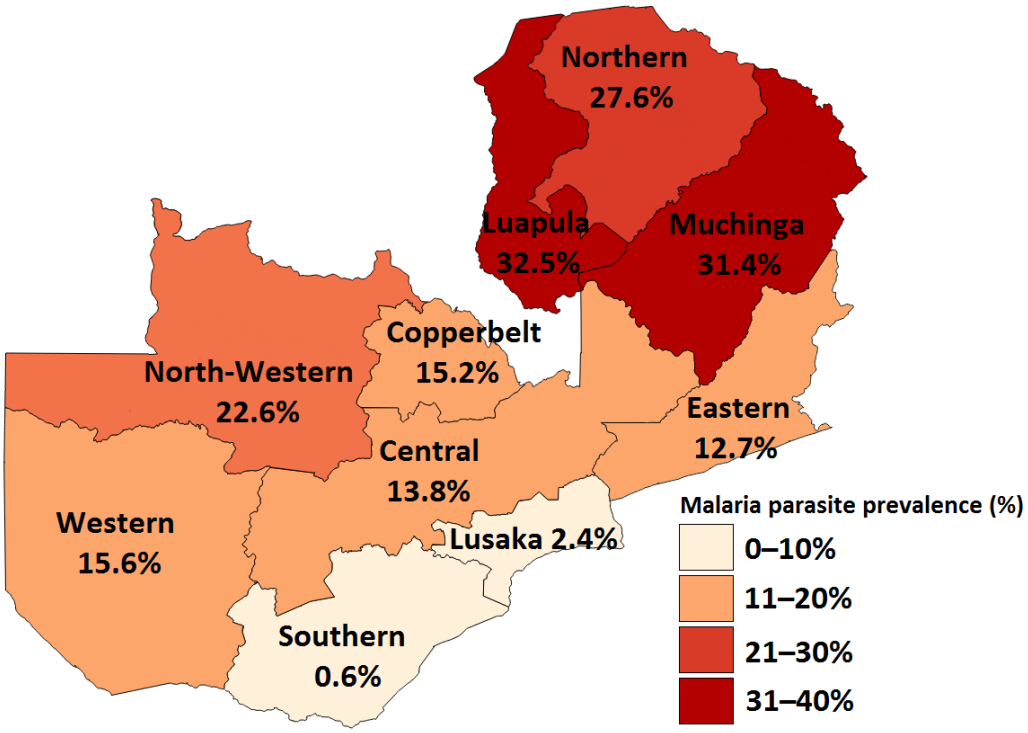


Table A: Malaria parasite prevalence in children under five years of age by background characteristic from Malaria Indicator Surveys (MIS). Rapid Diagnostic Test (RDT) results in parenthesis, 2006-2015

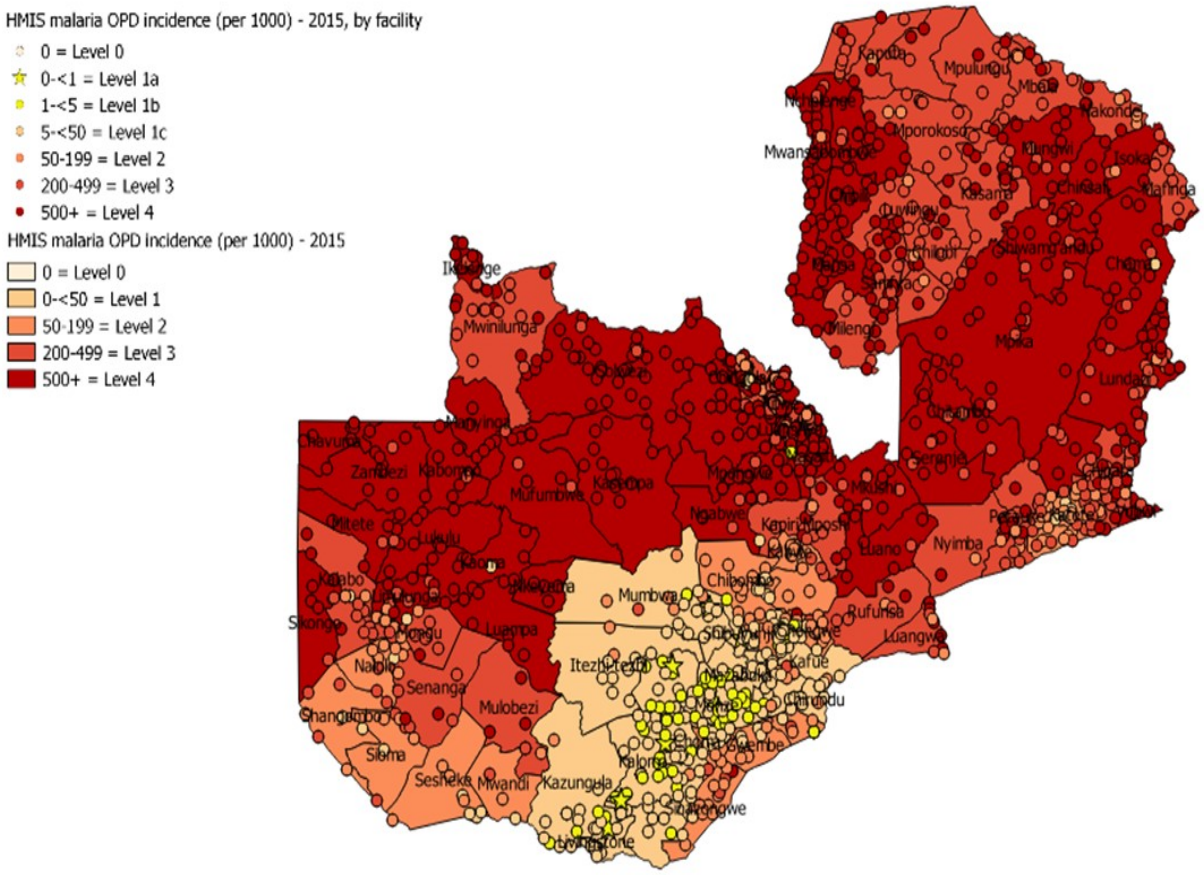
Background characteristic	Percentage with malaria parasites read by microscopy 2006	Percentage with malaria parasites read by microscopy 2008	Percentage with malaria parasites read by microscopy (or RDT) 2010	Percentage with malaria parasites read by microscopy (or RDT) 2012	Percentage with malaria parasites read by microscopy (or RDT) 2015
Age (in months)					
<12	12.6	3.6	5.7 (12.5)	9.8 (15.9)	12.9 (20.7)
12–23	22.8	10.2	12.1 (21.9)	11.7 (24.4)	15.1 (24.6)
24–35	25.3	11.2	20.1 (30.8)	16.3 (31.7)	22 (33.6)
36–47	26.3	13.8	21.4 (36.1)	16.2 (35.0)	22.9 (36.2)
48–59	24.4	12.5	22.0 (33.7)	19.6 (38.0)	23.5 (37.2)
Sex					
Male	21.9	10.5	16.9 (26.8)	14.7 (29.1)	20.5 (32)
Female	21.8	9.8	15.1 (26.7)	15.1 (30.0)	18.4 (29.5)
Residence					
Urban	6.4	4.3	5.2 (12.0)	3.7 (8.2)	6 (12.8)
Rural	27.8	12.4	20.4 (32.7)	20.2 (39.7)	23 (35.5)
Province					
Central	27.7	7.9	9.4 (11.5)	8.5 (12.8)	13.8 (16.9)
Copperbelt	12.4	9.9	12.1 (24.0)	4.7 (17.4)	15.2 (26.2)
Eastern	21.0	9.3	22.0 (50.1)	25.3 (51.1)	12.7 (21.2)
Luapula	32.9	21.8	50.5 (63.4)	32.1 (56.0)	32.5 (55.5)
Lusaka	0.8	1.7	0.0 (1.4)	0.0 (4.8)	2.4 (3.5)
Muchinga				19.4 (33.5)	31.4 (35.6)
Northern	35.3	12.0	23.6 (32.6)	23.7 (47.3)	27.6 (43.8)
North-Western	24.3	15.2	6.1 (17.3)	16.9 (32.5)	22.6 (40.6)
Southern	13.7	7.9	5.7 (12.2)	8.4 (10.0)	0.6 (1.5)
Western	11.1	2.6	5.1 (11.8)	12.6 (34.3)	15.6 (21.3)
Wealth index					
Lowest	30.4	13.1	29.2 (42.1)	27.4 (49.5)	32.6 (50.8)
Second	27.6	13.6	21.8 (36.2)	21.1 (42.8)	24.2 (42)
Middle	23.4	12.1	12.1 (22.9)	17.9 (35.1)	19.7 (32.4)
Fourth	7.5	6.7	9.4 (20.6)	13.9 (27.7)	14.3 (20)
Highest	6.2	2.8	1.4 (4.4)	1.8 (5.8)	5.6 (6.9)
Total	**22.1**	**10.2**	**16.0 (26.7)**	**14.9 (29.5)**	**19.4 (30.7)**

In North-Western Province, the HMIS data also shows a trend similar to the MIS of increasing malaria incidence during the period of 2011–2014, but with a slight decline in 2015. The malaria burden continues to be highest in Luapula, Muchinga, and Northern Provinces and because of this, these provinces are areas PMI continues to focus efforts. In Central, Copperbelt, and Western Provinces malaria cases (reported confirmed and clinical) have increased since 2011. Nationally, since 2010, reported malaria inpatients and deaths have declined 52% and 65%, respectively; this could be due in part to improved case management at the health facility level. The following table (Table B) shows HMIS reporting of cases (clinical and confirmed), inpatients, and deaths during the period of 2010–2015. In 2015, the national malaria incidence was 352.4 per 1,000 population (Figure 3).

Table B: Health Management Information Systems (HMIS) reported cases, deaths and inpatients, 2010-2015 (Reporting rate as of 2015 at 70%)

Period	2010	2011	2012	2013	2014	2015
Cases (clinical and confirmed)						
HMIS malaria cases total clinical	2,963,809	2,213,760	2,091,028	2,609,059	2,013,093	999,195
HMIS malaria cases total confirmed	1,296,426	2,210,288	2,672,548	2,723,832	3,974,249	4,094,878
HMIS malaria cases total	4,260,235	4,424,048	4,763,576	5,332,891	5,987,342	5,094,073
HMIS malaria confirmation rate	30%	50%	56%	51%	66%	80%
Inpatient cases and deaths						
HMIS malaria inpatient cases total	213,639	188,575	166,192	163,974	150,133	107,802
HMIS malaria deaths	6,640	4,573	3,954	3,485	3,162	2,337
Inpatient case fatality rate	3%	2%	2%	2%	2%	2%
Inpatient cases and deaths (<5yr)						
HMIS malaria inpatient cases total, <5yr	121,428	103,975	87,819	85,185	68,228	52,477
HMIS malaria deaths, <5yrs	3,955	2,709	2,277	2,055	1,733	1,297

Figure 3: Health Management Information System (HMIS) reported malaria incidence (per 1,000) by district during 2015



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

In 2015, the Zambian Government again re-aligned the responsibilities for the management and coordination of the health sector. All health functions have reverted to the Ministry of Health (MoH). Previously, health functions were shared between the MoH and the Ministry of Community Development Mother and Child Health. MoH functions are coordinated through structures that have been established at all levels:

- *National Level*: The MoH Headquarters in Lusaka is responsible for overall coordination and management of the health sector.

- *Provincial Level*: Provincial Health Offices (PHOs) are responsible for coordinating health service delivery in their respective provinces.

- *District Level*: District Health Offices (DHOs) are responsible for coordinating health service delivery at district and community level.

- *Community Level*: At the community level, neighborhood health committees have been established, to facilitate linkages between the communities and the health system.

Government-run health facilities, which provide the majority of the health care in Zambia, offer a basic health care package of high-impact interventions. Services included in the basic health care package are provided free-of-charge or on a cost-sharing basis, depending on the location and level of the system. In rural districts these services are free. The following are the levels of health care facilities offered throughout the country; malaria control interventions are delivered in all of them.

- Community
- Health posts (district level)
- Health centers (district level)
- Level 1 hospitals (district level), Level 2 hospitals (provincial level), and Level 3 hospitals (central level)

District medical officers (DMOs) are responsible for provision of services at the district and community level. The second- and third-level hospitals are referral or specialized hospitals. However, due to resource constraints, there is generally a variation between what the levels are supposed to provide and what they actually do provide. Table C shows the breakdown by type of facility and provider.

The DMOs provides overall planning, coordination, and monitoring of malaria activities within their districts. Activities such as implementation of IRS, ITN distribution, and malaria case management at level 1 hospital, health centers, and community levels are implemented through DMOs. The National Malaria Control Centre (NMCC) provides technical but not operational assistance at these levels.

Health posts are intended to cover 500–1,000 households. A newly created cadre of community health assistants (CHAs), trained for one year and part of the government payroll, has been deployed at some health posts throughout the country. At the community level, community health workers (CHWs) provide malaria diagnostic and treatment services through the integrated community case management (iCCM) program. Health centers, staffed by a clinical officer, nurse, or environmental health technician, serve a catchment area of approximately 10,000 residents. In 2010, it was estimated that in urban areas, approximately 99% of households are within five kilometers of a health facility, compared to 50% in rural areas. In 2012, Lusaka Province had the highest number of health facilities (294) followed by Southern (253), and the Copperbelt Province (250). Muchinga, the newly created province, had the lowest number of health facilities (99). The current number of health facilities is likely greater than in 2012, but the MoH has not conducted a more recent health facility assessment.

In addition to the MoH, the Churches Health Association of Zambia (CHAZ), parastatal organizations, private clinics, and traditional healers also provide health care in Zambia. CHAZ is an inter-denominational umbrella organization for coordinating church health services in Zambia that has 116 health facilities (Table C) including hospitals, health centers, health posts, and community-based organizations, and 11 health training schools, most of which are staffed by Government of Zambia health workers. Altogether, these institutions are responsible for over 50% of formal health services in the rural areas of Zambia and about 30% of health care in the country as a whole.

There are over 250 for-profit private health facilities (Table C) in Zambia, most of which are clinics attending to outpatients only, and are located mainly in the urban districts. In addition, private mining companies provide preventive and curative medical services for their workers and families, as well as

surrounding communities in some cases. Several of the larger mining companies, such as Konkola and Mopani Copper Mines, have been carrying out IRS for a number of years within and around their compounds.

Table C: Summary of health facilities by type and provider, Zambia, 2012

Health Facilities, by type	Total	Percentage of Facilities
Health Posts	307	16%
Rural Health Centers	1,131	58%
Urban Health Centers	409	21%
Level 1 Hospitals	84	4%
Level 2 Hospitals	19	<1%
Level 3 Hospitals	6	<1%
Total	**1,956**	**100%**
Health Facilities, by provider		
MOH	1,590	81%
Mission	116	6%
Private	250	13%
Total	**1,956**	**100%**

Source: Ministry of Health, 2012

4. National malaria control strategy

The 2011-2015 National Malaria Strategic Plan (NMSP) underwent a midterm review in 2013. As a result of the review, the NMSP was extended by an additional year to run through 2016. The vision of the revised NMSP was to achieve progress towards a "malaria-free Zambia" through equity of access to quality-assured, cost-effective malaria prevention and control interventions close to the household. The NMSP aims to achieve the following three goals by 2016: 1) reduce malaria incidence by 75% from the 2010 baseline; 2) reduce malaria deaths to near zero and reduce all-cause child mortality by 20%; and 3) establish and maintain five "malaria-free zones" in Zambia. The Government of Zambia (GRZ) is in the process of developing a follow on strategic plan for 2017-2021 with the ambitious goal of eliminating malaria.

The major objectives of the new strategic plan include the following:

- To clear infections and interrupt transmission of malaria.
- To document infection, illness, severe disease and mortality burden reduction in districts, provinces and nationally and assess progress to elimination.
- To develop, strengthen, and maintain national political support, technical and operational capacity and financial resources for malaria elimination.
- To prevent the re-emergence of malaria transmission due to importation in districts where it had been eliminated.

The NMCP aims to strengthen national-, provincial-, and district-level capacity to plan, manage, and implement malaria activities; address human resource needs; ensure that there is an established planning and forecasting framework for projecting funding needs and tracking health expenditures; develop

capacity at all levels of the health system to manage the storage and distribution of malaria commodities; and reinforce coordination among partners. The elimination strategy aims to target different areas and implement activities in a step by step approach based on transmission levels. The NMCP will aim to scale up vector control interventions and timely diagnosis and treatment, as well as increase coverage of three doses of sulfadoxine-pyrimethamine (SP) for IPTp and mass drug administration (MDA) in certain circumstances. In addition, the strategic plan notes the need to strengthen information systems for better quality and timely reporting of infections through establishing a robust surveillance, monitoring and evaluation (SM&E) framework, which will allow for detecting and investigating individual cases in the communities. The strategic plan recognizes that only when all of these important steps are developed and in place can elimination be possible.

5. Updates in the strategy section

The NMCP is planning to conduct a Malaria Program Review of the 2011–2016 NMSP in 2016 and has developed a *"Strategy to Move from Accelerated Burden Reduction to Malaria Elimination in Zambia."* The new strategic plan proposes to achieve elimination by clearing infections and interrupting transmission of malaria and documenting infection, illness, severe disease, and mortality. The plan addresses the importance of developing, strengthening, and maintaining national political support, technical and operational capacity, and financial resources for malaria elimination. Additionally, the plan states that progression to elimination will also be achieved through preventing the re-emergence of malaria transmission due to importation in districts where it had been eliminated. Zambia's Elimination strategy will involve a two-pronged approach, targeting different areas based on transmission levels. For districts with more than 50 cases per 1,000 population, the focus will be on reducing burden and health system strengthening. In contrast, for districts with less than 50 cases per 1,000 population surveillance will be the key intervention. In addition, a step-wise approach will be used within each of these areas that will evolve from scale-up to elimination interventions based upon the burden of disease.

The Government of Zambia conducted a presidential by-election in January 2015 following the death of President Michael Sata in October 2014. President Edgar Lungu was elected and took office on January 25, 2015. On August 11, 2016, Zambia will conduct a general election to elect the President and National Assembly and vote on amendments to the Bill of Rights. The outcome of this election may have an impact on the program and personnel during 2017.

6. Integration, collaboration, and coordination

The NMCP and its collaborating partners maintain regular communications and coordinate efforts through routine partners' meetings and technical working groups on IRS, SBCC, SM&E, case management, ITNs, and operational research. PMI will also engage in the Monitoring and Evaluation Technical Working Group at the Ministry of Health and collaborate on the CHA programming, which ensures quality community-based health care for malaria. All partners contributed to the development of the new 2011-2015 National Malaria Strategic Plan (NMSP), annual action plans, and the 2015- 2017 Global Fund Concept Note. PMI will continue to work with the Ministry of Health to contribute to both the National Elimination Strategy and the National Health Strategic Plan being undertaken alongside the National Development Plan (NDP), being led by the Vice President.

The MoH is embarking on a new strategic plan, to cover 2016-2021. The new national health strategic plan (NHSP) will form an important component of the NDP, which is being spearheaded and

coordinated by the Vice President; the NDP is being developed alongside the NHSP. While drastic changes are expected in the NHSP, early signals indicate that a few areas will receive particular emphasis. The areas of focus are expected to include: improved planning and monitoring of health investments at district level through the Medium Term Strategic Framework (MTSF) that ensures to the maximum degree possible that all investments are 'on plan' and 'on budget;' monitoring and evaluation linked to health results and development impact; and cross-sector coordination and collaboration, within Health and across Ministries. The Malaria Elimination Strategy is being developed alongside the NDP and NHSP.

In 2014, a universal campaign was conducted that distributed over 8 million ITNs nationwide. The campaign was a collaborative effort between the NMCP, PMI, DFID, Global Fund, MACEPA, and other partners. PMI contributed approximately 1 million ITNs for the campaign. In 2017/2018, a replenishment of the universal ITN campaign will be undertaken with NMCP, PMI, and the Global Fund coordinating and contributing to the effort. A total of 9.5 million nets will be procured and distributed during the next campaign.

PMI, as part of a larger U.S. Government program, will work to ensure that every opportunity is maximized to reach women and children. To that end, PMI will work with other Health Office staff and work across other activities to integrate appropriate and evidence-based interventions that assist PMI in reaching its goals. Further, PMI will continue to meet regularly with the WHO, United Nations Development Program (UNDP), United Nations Children's Fund (UNICEF), MOH, Global Fund, MACEPA, Clinton Health Access Initiative (CHAI), Isdell Flowers Foundation, and Bill and Melinda Gates Foundation staff to ensure coordination of efforts and utilization of lessons learned from the various partners to improve implementation of malaria interventions. Table D, below, provides a breakdown of the projected financial contributions of the different organizations to the malaria program over the course of the years 2015–2017.

Table D: Malaria Financial Contribution (2015-17), ($USD)

Funding Source	2015	2016	2017	TOTAL
GRZ	$28,000,000	$28,500,000	$29,000,000	$85,500,000
Global Fund	$18,876,269	$19,271,102	$43,476,805	$81,624,176
PMI	$24,000,000	$24,000,000	$24,000,000	$72,000,000
DFID	$7,200,000	0	0	$7,200,000
WHO & UNICEF	$300,000	$300,000	$300,000	$900,000
MACEPA	$2,500,000	0	0	$2,500,000
Private Sector	$1,124,832	$1,181,074	$1,240,128	$3,546,034
TOTAL FUNDING	**$82,001,101**	**$73,252,176**	**98,016,933**	**253,270,210**

Sources:

1) *Global Fund Concept Note Application (2015-17)*
2) *Global Fund Grant Performance Report Zambia (MOH and CHAZ) – 19 February 2015)*

7. PMI goal, objectives, strategic areas, and key indicators

Under the PMI Strategy for 2015-2020, the U.S. Government's goal is to work with PMI-supported countries and partners to further reduce malaria deaths and substantially decrease malaria morbidity, towards the long-term goal of elimination. Building upon the progress to date in PMI-supported countries, PMI will work with NMCPs and partners to accomplish the following objectives by 2020:

1. Reduce malaria mortality by one-third from 2015 levels in PMI-supported countries, achieving a greater than 80% reduction from PMI's original 2000 baseline levels.

2. Reduce malaria morbidity in PMI-supported countries by 40% from 2015 levels.

3. Assist at least five PMI-supported countries to meet the World Health Organization's (WHO) criteria for national or sub-national pre-elimination.[1]

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

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

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

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

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

8. Progress on coverage/impact indicators to date

At the national level, the 2015 MIS (Table E) showed encouraging malaria prevention and control coverage. Key findings are as follows:

- 77% of households have at least one ITN, the majority of which are long-lasting insecticidal nets.
- 28.9% of households reported that they had received IRS during the past 12 months.
- 80.6% of households reported availability of at least one form of vector control method (IRS or ITN) with 25.3% having both.
- On the night before the survey, 58.9% of children under age five slept under an ITN. 55.1% of all household members slept under an ITN.
- 90.1% of women who had their last birth in the five years preceding the survey reported taking one dose of IPTp during their pregnancy; 60.8% of women reported taking three or more doses of IPTp.
- 92.3% of children with a fever in the two weeks preceding the survey who took antimalarial drugs were treated with an ACT.

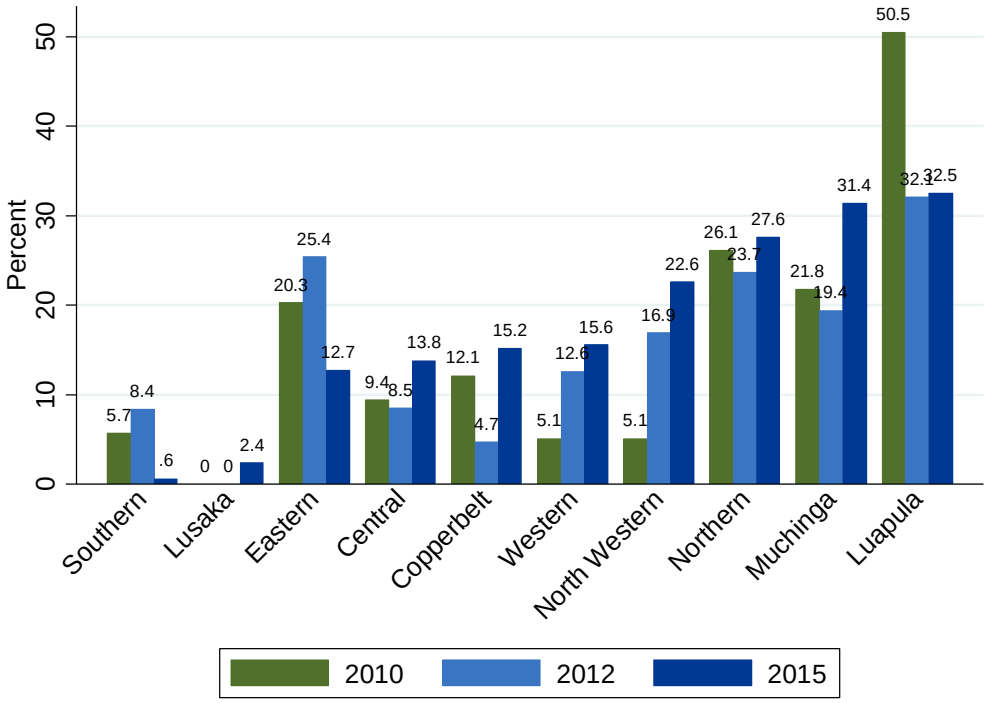
However, progress is not homogeneous throughout the country. Household ownership of at least one ITN ranges from 93.8% in Eastern Province to 51.7% in Lusaka Province, and the percentage of households with at least one ITN per sleeping space varied from 84% in Eastern Province to 49% in Northern Province. Eastern Province's high ITN coverage likely contributed to a large drop in parasite prevalence. Lusaka Province parasite prevalence continues to remain very low and the prevalence in both Southern and Eastern Provinces improved. Between 2012 and 2015 malaria prevalence has remained stable in Luapula Province, but has increased in six provinces (Central, Copperbelt, Muchinga, Northern, North-Western, and Western), as seen in Figure 4, below.

Table E: Evolution of Key Malaria Indicators in Zambia from 2006 to 2015

Indicator	2006 MIS[1]	2008 MIS[2]	2010 MIS[3]	2012 MIS[4]	2014 DHS[5]	2015 MIS[6]
% Households with at least one ITN	38	62	64	68	73	77
% Households with at least one ITN per sleeping space	NA	33	34	55	27	63.9
% Children under five who slept under an ITN the previous night	24	41	50	57	41	58.9
% Pregnant women who slept under an ITN the previous night	25	43	46	58	41	NA
% Households in targeted districts protected by IRS	26	43	23	25	28	28.9
% Children under five years old with fever in the last two weeks for whom advice or treatment was sought	60	64	31	25	75	NA
% Children under five with fever in the last two weeks who had a finger or heel stick	NA	11	17	32	49	35.5
% Children receiving an ACT among children under five years old with fever in the last two weeks who received any antimalarial drugs	18	30	76	85	91	92.3
% Women who received two or more doses of IPTp during their last pregnancy in the last two years	59	66	70	72	73	78.8

1. Zambia Ministry of Health, 2006. Zambia National Malaria Indicator Survey 2006. Lusaka, Zambia: Ministry of Health.
2. Zambia Ministry of Health, 2008. Zambia National Malaria Indicator Survey 2008. Lusaka, Zambia: Ministry of Health.
3. Zambia Ministry of Health, 2010. Zambia National Malaria Indicator Survey 2010. Lusaka, Zambia: Ministry of Health.
4. Zambia Ministry of Health, 2012. Zambia National Malaria Indicator Survey 2012. Lusaka, Zambia: Ministry of Health.
5. Zambia Ministry of Health, 2014. Zambia Demographic Health Survey 2014, Lusaka, Zambia: Ministry of Health.
6. Zambia Ministry of Health, 2015. Zambia National Malaria Indicator Survey 2015. Lusaka, Zambia: Ministry of Health.

Figure 4: MIS reported malaria parasite prevalence (microscopy) among children under five years of age



9. Other relevant evidence on progress

The last nationwide health facility survey was in 2011. It provides insight into the preparedness of health facilities to deliver quality malaria services. The survey included 148 health facilities, of which 41 were hospitals, 38 were urban health centers, 39 were rural health centers and 30 were health posts. A total of 219 health workers were observed and 1,290 patients were assessed, of which 872 were suspected of having malaria. Key findings are:

- Testing for malaria was generally available; highest in hospitals (93%) and lowest in health posts (63%).
- The first-line drug also was available; most frequently in hospitals (95%) than in health posts (73%)
- Approximately one-third of health workers had not received an in-service training in the last five years.
- Testing of suspected malaria reached 76% in children under five years of age.
- Seventy-three percent of “true positives” (after re-examination) received appropriate antimalarial treatment.

A program of enhanced surveillance and active community case detection and laboratory confirmation in Lusaka District has shown low levels of transmission. In 2011–2012, 395 index cases (17% of all cases of confirmed malaria) that had not traveled or had malaria in the month prior to testing were identified. A total of 5,795 persons associated with the index cases were tested in their homes or nearby homes. Only 91 (1.6%) of these neighborhood members were positive by RDT. Because of the success

of the program, the Lusaka District health officials had planned to take over funding in all 29 clinics, but unfortunately they were unable to continue the program at the same level due to lack of funding.

A PATH-supported study, which took place 2014 to 2016 to evaluate mass drug administration (MDA) and focal mass drug administration (fMDA) in a population of approximately 300,000 showed that MDA targeting the whole population with dihydroartemisinin-piperaquine (DHAP), when added to the standard of care (enhanced case management, ITNs, IRS with an organophosphate, and robust surveillance including rapid reporting and case investigation), resulted in reductions in infection prevalence. The findings suggest MDA could be a promising strategy for accelerating toward malaria elimination in certain transmission settings.

III. OPERATIONAL PLAN

1. Vector monitoring and control

NMCP/PMI objectives

Zambia's strategic plan includes an integrated vector management (IVM) strategy. The two main interventions for vector control are the use of ITNs, as well as spraying eligible structures with IRS. The strategy aims to strengthen the IVM system to include supplemental interventions, such as larviciding. Although larval control is part of the IVM system, it has not been widely implemented. Additional activities under the IVM system are vector surveillance and insecticide resistance monitoring. PMI supports the distribution of ITNs, IRS, vector surveillance and insecticide resistance monitoring. PMI does not support larviciding.

The use of ITNs for the prevention of malaria is a primary vector control strategy. Zambia's Strategic Plan calls for universal net coverage, which is defined as "ensuring all sleeping spaces in targeted households are covered by an ITN." ITNs continue to be the main intervention for achieving sustained vector control for all people at risk of malaria infection in the country. In order to achieve universal coverage, a number of delivery methods have been adopted. These include free mass distribution of ITNs and routine distribution to pregnant women and children under-five years of age through ANC and EPI clinics. Further, in 2016, the NMCP plans to roll-out community-based distribution, as well as school-based distribution to enhance routine distribution efforts.

An additional strategy for vector control is IRS. The NMCP/PMI collaboration aims to provide access to evidence-based vector control to 100% of households and persons at risk in targeted areas. IRS is recognized as the only intervention available to manage insecticide resistance through rotation among different classes of WHOPES-approved insecticides, making entomological monitoring an indispensable component of an evidence-based resistance management program.

The new national strategic plan for 2017–2021 continues on the previous vector control strategy with the goal of attaining universal coverage of all sleeping spaces in all targeted households with ITNs and attaining operational coverage of over 90% of targeted structures with IRS in a timely manner, prior to peak transmission season. According to the WHO, IRS is the preferred vector control intervention as part of an insecticide resistance management strategy in areas where there is documented resistance to pyrethroids. Otherwise, IRS will be a key addition to ITNs in specifically targeted densely populated areas. On-going entomologic surveillance will continue to be used to monitor vector habits, densities, and sensitivities to the insecticides being deployed.

The NMCP is using other partners for small-scale larviciding projects in Lusaka and have considered other areas throughout Zambia, but has not requested PMI support.

a. Entomologic monitoring and insecticide resistance management

Progress since PMI was launched

Insecticide resistance to available IRS chemicals continues to pose a threat to the IRS program. PMI supported the NMCP to develop a National Insecticide Resistance Management Plan (2014–2017) that calls for periodic, evidence-based, scheduled rotation of insecticides used in the IRS program. The plan recommends that:

1) Pyrethroids should no longer be used for IRS, until local insecticide resistance monitoring demonstrates that the high levels of pyrethroid resistance have declined in the vector population;
2) Although organophosphates are still effective for IRS in Zambia, the NMCP should consider rotating to DDT in 2015 or 2016 as a means of managing resistance to organophosphates;
3) The NMCP needs to continue to monitor resistance at each sentinel site twice a year, before and after spraying;
4) Going forward, aim to rotate insecticide in all areas informed by monitoring data and should include a combination of OP, DDT, and carbamates.

However, these preliminary recommendations are subject to review and modification based upon practical implications of use of particular insecticides, especially DDT. In addition, with PMI assistance, the MOH/NMCC developed a more complete map of insecticide resistance in the country. Previous insecticide resistance surveys have reported resistance in the two major malaria vector species, *An. gambiae* and *An. funestus*. The most recent susceptibility tests conducted in 2016 showed both vectors are still mostly resistant to pyrethroids throughout Zambia. Resistance to bendiocarb (a carbamate) was found for *An. funestus*, particularly in areas of Luapula Province. The current insecticide susceptibility test results are provided in Figures 5 and 6, below.

Figure 5. Insecticide susceptibility status *Anopheles funestus* s.l., 2016

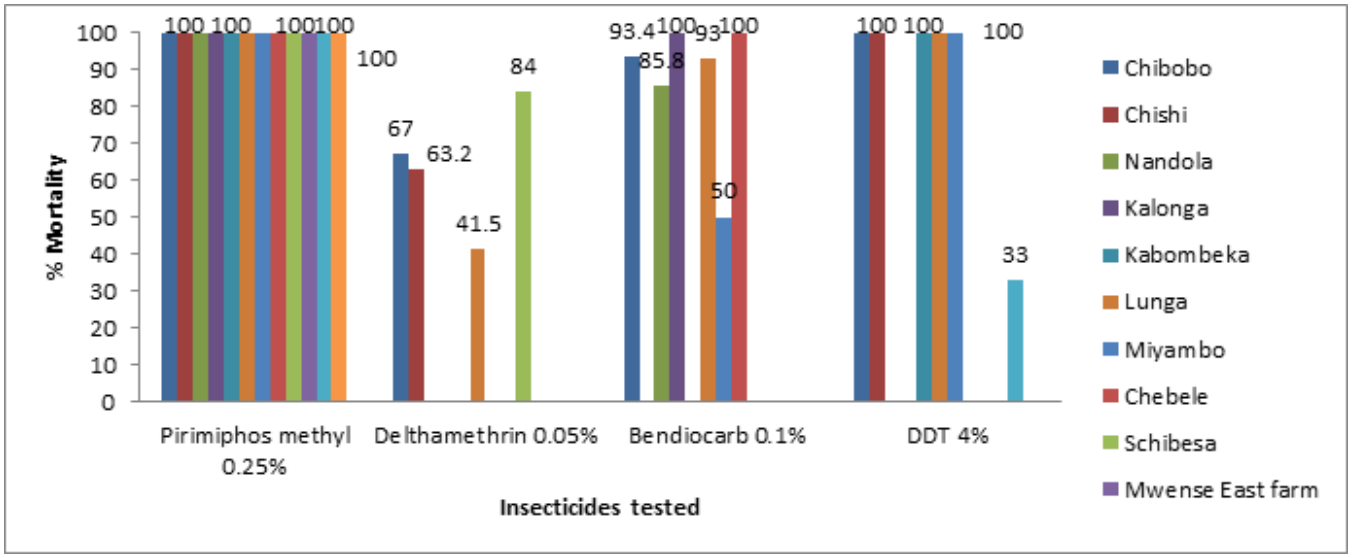
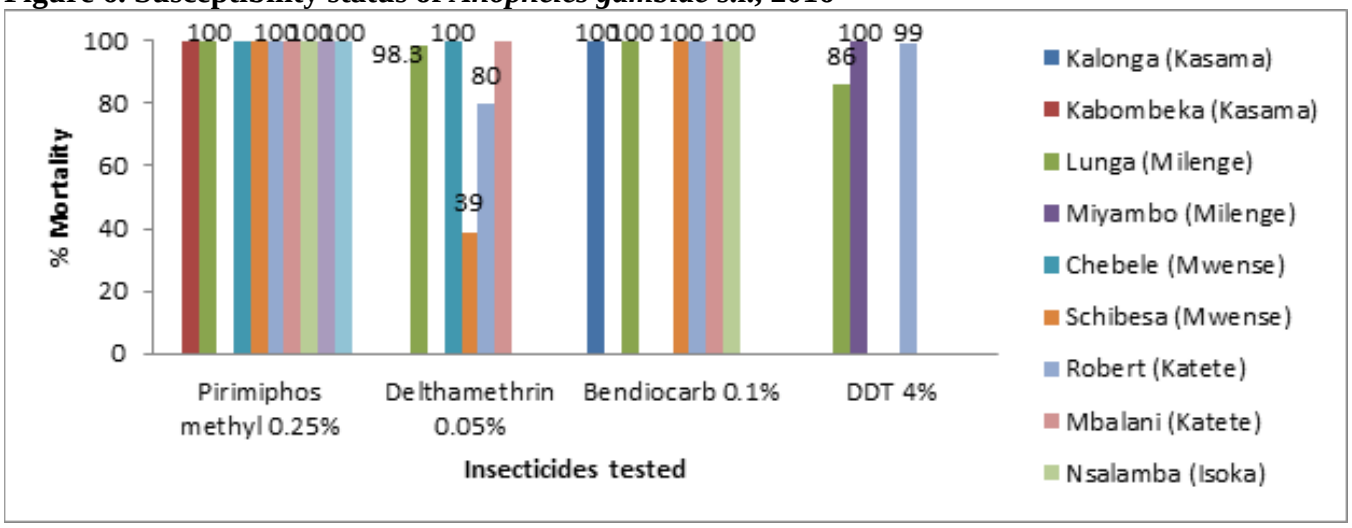


Figure 6. Susceptibility status of *Anopheles gambiae* s.l., 2016



A pre-fabricated insectary, procured with PMI funds, is now operational at the NMCC campus. This facility has strengthened both IRS and ITN assessment capability. However, the usefulness of this facility would be enhanced considerably with the addition of a lab bench and shelving. This would compensate for the loss of lab space in an adjoining building that PMI had hoped to renovate for their use.

Progress during the last 12-18 months

During the 2015 spray season (September through November 2015), long-lasting organophosphates were used across the whole country. Bioassays were conducted to assess the quality of spraying in the PMI-supported target districts. The impact of the IRS campaign on the malaria vectors was assessed from November 2015 to February 2016. The mean indoor resting density of *Anopheles funestus* s.l. dropped from six *Anopheles funestus* s.l. per room per day to two in the intervention sites in January three months after IRS. In the control sites, the indoor resting density per room per day increased from three *Anopheles funestus* s.l. per room per day before IRS to five *Anopheles funestus* s.l. per room per day in January in the control sites.

The quality assurance of the IRS operations was assessed 24 hours after the spraying and the assessment of decay rate of insecticide sprayed was followed on a monthly basis. The WHO cone bioassay performed 24 hours and one month after spraying showed 100% mortality of the susceptible malaria vectors exposed to the mud and cement sprayed walls. Pirimiphos-methyl was effective on both mud and cement in four of the entomology surveillance sites in February four months after the spraying. However, the tested mosquito mortality rate was less than the 80% WHO threshold on the mud and cement sprayed walls in two sites, Milenge and Serenje, four months after spraying. The residual life of pirimiphos-methyl in these two districts was shorter than expected; the cause of this is being investigated.

Plans and justification

The six PMI supported sentinel sites will be retained for 2017 entomological surveillance activities (Table F). However, this level of surveillance alone is insufficient for resistance management decision-making. The most efficient expansion of surveillance is to use the current sites to anchor transects of 50

to 100 kilometers that allow for assessments to be conducted on how representative the sentinel sites are and provide information on resistance hot-spots. Additionally, other entomologic metrics that influence resistance management decisions will be captured for these transects. PMI will review surveillance activities with the NMCP and stakeholders during the Insecticide Resistance Management Technical Working Group meeting in September 2017. Molecular species identification with appropriate timeliness will be provided by CDC Entomology Branch until the NMCC lab refurbishment and training of NMCC personnel are complete, a rebooting required by the loss of key entomology personnel. Existing assistance of Macha Malaria Research Institute in species determinations will also continue when it is possible for the work to be done in a timely way. PMI will take every opportunity to include other entomological monitoring activities being undertaken in Zambia, for example those conducted as a part of the PMI intensity assay operational research project or data collected by other entities working in Zambia.

Table F. PMI-Supported Entomological Surveillance Sentinel Sites

District	Province
Katete	Eastern
Serenje	Central
Kasama	Northern
Isoka	Muchinga
Mwense, Milenge	Luapula

Proposed activities with FY 2017 funding: ($479,000)

- Entomological monitoring and insecticide resistance monitoring and support to the insectary. ($450,000)

- CDC technical assistance on entomological monitoring and insecticide resistance. ($29,000)

b. Insecticide-treated nets

Progress since PMI was launched

The 2012 MIS showed that 68% of homes had at least one ITN. However, coverage varied across provinces, ranging from 52% in Western to 90% in Luapula. To address falling coverage levels in some provinces, the NMCP conducted a national mass ITN campaign in 2013-2014. The GRZ received financial and technical support for the mass campaign from a number of stakeholders, including PMI, the Global Fund, DFID, UNICEF, WHO, MACEPA, and others. As a result of various distribution efforts, the percentage of homes with at least one ITN increased from 38% in 2006 to 77% in 2015.[2] The percentage of household members that slept under an ITN increased from 19% in 2006 to 55% in 2015.[2] Despite the progress, ITN coverage remains below the country's universal coverage target.

The NMCP has a target of 80% use of ITNs by children under five years and pregnant women by 2016. ITN use in children under five increased from 24% in 2006 to 58% in 2015 following the mass ITN campaign.[3] Eastern Province reported the highest under-five use at 78% and Lusaka and Northern had the lowest at 42%. The under-five utilization was 77% nationally in households with at least one ITN.

[2] Malaria Indicator Survey 2006, 2015

Fifty-eight percent of pregnant women reported sleeping under an ITN in 2015, ranging from 37% in Lusaka to 84% in Eastern.

Progress during the last 12-18 months

PMI supports continuous ITN distribution to vulnerable populations in Zambia. To sustain net coverage across the country, routine net distribution through ANC and EPI was conducted in 2015 and 2016 to distribute over 2 million ITNs nationwide. The routine distribution was a collaborative effort between the NMCP, PMI, Global Fund and DFID. PMI contributed 800,000, Global Fund 857,436, NMCP 36,536 and DFID 562,750 ITNs. At the time of writing the MOP not all ITNs had been distributed.

PMI is also supporting the expansion from facility-based distribution channels to include school-based and community-based distribution. A PMI supported situational analysis showed that the addition of community and school-based channels to ANC and EPI can maintain ITN ownership levels at 90%. In October/November 2016, a school-based distribution pilot will begin in four districts in Luapula province. Each district will receive an orientation for school-based distribution. The pilot will target students in grade one and grade four to receive new ITNs. Lessons learnt from the pilot will inform roll out to the rest of country.

In 2016, a community-based ITN distribution pilot will be conducted in one district in Luapula Province. The pilot will be based on a voucher program. The districts will be supplied with six months stock of ITNs required for community distribution, while health centers will be supplied with three months of stock. Selected health centers will identify an ITN voucher distributor that will cover an identified catchment area. The ITN voucher distributor will be provided with coupons and will verify need in the community, in collaboration with other community based groups (e.g., neighborhood health committees, Safe Motherhood Action Groups (SMAGs), etc.). Community members will be provided with a coupon that they can turn in for a new ITN at their respective health center.

The GRZ plans to implement its next universal coverage campaign in 2017. PMI, Global Fund, and other partners are providing financial and technical support to the NMCP for the mass ITN campaign planned to commence in June 2017. The ITN need is estimated at over 9 million nets based on a population of 16,405,229 in 2017, calculating 1 ITN per 1.8 population and an additional 10% buffer. The NMCP is prioritizing the mass campaign over other ITN distribution channels in 2017. Therefore, the country plans to distribute ITNs to all groups during the mass campaign. A small number of nets will be distributed through ANC/EPI in some high burden provinces to maintain these channels.

PMI supported an operational research project on ITN durability that was completed in 2013. This study, which examined the structural integrity of ITNs distributed in Northern and Luapula Provinces, started in 2011 and the field work was completed by the end of 2013 (see Operational Research section for results).

Commodity gap analysis

Table G. ITN Gap Analysis

Calendar Year	2016	2017	2018
Total Targeted Population	15,933,883	16,405,229	16,887,720
Continuous Distribution Needs			
Channel #1: ANC	1,500,000	64,000	1,500,000
Channel #2: EPI	300,000	16,000	300,000
Channel #3: Schools	250,000	0	450,000
Channel #4: Community	25,000	0	75,000
Estimated Total Need for Continuous	2,075,000	80,000	2,325,000
Mass Distribution Needs			
2017/2018 mass distribution campaign	0	9,515,660	0
Estimated Total Need for Campaigns	0	9,515,660	0
Total Calculated Need: Continuous and Campaign	**2,075,000**	**9,595,660**	**2,325,000**
Partner Contributions			
ITNs carried over from previous year	0	145,186	0
ITNs from Government	0	0	0
ITNs from Global Fund	857,436	6,153,485	0
ITNs from DFID	562,750	0	0
ITNs planned with PMI funding	800,000	900,000	800,000
Total ITNs Available	2,220,186	7,198,671	800,000
Total ITN Surplus (Gap)	145,186	-2,396,989	-1,525,000

Notes: Total ITN need per year does not include Lusaka Urban. Deterioration rates = 8% first year, 20% second year, and 50% third year. 4,199,316 ITNs will be procured in 2016; these will only arrive in country and become available for distribution in 2017 for the mass campaign. GRZ has not confirmed any commitment yet. There is a possibility of the Against Malaria Foundation providing nets to meet the gap in 2017.

Plans and justification

With FY 2017 funding, PMI will procure and distribute ITNs to maintain a supply of nets for continuous/routine distribution through ANC/EPI, primary school, and community channels. PMI will provide technical assistance for the continued roll out of primary school and community distribution. In addition, PMI will continue to monitor the durability of ITNs distributed during the mass campaign. The continued net durability monitoring will take advantage of the mass ITN campaign that will be conducted in 2017 during which over 9 million nets will be distributed across the country. The 2017 mass campaign is likely to include some brands of ITN not previously distributed and monitored in Zambia. In order to maximize ITN usage, PMI will continue to support social and behavior change communication (SBCC) activities, prioritizing local over national activities.

Proposed activities with FY 2017 funding: ($3,170,000)

- Procurement of approximately 800,000 ITNs for 2018 continuous/routine distribution. ($2,280,000)

- Support the distribution of ITNs, including transportation and other logistics, to districts and health facilities. ($550,000)

- Provide technical assistance to expand continuous distribution channels for sustaining high ITN coverage in selected provinces/districts. ($150,000)

- Monitor the durability and physical integrity of ITNs in two sites following the 2017 mass campaign. ($180,000)

- Provide CDC technical assistance for routine monitoring of net durability. ($10,000)

- Support SBCC activities to increase consistent utilization of ITNs. *(See full description under the SBCC section, below).*

c. Indoor residual spraying

Progress since PMI was launched

Zambia is implementing IRS for malaria control as part of an integrated vector management strategy. The modern history of IRS in Zambia began when the GRZ started spraying again in 2003 following the success of IRS by the private sector, specifically, at the Konkola Copper Mines in the Copperbelt Province and later at Zambia Sugar Company in the town of Mazabuka in Southern Province. IRS is one of the key malaria control strategies of the NMCP.

The Government of Zambia has in recent years been increasing resource allocation to malaria control in general and IRS in particular. In 2013 the MOH procured $10 million worth of organophosphate for IRS in non-PMI supported areas. Additional resources and technical support have been mobilized through a number of external partners, including PMI, DFID, the Roll Back Malaria partnership, the Global Fund, the World Bank's Malaria Booster Project, and WHO.

In 2010, Zambia reported insecticide resistance to three of the four insecticide classes recommended by the WHO for vector control. High levels of resistance were reported to DDT, carbamates, and pyrethroids, which were the main insecticides in use at that time for controlling malaria. Initial geographic coverage of resistance data was limited to nine districts in three provinces surrounding the capital of Lusaka. Therefore, the potential for vector control failure was high. PMI supported the NMCP to establish an insecticide resistance management technical working group and enhanced efforts to monitor both insecticide resistance and the resistance mechanisms present in the country, which has met annually since its inception and continues to advise the program. This information was compiled to develop an insecticide resistance management (IRM) plan in accordance with the WHO Global Plan for Insecticide Resistance Management of malaria vectors.

Table H: PMI-supported IRS activities 2006 – 2017

Calendar Year	Number of Districts Sprayed	Insecticide Used	Number of Structures Sprayed	Coverage Rate	Population Protected
2006	15	DDT and pyrethroids	592,346	85%	—
2007	15	DDT and pyrethroids	657,695	93%	—
2008	36	DDT and pyrethroids	1,100,000	90%	—
2009	36	DDT and pyrethroids	1,300,000	90%	—
2010	54	DDT and pyrethroids	1,300,000	89%	5,500,000
2011	35	Carbamates and pyrethroids	1,200,000	83%	6,200,000
2012	20	Carbamates and organophosphates	460,303	86%	1,710,833
2013	20	Organophosphates	432,398	81%	1,842,821
2014	40**	Organophosphates	409,544	93%	2,000,824
2015	39**	Organophosphates	519,598	95%	2,544,290
2016*	35*	Organophosphates	542,184 (target)	TBD	TBD
2017*	35*	TBD	542,184 (target)	TBD	TBD

* Represents projected targets based on national strategic plan and/or discussions with the NMCP.
** Includes DFID-funded districts.

Progress during the last 12-18 months

In FY 2015, PMI supported the NMCP IRS operations in 25 PMI focus districts (9 in Eastern Province, 7 in Muchinga Province, and 9 in Northern Province). An additional 14 districts in Luapula and Central Provinces were sprayed using DFID funding (10 in Luapula Province and 4 in Central Province) bringing the total number of districts supported with PMI and DFID funding to 39. These 39 districts (Figure 7) were sprayed over 51 campaign days, with 519,598 structures sprayed out of the 549,520 structures that were found (95% coverage), protecting more than 2.5 million people. DFID support for IRS in the 14 districts was discontinued at the end of calendar year 2015.

Figure 7: PMI and DFID Supported Districts

The IRS program was conducted in compliance with U.S. Government's USAID Regulation 216, Zambia Environmental Management Act cap 204, No 12 of 2011, and USAID Initial and Supplemental Environmental Assessments (SEA) and Pesticide Evaluation Report and Safer Use Action Plan and its amendments. A new SEA to cover IRS activities in Zambia from 2015 to 2020 was approved prior to the commencement of the 2015 spray operations. During April 2015, a pre-season environmental compliance assessment was conducted. In September–December 2015, mid-spray environmental compliance inspections were conducted in the 39 target districts, as was random inspection of houses sprayed to check for quality of messages to homeowners after the spray. End-of-day clean-ups and triple rinsing practice to check for liquid waste management checks were also carried out. Post-spray inventories in all 39 districts were conducted immediately after the 2015 spray program; all districts carried out clean-ups at time of inspection. An insecticide inventory verified good stock control in all sites.

Global Fund provided a large proportion of funding for the 2015 spray season in the non-PMI supported areas, the delayed release of the funds delayed the implementation of the IRS program by the NMCC to March–May 2016. The NMCC conducted IRS in 43 non-PMI supported districts using organophosphates. The NMCC had over 240,00 bottles of insecticides left over from the 2014 spraying season for use in the 43 districts during the 2015/16 spray season. PMI provides technical support to the NMCC for environmental compliance including waste disposal, recycling of insecticide bottles, entomology, and planning for IRS activities in the non-PMI supported provinces.

The targeted approach requires a minimum coverage of 85% of the structures found in each targeted spray area/zone. The strategy for selecting the targeted catchments areas for IRS through evidence-based data use the following criteria: malaria burden, population density, structure density, available resources, and consideration of universal coverage of ITNs as the primary vector management intervention. The criteria for selection of areas to be sprayed at the catchment (sub-district) level were previously developed by the NMCC; however, adherence to these criteria has been variable. The policy change for IRS, which was implemented in 2011, entailed further refining the criteria for targeting areas at the catchment level to be sprayed. In 2015, PMI improved upon the targeting for IRS in Luapula (10) and

Central (4) Provinces (14 of the 15 districts that were piloted in 2014) using satellite-based enumeration of eligible structures overlaid with HMIS data. Additional improvements in 2015 for all PMI-supported IRS program included supporting districts to conduct a thorough review of the target spray areas to ensure they were accessible and operationally feasible, which led to an increase in targeted structures. Approximately 50-77% of the structures fitting within the inclusion criteria in the 4 PMI-supported high burden provinces are covered by IRS (Table I).

Table I. Total number of structures identified and targeted for IRS in 2016 for the 4 PMI-supported provinces

Province	Total structures identified from mapping	Total number of structures targeted for 2016 IRS
Northern	239,881	121,602
Muchinga	126,958	70,249
Eastern	270,035	196,578
Luapula	199,018	153,755
Total	**835,892**	**542,184**

Zambia has been confirmed as a country for the UNITAID funded NgenIRS Project beginning in 2016. This market intervention project includes a short term co-payment to accelerate the reduction of price for long-lasting IRS insecticides. The price reduction will enable Zambia to expand coverage of long-lasting IRS from baseline levels, and participation in the NGenIRS Project confirms Zambia's commitment to do so. As a consequence of the NgenIRS project, PMI will be able to procure organophosphates at reduced cost resulting in savings that will benefit continued IRS support to Luapula in 2016 and 2017.

Plans and justification

For the 2017 spray season, PMI will cover the cost of IRS in 35 districts in four provinces: Eastern, Luapula, Muchinga, and Northern. Approximately 540,000 structures will be targeted, protecting more than 2 million people. The actual number of household/structures sprayed will depend on the cost of insecticides selected, and the cost of implementation. The incidence of the disease at sub district level will inform selection of areas for IRS.

Planned activities also include expanded insecticide resistance monitoring and management, entomological monitoring, and support of environmental assessments. Specific activities include: pre-season environmental compliance inspection; collection of empty plastics bottles generated from the previous spray campaign; support to rehabilitation of IRS facilities such as soak pits, shower rooms, and change rooms; support for MOH/NMCC to conduct training of trainers for spray operators; preparing a "Letter Report" for environmental compliance; launching spray operations in up to 36 districts; carrying out periodic testing of vector population for phenotypic resistance; carrying out pre-spray vector population density determination in PMI supported sentinel sites; supporting NMCP teams to carry out monitoring and supervision during IRS implementation; procurement of insecticide, spray pumps, PPE, and other IRS commodities.

PMI supports the MOH policy to rotate the insecticide used for IRS, based on evidence of vector resistance to insecticides. The recommendation from the Insecticide Resistance Management Technical Advisory Committee is to consider rotating to DDT in 2017 in selected districts; however, PMI would recommend first considering other insecticides. In most of southern Africa, *An. funestus* has been

traditionally highly susceptible to DDT. However, there have been recent reports from South African researchers of DDT resistance in *An. funestus* collections from eastern Zambia. Thus, this should be considered along with assessment of the DDT product that can be procured and the assurance of environmental compliance in accordance with international standards.

Proposed activities with FY 2017 funding: ($7,844,500)

- Procure insecticides (i.e., organophosphates) and other IRS supplies/equipment for spraying up to 542,184 structures in 35 districts, inclusive of districts previously supported by DFID. Support environmental monitoring and environmental assessment, to include use of organophosphates, carbamates, or other potential new insecticides. ($6,140,500)

- Train spray operators, supervisors, and store keepers; monitoring and evaluation; SBCC for IRS; pesticide storage; waste disposal; and pay for spray operations in 35 PMI-funded districts. ($1,674,000)

- Conduct environmental monitoring, environmental assessments, and risk mitigation in IRS districts. ($30,000)

2. Malaria in pregnancy

NMCP/PMI objectives

The national strategic plan includes three strategies to reduce the malaria burden in pregnant women. The strategy includes the provision of free intermittent preventive treatment for pregnant women (IPTp), free ITNs, and free prompt diagnosis and treatment of clinical malaria. These interventions are implemented as part of routine focused antenatal care (FANC).

In 2014, the NMCP aligned the national policy on IPTp with the recently updated WHO policy on IPTp. The national 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 after 16 weeks of gestation. Iron and 5mg folate are also provided to pregnant women through antenatal care. The NMCP is still in discussions around whether to update the policy to include low dose folic acid in the FANC Guidelines. The current policy still includes folic acid at the 5mg dose. PMI/Zambia continues to advocate for low dose folic acid with the MOH. Technical working groups meet regularly to move forward the malaria in pregnancy agenda in Zambia. These groups include representatives from the MoH and various malaria and reproductive health partners including PMI.

In partnership with the NMCP, PMI supports three main strategies to address malaria in pregnancy: IPTp, ITNs, and case management. ITNs are procured and distributed directly to pregnant women through ANC clinics and also are accessible to them through additional distribution channels (mass campaigns and continuous school-based and community-based channels, as discussed in the ITN section). PMI also supports appropriate case management of malaria in pregnancy through trainings of healthcare workers on malaria diagnosis and treatment guidelines (see the Case Management section for details).

Table J. Status of IPTp policy in Zambia

WHO policy updated to reflect 2012 guidance	2014
Status of training on updated IPTp policy	In process
Number of health care workers trained on new policy in the last year	504
Are the revised guidelines available at the facility level?	Yes
ANC registers updated to capture three doses of IPTp-SP?	Yes
HMIS/ DHIS updated to capture three doses of IPTp-SP?	Yes

Progress since PMI was launched

Since 2004, Zambia, has promoted FANC, a comprehensive prenatal care package provided to pregnant women at ANC clinics that includes care related to malaria such as providing SP, providing an ITN at the first ANC visit, and educating pregnant women on the importance of seeking care immediately for fever. IPTp is an important part of this approach to reduce maternal and newborn mortality and morbidity, including from stillbirths and premature delivery. Over the past 9 years, PMI has invested over $3 million in FANC and MIP in Zambia. Funding from PMI has been critical to the development of the national FANC curriculum; development of district-level trainers throughout the country; the national rollout of in-service trainings in FANC; updating the pre-service curriculum in nursing schools in Zambia; strengthening supervision and quality improvement of ANC services; and creating demand for quality ANC services and advocating for safe motherhood issues. PMI funds were complemented with MCH co-funding in line with the program's budget.

Progress during the last 12-18 months

Focused antenatal care training and supervision is provided to healthcare workers via clinical care teams (CCTs) present in all districts and provinces nationwide. These teams consist of staff who are already part of the health system, namely a clinical care supervisor and a CHW coordinator. Provincial-level CCTs supervise and train CCTs and health workers at district-level facilities. District-level CCTs train and supervise health workers at the local facility level. PMI supports the malaria in pregnancy component of training for the CCTs.

Because the availability of SP is critical for IPTp, PMI has continued to invest in EMLIP to improve distribution of malaria commodities (see Treatment and Pharmaceutical Management section) and to prevent stockouts of malaria commodities in facilities. Availability of SP in ANC clinics has improved due to these investments.

SP resistance continues to be monitored as a threat to the efficacy of IPTp. A PMI-funded study[3] analyzed the efficacy of SP for IPTp in Mansa, Zambia in 2013. This study found a 26% parasitological failure rate for IPTp-SP relative to the moderate 61% prevalence of the quintuple mutant among pregnant women with asymptomatic malaria parasitemia. The threat of SP resistance looms, and continuous resistance monitoring is needed especially in light of the emergence of the sextuple mutation, but IPTp-SP seems to retain some degree of efficacy in Mansa. Although the study cannot be generalized for Zambian women nationwide, this provides evidence that IPTp is still effective in the study population of Zambian women.

[3] Tan et al. Malaria Journal 2014, 13:227 http://www.malariajournal.com/content/13/1/227

National SBCC efforts for MIP are now part of a larger integrated campaign on maternal health and nutrition that disseminates messages through national radio and television spots encouraging early prenatal care, use of nets during pregnancy, and the importance of IPTp. Community SBCC efforts focus on educating and training SMAGs, where they are present; MIP; and other aspects of ANC. Other community SBCC activities related to MIP were also supported by PMI (see SBCC section).

Commodity gap analysis

Table K. SP Gap Analysis for Malaria in Pregnancy

Calendar Year	2016	2017	2018
Total Population	15,933,883	16,405,229	16,887,720
SP Needs			
Total number of pregnant women attending ANC	803,705	827,480	851,816
Total SP Need (in treatments)	**2,009,263**	**2,068,700**	**2,129,540**
Partner Contributions			
SP carried over from previous year	3,010,032	1,000,769	1,932,069
SP from Government	0	3,000,000	3,000,000
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	**3,010,032**	**4,000,769**	**4,932,069**
Total SP Surplus (Gap)	**1,000,769**	**1,932,069**	**2,802,529**

Notes: Pregnant women account for approximately 5.2% of the national population. Total antenatal attendance is estimated at 97%. 90% of pregnant mothers attending antenatal clinics will receive first IPTp dose, 79% will receive second IPTp dose and 61% will receive the third IPTp dose (MIS 2015). It is estimated that 20% of the total antenatal attendances visit the health facilities at the right time (fourth month of pregnancy) and are likely to receive the fourth IPTp dose in 2015. This assumption was applied for 2016 to 2018.

Plans and justification

The strategy to increase IPTp coverage in Zambia includes targeting rural areas. PMI will continue to support supervision and training of health center clinical staff in FANC in the updated policies through CCTs. Because cultural and knowledge barriers resulting in decreased uptake of IPTp will require continued SBCC regarding IPTp, PMI will continue to make investments in SBCC to prevent MIP (see SBCC section).

To improve patient knowledge and demand for prevention and treatment of malaria in pregnancy, PMI will continue to support national- and community-level SBCC activities, with an emphasis on local SBCC activities such as SMAGs in rural areas.

Proposed activities with FY 2017 funding: ($500,000)

- Training provincial and district level health workers on then updated NMCP IPTp guidelines in four high malaria burden provinces (Eastern, Luapula, Muchinga, and Northern). These 4 provinces constitute 36 high burden malaria districts. ($500,000)

- National and community level SBCC efforts for MIP will include messages through national and local radio, national television spots, and SMAGs encouraging timely ANC attendance,

encouraging ANC visits during pregnancy, use of nets during pregnancy, and updated IPTp recommendations. *(see full description under the SBCC section, below)*

3. Case management

a. Diagnosis and Treatment

NMCP/PMI objectives

Zambia's strategic plan diagnostic objective is to ensure all suspected malaria cases receive parasitological confirmation. Parasitological confirmation is done by examining either a blood smear/slide by microscopy or malaria RDT. Antimalarial treatment based on a clinical diagnosis should only be considered when a parasitological diagnosis is not immediately available.

Microscopy should be used where there is a well-functioning laboratory with staff well-trained in malaria diagnostics. RDTs are to be used in health facilities where there is no microscopy or no well-trained laboratory staff, when a laboratory is closed or too busy to handle the work load, and at the community level by CHWs trained in iCCM.

Regarding malaria case management, all suspected malaria cases shall be subjected to parasite-based diagnosis and treatment initiated in accordance with the test result. The first-line drug for treatment of uncomplicated malaria in Zambia is artemether-lumefantrine (AL) with dihydroartemisin-piperaquine (DHA-PQ) as an alternative first-line choice. For uncomplicated malaria in pregnancy, the first-line treatments are quinine in the first trimester and AL in the second and third trimesters.

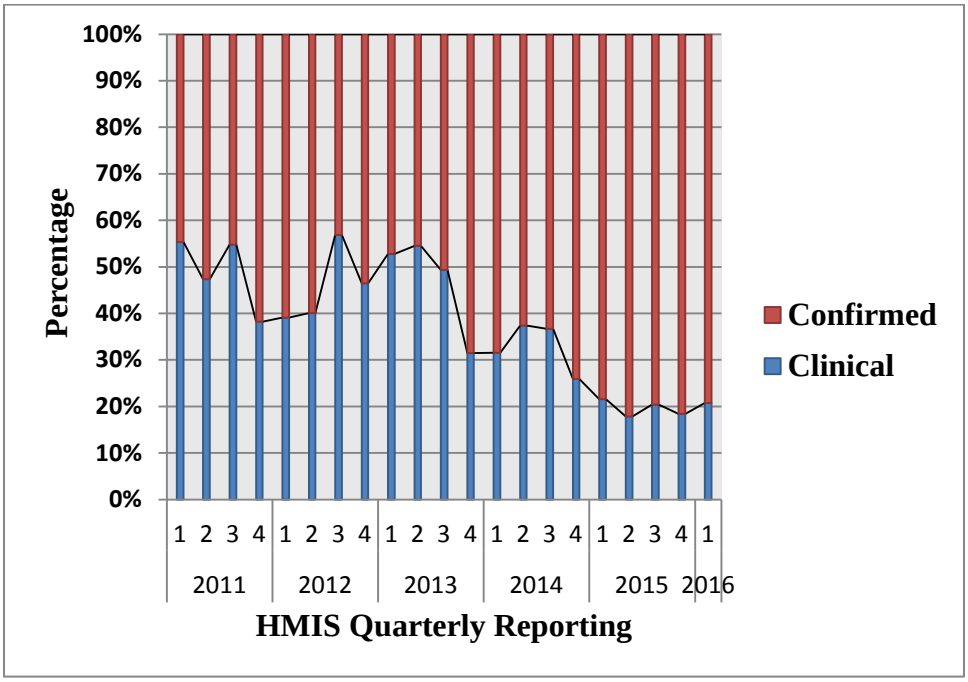
The treatment of severe malaria was updated in 2014. Injectable artesunate is the drug of choice in adults and children; if injectable (intravenous-IV or intramuscular-IM) artesunate is unavailable, artemether (IM) or quinine (IV or IM) are suggested alternatives. The national malaria treatment and diagnostic guidelines recommend that patients with severe malaria receive pre-referral treatment with IM or rectal artesunate; if that is not available, then IM quinine is recommended. The guidelines state that the treatment of severe malaria in pregnancy is with quinine in the first trimester and injectable artesunate in the second and third trimesters.

Progress since PMI was launched

The NMCP, PMI, and partners have invested in three key areas related to malaria diagnostics: 1) procurement and distribution of diagnostic commodities; 2) training of clinical and laboratory personnel in the use of malaria diagnostic tools; and 3) training of national, provincial, and district level staff in providing outreach training and supportive supervision (OTSS) for quality assurance of malaria diagnostics.

This investment is having an impact. The percentage of children with fever that reported having a heel or finger stick increased from 17% (MIS 2010) to 36% (MIS 2015). The HMIS confirms progress in diagnostics (Figure 8). Eighty percent of reported malaria cases were confirmed in 2015, compared with 31% in 2010, and 80% were confirmed nationally in the first quarter of 2016 (HMIS).

Figure 8. Diagnostic Confirmation Trend Total Malaria Cases in Zambia, 2011 - 2016 (Q1)



While the RDT supply has improved, and despite stock availability at the central level, stockouts at the facility level remain a challenge. The PMI EUV survey conducted in February 2016 reported RDT stockouts in 10% of the 41 facilities visited. The stockouts were mostly in districts where the EMLIP[4] is yet to be rolled out.

To strengthen malaria diagnostic capacity at all levels, PMI has invested in training laboratory technicians, clinicians, and CHWs in malaria diagnosis— supporting health workers in approximately 18 facilities in each of the 10 provinces in the country and training over 1,400 CHWs in iCCM and over 2,300 clinicians.

Although iCCM training is supported by various partners, the provision of non-malaria commodities (ORS, Zinc, amoxicillin) for use by iCCM-trained CHWs is a challenge. Currently, the MoH is responsible for procuring non-malaria iCCM commodities, however supplies are inadequate. Therefore, pneumonia and diarrhea case management is currently not occurring to the same extent as malaria case management. PMI continues to support the MoH's efforts to encourage partner support for non-malaria iCCM commodities.

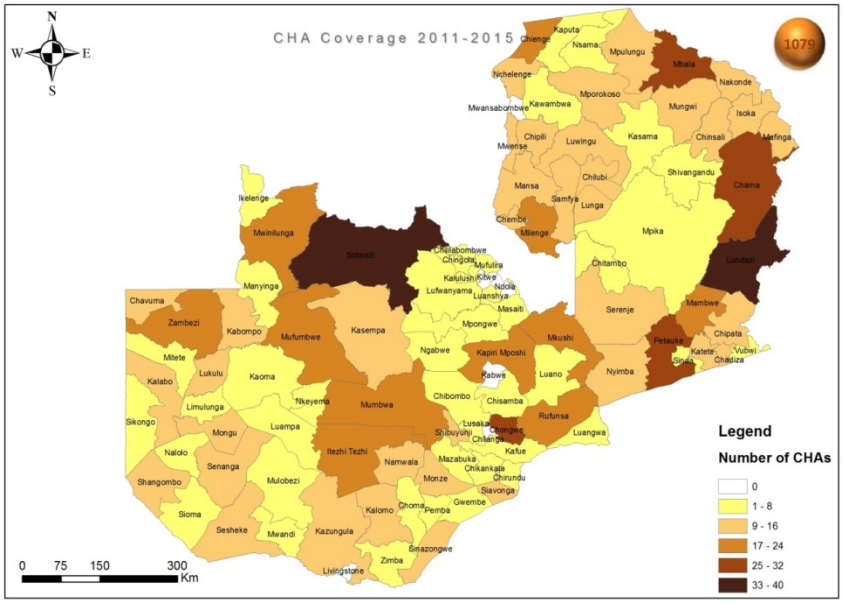
According to the national *Health Sector Human Resources Strategic Plan (2011-2016),* Zambia has 1,535 clinical officers, 911 medical doctors, 2,671 midwives, and 7,669 nurses. Training for clinicians includes training in national malaria diagnosis and treatment guidelines, training in IPTp, and case

[4] The MOH, in collaboration with partners, launched the Essential Medicines Logistics Program (EMLIP) in April 2009. This initiative aimed to improve access to essential drugs in the public sector in Zambia. The model eliminated the intermediate storage of drugs at the district level. The district store was converted into a "cross-dock," i.e., point of transit, wherein it receives shipments from MSL that are pre-packed for individual health facilities. In 2014, the MoH, with support from partners, evaluated EMLIP and redesigned it to include health centers on the list of products to be distributed.

management in pregnancy, as well as refresher trainings. There are more than 23,000 community volunteers in Zambia. Information on how many of these volunteers are CHWs is not readily available.

In 2010, the Government of Zambia introduced a community health assistant (CHA) program with the goal of developing a cost-effective, adequately trained, and motivated community-based health workforce to contribute to improved management of malaria, child and maternal health, and common preventable health conditions. CHAs are envisioned to bridge the gap between the community and formal health services. CHAs are expected to spend 80% of their time in the community carrying out disease prevention and health promotion activities and 20% at the health post carrying out curative services. For malaria, the CHAs are expected to diagnose malaria using RDTs and treat with the appropriate medication and support malaria prevention activities, including SBCC and distribution of ITNs. Furthermore CHA are expected to supervise the CHWs that work in their catchment areas. As of January 2016, 1,078 CHA have been trained with support from DFID and deployed in health posts across the country. The GRZ aims to train and deploy 2,650 CHAs by December 2018 (see Figure 9).

Figure 9. National coverage of community health assistants, 2011-2015



All cadres listed above are targeted for training. PMI supported the development and distribution of a laboratory training manual with standard operating procedures, the WHO accreditation of three laboratory technicians at the national level to build microscopy expertise and training capacity, and diagnostics refresher training for 18 district laboratory supervisors.

To ensure quality of malaria diagnostics and adherence to test results, PMI supports the OTSS program. In OTSS, provincial and district-level supervisors visit health facilities using standardized checklists to observe microscopy and RDTs, recheck malaria smears, and collect information on provider adherence to laboratory results. These supervisors also provide on-site training and corrective action as needed.

Progress during the last 12-18 months

In 2015, although health facility stockouts were reported, there were no reported central level stockouts of RDTs or ACTs in the country. A total of 22 million RDTs arrived in Zambia in 2015 from

procurements by GRZ (10 million), PMI (2,172,500), Global Fund (3,254,275), DFID (4 million using PMI's procurement mechanisms), and the CHAZ (2,767,000). In 2016, over 11 million RDTs are expected to arrive with GRZ providing the bulk of the supply (10 million). Additional support will be provided by PMI (400,000), DFID (450,000), and Global Fund (494,975).

PMI procured 4,052,180 ACTs in 2015 for the treatment of malaria in health facilities and in the community. In addition, 1,590,600 ACTs were procured with DFID funding; GRZ procured over 4,024,110, Global Fund 1,620,150, and Malaria No More procured 501,300 ACTs. In 2016 approximately 16 million ACTs are expected with PMI providing over 3 million, DFID 3,963,180, Global Fund 5,302,400, and GRZ 3,933,420.

In 2015, PMI introduced an electronic data system (EDS) in order to enhance OTSS data collection and use for decision making. Twenty-five provincial supervisors, 75 district supervisors and 7 NMCC staff were trained on EDS. This was followed by the first provincial and sub-district EDS rounds involving 41 and 100 health facilities respectively in four provinces. The introduction of EDS has resulted improved data quality. PMI is also supporting the establishment of a national malaria slide bank. To date 10 laboratory technicians from sample collection sites have been trained on WHO protocols for national slide banking. Furthermore, PMI conducted six follow-up quality assurance visits to confirm species identity and parasite quantification for samples.

In 2014, the NMCP and partners made revisions to the *Guidelines for the Diagnosis and Treatment of Malaria in Zambia* that included: injectable artesunate for severe malaria, DHA-PQ as an alternate first-line treatment of uncomplicated malaria, and rectal artesunate for pre-referral treatment of severe malaria, although the NMCP does not have immediate plans for its roll-out. Initial procurements of injectable artesunate were supported by PMI. However, subsequent procurements have been taken up by the Government of Zambia (800,000 vials of 60mg each in staggered shipments) and the Global Fund (228,650 60mg vials). Training of health workers in the use of injectable artesunate has continued with all level 2 hospitals now trained.

PMI is supporting the NMCP to conduct a TES to ensure the efficacy of first-line malaria drugs. This TES has included AL, ASAQ, and DHA-PQ. Data collection at the three sites (Katete in Eastern, Gwembe in Southern, and Mansa in Luapula province) has been completed. Slide reading and data analysis are currently ongoing.

Commodity gap analysis

Table L: RDT Gap Analysis

Calendar Year	2016	2017	2018
RDT Needs			
Total country population	15,933,883	16,405,229	16,887,720
Population at risk for malaria	15,933,883	16,405,229	16,887,720
PMI-targeted at-risk population	15,933,883	16,380,032	16,838,673
Total number of projected fever cases	13,114,172	15,081,298	17,343,493
Percent of fever cases tested with an RDT	90	90	90
Total RDT Needs	**16,966,460**	**15,609,143**	**17,950,515**
Partner Contributions			
RDTs carried over from previous year	2,982,710	0	1,390,856
RDTs from Government	10,000,000	5,000,000	10,000,000
RDTs from Global Fund	494,975	9,000,000	0
RDTs from Other Donors	450,000	0	0
RDTs planned with PMI funding	400,000	3,000,000	3,000,000
Total RDTs Available	14,327,685	17,000,000	14,390,856
Total RDT Surplus (Gap)	**-2,638,775**	**1,390,856**	**-3,559,659**

Notes: OPD attendance was 19,006,047 in 2015. Applying a 15% increment, it was assumed that OPD attendance will increase to 21,856,954 in 2016, 25,135,497 in 2017, and 28,905,822 in 2018. The 15% is accounted for by 10% program and surveillance, 5% for damages, repeat test, training and quality control. Note that true OPD attendance numbers are likely higher than indicated here since data shown were obtained from HMIS which has a report completion rate of approximately 70%. Hence the true RDT need is likely higher than shown here. Based on data from the EUV for the period November 2015 to April 2016 (malaria peak season), it is assumed that 60% of OPD attendance will present with fever as a clinical symptom. RDT need for 2016 is inclusive of 3 months of pipeline of 3,393,292 RDTs to ensure adequate supply at the beginning of the next year.

Table M: ACT Gap Analysis

Calendar Year	2016	2017	2018
ACT Needs			
Total country population	15,933,883	16,405,229	16,887,720
Population at risk for malaria	15,933,883	16,405,229	16,887,720
PMI-targeted at-risk population	15,933,883	16,405,229	16,887,720
Total projected number of malaria cases	5,300,000	5,000,000	4,800,000
Total ACT Needs	**18,603,511**	**13,989,840**	**13,430,246**
Partner Contributions			
ACTs carried over from previous year	0	0	0
ACTs from Government	3,933,420	3,900,000	4,000,000
ACTs from Global Fund	5,302,400	2,808,972	3,000,000
ACTs from Other Donors	3,963,180	0	0
ACTs planned with PMI funding	3,000,000	3,000,000	3,000,000
Total ACTs Available	16,199,000	11,025,163	10,000,000
Total ACT Surplus (Gap)	-2,404,511	-4,280,868	-3,130,246

Note: ACT need is calculated based on "consumption data" as reported by the 106 EMLIP districts. ACT needs for 2016 is inclusive of 3 months pipeline of 3,720,702 ACTs to ensure adequate supply at the beginning of the next year.

Plans and justification

The NMCP has prioritized technical support for case management for PMI support. HMIS data has shown progressive improvement in malaria diagnosis confirmation. Confirmed malaria cases accounted for 80% of total malaria cases in the first quarter of 2016 up from 78% during the same period in 2015 and 68% in 2014. Furthermore, the MIS 2015 indicated that among children under five with fever that received an anti-malarial drug, 80% reported receiving the recommended antimalarial (AL) up from 18% in 2006. To ensure continued efficacy of the first line treatment, PMI will support therapeutic efficacy studies to detect any potential problems with resistance.

According to the 2015 MIS, the private sector accounted for 7% of children who received anti-malarials for treatment of malaria while government health facilities accounted for 46% with CHWs accounting for 25%. Approximately 21% cases reported already having malaria treatment at home suggesting possible stockpiling of medicines. The private health care sector in Zambia is small, accounting for just 14% of all health facilities which are found mostly in Lusaka and Copperbelt Provinces where malaria incidence is low.

Thus, the priority going forward for PMI will be to improve diagnostics and supportive supervision, improve malaria case management at facility level, and expand access to treatment through iCCM. With FY 2017 funding, PMI will work to increase prompt and effective treatment for uncomplicated malaria at the health facility level and support efforts to expand malaria treatment at the community level utilizing CHWs.

To provide health care workers, laboratory technicians, and CHWs with the tools to diagnose malaria, PMI will continue to support the procurement of malaria diagnostic commodities. PMI will procure

RDTs for use in health facilities and by CHWs. Also, reagents for microscopy will be provided for use by trained laboratory technicians at targeted facilities.

PMI will continue to support OTSS at targeted facilities as well as refresher training. Health facilities performance for malaria diagnosis and treatment will be monitored through OTSS. Health facilities whose performance shows significant improvement will be transitioned to receive fewer OTSS visits. Additional facilities will then be selected to receive OTSS. Selection of additional health facilities for OTSS going forward will be based on diagnostic performance. High volume and low performance facilities will be targeted. PMI will also strengthen the quality of parasitological diagnosis in the public health sector in four provinces through supportive supervision of healthcare providers at primary health facilities and community levels.

Proposed activities with FY 2017 funding: ($6,437,330)

- Procure 3 million RDTs to be used at health facilities and by CHWs to contribute towards filling the national RDT need in 2018. ($967,330)

- Procure approximately 3.3 million AL treatment courses for uncomplicated malaria. ($3,300,000)

- Procure microscopes, reagents, and supplies to equip health centers for their malaria microscopy needs. ($70,000)

- Strengthen malaria diagnostic capacity and quality assurance centrally and in areas outside the four higher malaria burden provinces through the training of malaria microscopists and support for OTSS. ($400,000)

- Improve the quality of parasitological diagnosis in the public sector in four targeted provinces through training and supportive supervision of healthcare providers at primary health care and community levels. PMI will work at the provincial, district, and community level to improve the appropriate use of diagnostics including interpreting test results and managing patients based on results. ($400,000)

- Conduct therapeutic efficacy study to detect any problems with resistance to AL, ASAQ, and DHA-PQ at the three study sites. Samples will be sent for k13 testing as part of PARMA, pending IRB approval. ($300,000)

- Support the supervision of healthcare providers in the treatment of uncomplicated malaria and the training of CHWs in iCCM in four targeted provinces. Also, support the training of health workers at health facilities with inpatient services on the use of injectable artesunate for severe malaria. ($1,000,000)

- Fund SBCC messages and activities to increase utilization and acceptance of diagnostics and to promote use of and adherence to recommended quality-assured ACTs. (*see full description in the SBCC section*).

b. Pharmaceutical management

NMCP/PMI objectives

The National Supply Chain Strategy for Essential Medicines (2015-2020) aims to provide equitable access to affordable, quality essential medicines and medical supplies to support the Zambian public health system. Key strategies of the MOH's strategic plan to achieve this objective include the following:

- Establish a coordinated and efficient supply chain in the [health] sector led by one lead entity/point of reference.
- Reduce shortages of medical commodities and supplies within the supply chain by increasing the fill rate from the current 50% to 90%.
- Improve access to medical commodities and supplies though decentralizing distribution.
- Enhance accuracy in quantification and forecasting of medical commodities and supplies within the sector through provision of accurate data.
- Mobilize resources to support supply chain interventions in the sector.
- Ensure sustained and improved quality for all medical commodities and supplies within the public health sector.
- Attain dynamic supply chain alignment and agility within the public health sector.
- Improve decision making processes through timely provision of information across the supply chain, by implementing appropriate supply chain information systems and technologies.
- Ensure private sector participation in the public health sector through various initiatives including public private partnerships.

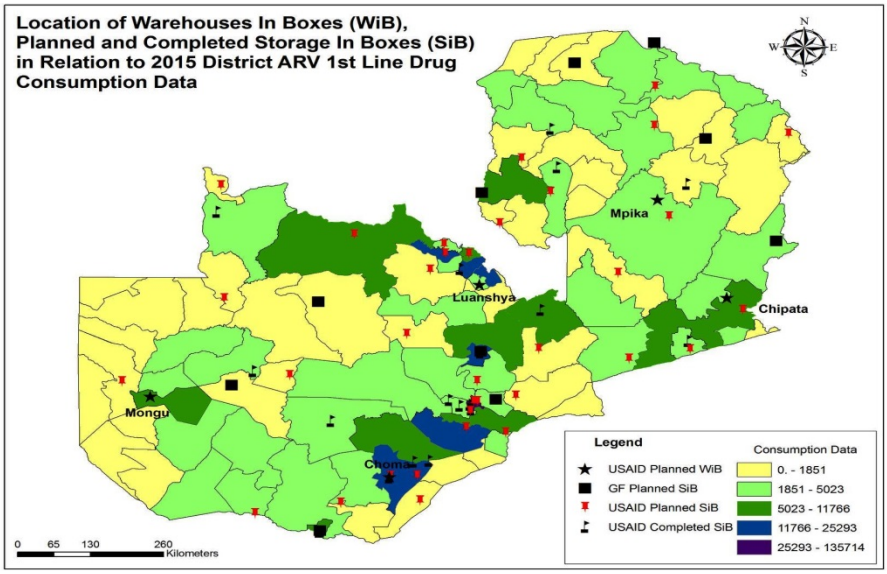
During the strategic planning process, key supply chain objectives were grouped and defined into the following pillars that provide the framework around which the strategic objectives were formulated:

- Quantification
- Procurement
- Logistics
- Information Systems
- Quality assurance and rational use
- Commodity security, financing, and resource mobilization
- Performance management
- Human resources for health in supply chain
- Public Private Partnerships

In late 2012, the MoH announced the mandate of the Medical Stores Limited (MSL) would be significantly increased. In the past, MSL was responsible for central-level storage of commodities and distribution of those commodities to the district. Districts were then responsible for further distribution to health centers. The new policy expands MSL's mandate to include distribution to health centers. In order to expand its capacity for last mile distribution, MSL has created three regional hubs and staging posts throughout the country. MSL's revised mandate also includes taking on roles that were previously the responsibility of the MoH's Procurement and Supply Unit. These roles include procurement, procurement planning, and quantification of essential medicines and medical supplies. The transfer of these activities were originally planned to be completed in 2014. However, the transfer of these

activities has been put on hold as MSL builds its capacity and develops a comprehensive strategic plan for its expanded mandate. Furthermore, in order to strengthen the MSL capacity for last mile distribution, USAID, with funding from PEPFAR and in collaboration with the Global Fund, will support construction of five regional warehouses (Figure 10). This activity will focus on procurement and installation of warehouse in box units in Choma (Southern), Luanshya (Copperbelt), Mansa (Luapula), Mpika (Muchinga), and Mongu (Western). The procurements of these units will increase storage capacity in target districts for medical supplies including malaria commodities.

Figure 10. Location of warehouse and storage in boxes



Progress during the last 12-18 months

PMI provided support to the MoH, MSL, and other stakeholders to improve the collection, management, and use of logistics data through the development of an electronic Logistics Management Information System (eLMIS). In April 2014, the MoH approved the implementation of the eLMIS, an innovative tool which will electronically gather malaria logistics data (e.g., stock on hand, consumption, losses and adjustments) at facilities and transfers data electronically to MSL for order creation.

In 2016, MOH, with support from partners, rolled out the eLMIS facility version to 250 health facilities. This innovation has enabled staff to enter logistics data and facility orders directly as opposed to submitting forms to MSL. In addition, this has increase central level visibility of stock management at facility level. The eLMIS has now replaced the Supply Chain Manager software previously used for tracking logistics data. Furthermore, in 2016, the MOH with support from partners rolled out the redesigned EMLIP hybrid system to 38 additional districts. This brings the total trained to 106 districts (100%).

The LMU at the MoH recorded a 97% reporting rate and improved commodity facility level stock availability (100%) for malaria commodities in EMLIP districts for the period January to June 2016. In addition, according to monthly reports sent to the LMU from health facilities, the percentage of health facilities stocked out of all presentations of ACT fell from 3% in April 2015 to 0% in February 2016.

PMI continued to provide support to the national core group led by the MOH/NMCP to conduct annual and biannual forecasting and quantification exercises for ACTs, ITNs, RDTs, and SP. The national core group successfully conducted a transparent forecast and quantification exercise for 2016 through 2018. The entire process was facilitated by MoH/NMCP staff.

To improve strategic management and planning for increased commodity security, PMI provided support to the NMCP Malaria Case Management technical working group. As part of this support, PMI contributed to the finalization of a fully budgeted National Supply Chain Strategy (including an implementation plan). The final strategy was released to the public in March 2016. Technical assistance was also provided in support of technical organization capacity assessment for MSL in view of its new mandate to operate as a commercial entity.

Plans and justification

In collaboration with the MoH, PMI will continue strengthening the GRZ's commodities supply and logistics systems at central, provincial, district, and health center level. PMI will provide support for the continued supply chain system strengthening and roll out of the electronic logistic management system in collaboration with the MoH to ensure malaria commodity security at all levels of the health system. PMI leverages its supply chain strengthening support with other non-malaria USAID funding (e.g., HIV/AIDS). Distribution of malaria commodities benefits from these additional investments, which include: funding for regional warehouse hubs, procurement of warehouses in boxes to support districts, and vehicles to transport commodities from central level to health facility level. In addition, support will be provided to increase the MoH's ownership and coordination of forecasting, quantification, and procurement planning for malaria commodities. PMI will continue to provide support to assess and monitor stock status for antimalarial drugs and RDTs at central, district, and health center levels.

Proposed activities with FY 2017 funding: ($1,100,000)
PMI will assist the MoH in providing technical assistance to strengthen pharmaceutical and supply chain management systems. Specific activities will include the following:

- *Provide technical assistance to strengthen pharmaceutical and supply chain management systems*, including:
    - Provide technical assistance for quarterly forecasting of antimalarial drug and RDT needs and gaps in all districts. ($100,000)
    - Provide technical assistance to support strengthening of EMLIP including refresher training of health workers, monitoring and supportive supervision, improving feedback, and reporting on consumption/stocks from health facility to district and higher levels. ($700,000)
    - Support semi-annual end-use verification activities to track the availability of key antimalarial commodities at the facility level. Facilities will be selected to detect ACT (or other drug) stockouts, expiration dates of ACTs at health facilities, leakage, anomalies in ACT use by clinicians, and to verify quantification/consumption assumptions. ($100,000)
    - Provide technical assistance to MSL in support of its new mandate to ensure successful adoption of its new tasks, including forecasting and supply planning capacity, as well as the improvement of the storage and distribution of malaria commodities. ($200,000)

- Provide technical assistance to strengthen the importation, quality control, storage, distribution, and inventory management from central level to the health facility level. (*Costs included in commodity-specific procurement line items listed above*)

4. Health system strengthening and capacity building

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

The NMCC is the department under the Directorate of Disease Surveillance and Research of the MoH that provides technical and management oversight to malaria activities in public health facilities to the provincial level, as well as supporting and coordinating a wide range of partners, including research and training institutions. The NMCP has 12 staff positions, including a Case Management Officer; Chief Entomologist; Chief Parasitologist; Malaria Epidemiologist; SBCC, IRS, Surveillance and Information, and ITN Officers; Medical Laboratory Technologist; and Operational Research Officer. At the provincial and district level, Provincial Health Offices serve as an extension of the MoH.

The NMCP staff are committed to scaling-up malaria control and prevention activities; however, they are currently understaffed, and need further support to effectively supervise provincial-level activities and effectively coordinate the many partners contributing to malaria efforts in Zambia. In particular, the NMCP and partners recognize its need for additional coordination of IRS activities and advocacy and outreach efforts. The NMCP requires support to conduct provincial-level visits for supervision and program management which MACEPA and PMI are providing. PMI will support the IRS and SM&E programs. This partner will provide support for IRS training, mapping of households, entomology expertise and assistance for NMCP in gathering and analysis of malaria data. In addition, PMI will work with this partner to provide technical and system support to standardize the implementation of case reporting by CHWs into the HMIS. PMI also supports capacity building within the through the Field Epidemiology Training Program (FETP).

NMCP/PMI objectives

The NMSP vision, goals, and objectives are focused on working towards a malaria free Zambia. The NMSP is encored to the broader NHSP. Within the NHSP, there are several strategies that support this vision. The proposed strategies have been aligned to, and structured along, the “Six Health Systems Building Blocks” framework in order to facilitate a comprehensive analysis. These building blocks include: health service delivery; health workforce; medical products, infrastructure, and equipment; health information; healthcare financing; and leadership and governance. Highlights of the specific strategies related to this area are as follows:

Health Service Delivery

a) Implementation of the malaria prevention and control interventions including IRS, ITN distribution, intermittent preventive therapy in pregnancy (IPTp), and prompt and effective treatment
b) Strengthen key interventions such as school health and nutrition programs
c) Implement comprehensive health promotion/SBCC strategies to strengthen health promotion and disease prevention and address the social determinants of health in the country

d) Strengthen laboratory capacity by ensuring availability of adequate and appropriate infrastructure, equipment and supplies and qualified staff

Human Workforce

a) Hospital reforms program encompassing strengthened referral structures, outreach programs from tertiary to regional referral hospitals, mobile referral services and improved quality of clinical services in hospitals
b) Increasing the number of trained health workers available to the sector improving the remuneration package and expanding training output
c) Improve efficiency in utilization of existing staff by improving human resources management and better training coordination
d) Provide appropriate training and incentives to community health workers to mitigate human resources shortages

Medical Products Infrastructure and Equipment

a) Strengthen logistics management systems for essential commodities
b) Ensure rational use of commodities and services
c) Construction of national drug quality control laboratory, laboratories, and drug storage facilities

Health Information

a) Rollout and strengthen the HMIS to all public and private hospitals and at community level
b) Strengthen and build capacity of health information cadre at all levels in order to improve the efficiency, quality, and timely availability

Health Care Financing

a) Resource mobilization: explore alternative ways of raising health finances including public-private partnerships, private and social health insurance and ear-marked taxes

Leadership and Governance

a) Introduce performance based financing
b) Support the implementation of the National Decentralization Implementation Plan
c) Strengthen the sector collaboration mechanisms

Progress since PMI was launched

Although there has been a recent increase in the total reported cases of malaria from 2010–2015, the number of reported inpatient cases and deaths due to malaria has been reduced by 52% and 65%, respectively. This may be due in part to better case management and possibly increased testing and treatment at the community level. The national HMIS has also been upgraded from the District Health Information System 1.4 to 2.0 (DHIS2), offering significant improvements in timeliness of reporting, data visualization, and data systems management. This ability to better utilize data led to alert the NMCP of the deteriorating malaria situation in multiple provinces. PMI also supports the use of mapping technology, paired with health facility case data, to identify malaria hot spots within districts

that were targeted for IRS. This information was coupled with population and structure density data to determine the most cost-effective areas to spray. These routine surveillance activities and targeted surveys are designed move the Zambia public health system towards a data driven culture. The PMI Zambia team has been providing technical assistance and capacity building at the NMCP including SM&E and CHW training in iCCM that, together with many other interventions for malaria and other diseases, have resulted in a 55% reduction in all-cause mortality rates for children under the age of five (DHS). An example of this impact is evident in the PMI-funded operational research study that showed substantial reductions of inpatient admissions and outpatient visits for malaria after the scale-up of interventions, and hospital spending on malaria interventions also decreased by a factor of ten.[5] Zambia historically has high coverage of IPTp and this continues to be the case as the new WHO Guidelines for IPTp are adapted and implemented in country. In 2014, PMI supported trainings for 504 healthcare workers in IPTp in the new guidelines, which likely contributed to the increase in national coverage of at least two doses from 72% in 2012 to 79% in 2015. One PMI-supported FETP resident and one Level One (intermediate-level) resident have successfully completed the training since the program began in 2014.

Previously, PMI and Peace Corps have strengthened their partnership by jointly implementing and publishing an ITN durability monitoring study. Additionally, PMI funded a malaria focal person at the Zambia WHO Country Office who provided technical support to the drafting team to conduct a comprehensive gap analysis, partner mapping, and the writing of the Transitional Funding Mechanism Global Fund Application and present it to the Country Coordinating Committee for endorsement before transmission to the Global Fund Secretariat in Geneva. He provided support for the 2015 MIS and revision of National Malaria Treatment Guidelines.

Progress during the last 12-18 months

Currently, PMI is providing support to strengthen management capacity of provincial and district MoH personnel to provide supervision and mentoring to improve delivery of proven malaria interventions. PMI supports two FETP resident, one resident placed at the NMCC and another at placed at the provincial level. PMI supports a third year Peace Corps Malaria Coordinator in Zambia. Additionally, the PMI Resident Advisors provide subject matter expertise to the Peace Corps Malaria Coordinator to train over 250 Peace Corps volunteers in Zambia on malaria.

[5]Comfort, A.B., et al. 2014 Hospitals and Costs Incurred at the Facility Level after scale-up of Malaria Control: Pre-post Comparisons from Two Hospitals in Zambia, American Journal of Tropical Medicine and Hygiene, 90: 20-22.

Table N: Health Systems Strengthening Activities

HSS Building Block	Technical Area	Description of Activity
Health Services	Case Management	Improve, through training and supervision, QA systems to monitor the quality of laboratory diagnostic services. Funds from other programs aimed at improving health care services through trainings and supervision are also used to improve case management.
Health Workforce	Health Systems Strengthening	Build, through training and technical assistance, host country managerial and leadership capacity for effective malaria control. Support long-term capacity building within the MoH through supporting participation in a field epidemiology training program (FETP).
Health Information	Surveillance, Monitoring and Evaluation	Strengthen health information management systems (HMIS) to improve malaria surveillance, data-driven decision-making, planning, forecasting and program management. Funds and activities are leveraged with other program investments intended to strengthen HMIS as well.
	Operational Research	Provide training and financial support for in-country malaria operational research.
Essential Medical Products, Vaccines, and Technologies	Case Management	PMI will support improved forecasting, procurement, quality control, storage, and distribution of malaria commodities, such as insecticide-treated nets, artemisinin-based combination therapies, and rapid diagnostic tests.
Health Finance	Health Systems Strengthening	Provide technical assistance to leverage and better manage financial contributions and services from other global donors and partners for malaria prevention and control.
Leadership and Governance	Health Systems Strengthening	Strengthen national coordinating and regulatory bodies to direct and manage malaria resources, develop guidelines, and improve quality of services.

Plans and justification

PMI plans to focus FY 2017 funding on capacity-strengthening and malaria health system improvement investment at provincial, district, facility, and community levels, supporting the GRZ to deliver proven interventions more consistently and efficiently in order to achieve increased and sustained impact. These efforts will create a culture of data driven decision-making at the national and sub-national level. This will be accomplished through the following activities listed below.

Proposed activities with FY 2017 funding: ($180,000)

- Provide support to strengthen NMCP staff capacity through professional development activities. Activities will include training workshops (e.g., SM&E, commodity quantification) and regional/global meetings (e.g., American Society for Tropical Medicine and Hygiene). ($60,000)

- Support for Peace Corps third year volunteer. Housing and travel for one Peace Corps volunteer to assist in malaria activities and operational research as a third year or response Volunteer. Provide support for Peace Corps activities including provincial training of trainers courses and small project assistance grants. ($20,000)

- Provide support for one Zambian national to participate in a field epidemiology training program either at the intermediate or advanced level. This activity will support long-term local capacity within the MOH. ($100,000)

- Provide support to enhance national capacity in health systems strengthening, PMI will support the NMCP for HMIS, CHW, and other elements of the public health system in Zambia. (*Costs included in case management and SM&E line items*)

5. Social and behavior change communication

NMCP/PMI objectives

The NMCP is in the process of developing the 2017-2021 national malaria SBCC strategy in alignment with the National Malaria Strategic Plan and the National Health Strategic Plan. However, the NMCP'S SBCC strategy for 2011–2014 remains in effect until a new strategy document is developed. The new strategy is expected not to depart significantly from the current strategy. The NMCP's SBCC strategy for 2011–2014 has clear behavior change objectives for each of the malaria control interventions, and also identifies barriers to the desired behaviors. Target audiences are also identified and measurable communication objectives are clearly stipulated. All institutions working on malaria, including public, private, non-governmental organizations (NGOs), and PMI are required to follow the national strategy. Technical coordination of SBCC activities are also conducted through the malaria specific SBCC TWG.

Progress since PMI was launched

PMI progress on SBCC to date has included the development of 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 CHWs has included a SBCC component and CHWs are given job aid posters 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 in the remaining areas of the country. PMI has also supported training of NGO staff on SBCC related to malaria prevention, and supported Peace Corps volunteers to work with local NGOs on implementing malaria SBCC activities in various provinces.

Furthermore, PMI has been supporting SBCC activities to prevent malaria during pregnancy through SMAGs. PMI resources complement funding with other donors/partners to support these activities. By the end of 2014, the areas covered by SMAGs recorded impressive results, with the proportion of pregnant women who attended antenatal care increasing from 60% to 93% and the proportion of eligible pregnant women who received IPTp increasing from 55% to 95% in the targeted communities. The proportion of persons who had a fever in the past two weeks who got a malaria test increased from 70% to 87% while the proportion of persons who slept under an ITN increased from 48% to 65%. This successful approach will continue to be utilized in similar activities in targeted districts in the future.

PMI supports several vehicles for its communication activities. PMI has been supporting the implementation of an integrated community-based communications focusing on promotion of malaria prevention, diagnosis, appropriate treatment, and nutrition for pregnant women and children under five in 8 districts and 131 communities across 4 higher malaria burden provinces since 2011. The provinces and districts covered by this activities are: Chipata and Chadiza (Eastern Province), Kasama and Mpulungu (Northern Province), Mansa and Samfya (Luapula Province), and Mongu and Kaoma (Western Province). Community malaria counseling agents went door to door in their communities each week to counsel households on the many ways they can prevent malaria and decrease its impact. At the conclusion of each visit, the agents collected data on every household's behavior the past week; these data shed light on which households were consistently adopting which healthy behaviors. This weekly feedback highlighted the gaps, showcasing where additional support from the counselors was needed. The feedback loop implemented by the partner lead to a 10% increase in regular ITN use compared to communities without a community counseling agent.[6]

From 2006 to 2015, SBCC efforts contributed to improved malaria knowledge among Zambians including: on nets as a malaria prevention method (from 78% to 91%), and on fever as a symptom of malaria (from 65% to 80%). The percentage of those who recognized that mosquito bites cause malaria increased from 80% in 2006 to 89% in 2012 but decreased to 85% in 2015. This could be attributed to an emphasis on the use of ITNs without providing an explanation on the reason for use. Furthermore, net use among children under age of five has also increased from 24 to 59%. IPTp second dose coverage among pregnant women increased from 59% in 2006 to 79% in 2015.

Progress during the last 12-18 months

PMI has been providing technical assistance to the MoH to strengthen malaria SBCC by developing and implementing community-level SBCC activities, which focus on malaria care seeking and net use. PMI supported training of 3,472 people including provincial health education officers, district health promotion focal persons, and individuals and organizations involved in community-based health promotion. Additionally, PMI's community level SBCC support is targeted at all active community groups including SMAGs and CHWs. SBCC training forms part of the training curriculum for CHWs and SMAGs training. PMI provides support for training and supports CHWs and SMAGs to provide SBCC interventions in their communities.

Community health assistants (CHA) are MoH employees on Government of Zambia payroll. They are meant to spend 80% in the community and 20% of their time at health facilities. However, currently their coverage is low. In communities were CHA are present, PMI supports their SBCC activities

[6]Communications Support for Health: Final Report 2014

The activities included establishing and guiding SBCC Coordinating Committees in 40 malaria endemic districts. These committees take responsibility for strengthening SBCC coordination and implementation across the district and within communities. PMI also supported strengthening the capacity of community drama groups to communicate appropriate malaria messages in an effective manner to increase demand for and utilization of malaria interventions at the district level. The DCMOs also received a training video on community theater which captures the process of training community drama practitioners and documents the entire process of a community drama session.

As Zambia advances in its control of malaria efforts, the behavioral issues it will encounter will be more and more complex and likely demand further investments to resolve. Improving coverage of some interventions will likely slow down as early adopters of malaria interventions have already been reached and late adopters require additional and innovative ways to convince them to adopt and maintain the behaviors that, to date, they have rejected. Late adopters may not be homogenously distributed in the population and it will require special efforts to identify and reach them. A PMI-supported formative study and a KAP study are planned for 2016/2017. The two studies will inform development of the new national malaria SBCC strategic plan 2017 - 2021.

Plans and justification

A mix of communication activities—mass media, community, and interpersonal—is necessary to inform, promote, and maintain the behaviors to prevent and treat malaria. The mix of activities is dependent on the types of behaviors, barriers to behaviors, and whether the behavior has reached a critical mass in the population. However, in all cases, communication activities need to be sustained or the behavior will change over time, as the risk is perceived to have disappeared.

PMI will support SBCC implementation for malaria in four target provinces (Eastern, Luapula, Muchinga, and Northern Provinces) at health facility and community levels through community mobilization and community dialogues. This will lead to increased acceptance of IRS, increased ANC attendance with higher IPTp uptake, and improved health care seeking behavior and increased demand for and acceptance of malaria diagnostics. At the national level, PMI will support the NMCP for malaria focused SBCC strategies and materials in collaboration with other partners.

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

The NMCP believes that both national and community SBCC activities are needed to change and maintain behaviors in malaria prevention and treatment. Each approach reaches different audiences and reinforces key messages. The final mix of mass, community, and interpersonal communication activities and technical orientation will be based on evidence that will help focus efforts. A part of the M&E strategy for SBCC will be to analyze information collected through the regular MIS about knowledge and practices, as well coverage estimates (i.e., final results of SBCC efforts). Emphasis will be to maintain current levels of coverage and expand to cohorts that have been difficult to reach or are recalcitrant in adopting the desired behaviors.

Zambia has a mixed malaria epidemiological pattern with lower transmission in the southern provinces and higher transmission in the northern provinces. However, areas of high and low transmission also occur within the same province. This mixed epidemiological malaria pattern poses a challenge for malaria SBCC. At national level, the messages will be standardized to emphasize proven interventions (e.g., messages for consistent nightly use of ITNs, early initiation of ANC and IPTp at each FANC

appointment, and care seeking for all age groups). At the local level, SBCC will be tailored to epidemiological patterns and reflect promoting behavior that will gain the most impact on reducing malaria incidence (e.g. messages will focus on addressing known (and measured) seasonal net use practices).

The list below provides potential tasks and their rationale:

- Conduct national mass media and other SBCC activities to maintain ownership and proper use of ITNs through national multi-media efforts. National activities will focus on at least three groups: first, maintenance of appropriate behaviors in the population that is already exhibiting them; second, introduction of new cohorts to the desired behaviors; and, third reaching late adopters and those who are difficult to reach geographically. In addition, activities will aim to increase ANC attendance and demand for IPTp. National SBCC efforts for malaria in pregnancy are part of a larger integrated campaign on maternal health and nutrition that disseminates messages through national radio and television spots. Lastly, activities will aim to increase early care-seeking behavior for fevers and demand for malaria diagnosis. Mass media activities will promote early care seeking actions in health facilities, awareness of and demand for proper malaria diagnosis, and adherence to the treatment of malaria cases. ($450,000)

- Conduct community-based SBCC in four targeted provinces including through NGOs/faith-based organizations to increase net ownership and correct and consistent use of ITNs. Primary focus will be to target late adopters require a more focused and interpersonal approach. Activities will also support the increase ANC attendance and demand for IPTp. SBCC activities through community groups (SMAGs) will be implemented to increase use of IPTp. Activities will also aim to increase early care-seeking behavior for fevers and demand for malaria diagnosis usage at the community-level. ($1,300,000)

6. Surveillance, monitoring, and evaluation

NMCP/PMI objectives

The new national malaria strategic plan 2017–2021 strongly emphasizes the importance of a strong SM&E system to be in place to ensure timely availability of quality, consistent, and relevant data on malaria control performance. Surveillance is a key program component for malaria control in Zambia, as it enables the NMCP to process, present, interpret, and disseminate malaria data from services delivery points to use for timely decision making. Malaria surveillance data can be used to identify areas in need of interventions, and to measure the impact of interventions. These data guide policy and decision-making. A revised National M&E Plan will be developed to address the challenges in Zambia as it moves toward eliminating malaria. The SM&E strategy tracks all Roll Back Malaria-recommended indicators. Three SM&E strategies are:

1. Strengthen coordination/collaboration in surveillance, monitoring, and evaluation
2. Data management systems—strengthen the implementation of data management systems at community, facility, district, provincial, and national levels to efficiently collect, process, analyze, and manage malaria transmission and disease data

3. Surveillance to track progress towards elimination—strengthen capacities of health personnel at all levels with the aim of improving quality and timeliness of case detection and reporting

PMI's support to SM&E in Zambia aligns with the NMSP and the National Malaria M&E Plan. PMI coordinates and collaborates with the NMCP and several partners in providing technical assistance and resources for SM&E activities including MACEPA, the Global Fund, UNICEF, and WHO.

Progress since PMI was launched

Surveillance and monitoring: As of 2014, the national HMIS has been upgraded from the District Health Information System (DHIS) 1.4 to 2.0 in all districts throughout the country. Malaria cases are reported through the national HMIS using a combination of paper tools and the DHIS2 with all public and mission health facilities and some private facilities reporting health data monthly through the HMIS. Information flows from the health facility to the district and provincial level before being transmitted to the HMIS group within the MoH. The NMCP accesses malaria data from the MoH HMIS and maintains its own web-based data management system using the DHIS2 platform. The HMIS collects data on malaria clinical and confirmed cases, OPD, and inpatient cases, and deaths by age under one year, one to five years, and over five years. At the national level, DHIS2 provides significant improvements in timeliness of reporting, data visualization, and data systems management. Capacity building activities have been conducted at all levels of the health system in surveillance, monitoring, and evaluation. According to WHO, in 2013 the reporting rate for health facilities was 90%, with 20,124 reports out of 22,308 total expected (1,859 facilities x 12 months). The DHIS2 platform allows for data to be analyzed using maps, charts, pivot tables, or summarized through dashboards.

Evaluation: To evaluate outcomes and impact of malaria prevention and control activities in Zambia, nationally-representative surveys such as the DHS and the MIS are performed periodically. All-cause mortality in children under five years of age is tracked using the DHS; other child health indicators are also collected by the DHS and used in assessing impact. The 2007 DHS report provides a baseline estimate of mortality at the start of PMI and the 2014 DHS for reporting on progress.

[7] Institute of Health Metrics and Evaluation. "Assessing Impact, Improving Health Progress in Child Health Across Districts in Zambia: A Report of the MCPA Project,"
2014.

[8] Bennett et al. A methodological framework for the improved use of routine health system data to evaluate national malaria control programs: evidence from Zambia Population Health Metrics 2014, 12:30
http://www.pophealthmetrics.com/content/12/1/30

A number of other non-PMI-financed surveys and evaluations provide additional provincial-, district-, and community-level data on malaria epidemiology in Zambia, and provide useful information on the progress of malaria control efforts. These include health facility surveys to assess health worker performance and the quality of health care; availability of health guidelines, personnel, and equipment; and household surveys to assess knowledge, attitudes, and practices related to malaria. As part of routine supervisory visits to MoH facilities, checklists are also completed on health worker performance and other technical aspects of health care. Table O, below, shows household and facility surveys implemented and planned from 2010 to 2018.

Progress during the last 12-18 months

HMIS: Malaria data from the HMIS are being used to follow trends in incidence at the district level, targeting health facility catchment areas for IRS, locating hot spots in very low endemic areas, and following trends in confirmed cases and diagnostic use.

Evaluation: In 2016, the final results from the 2015 MIS were released. Progress in reducing malaria prevalence was made in Southern and Eastern Provinces; however, the malaria prevalence either remained the same or increased in other provinces indicating there is still need for improved and optimized malaria control in Zambia.

Rapid Reporting: Malaria surveillance systems were developed for Southern Province at the facility level using the malaria rapid reporting system, mobile phones, and geographic information system. Health care workers report malaria cases, lab testing, and drug availability by web-enabled cell phones on a weekly basis. These data can be accessed through DHIS2 online platform. This rapid reporting system has been expanded to additional facilities in Western and Central Provinces.

Active Infection Detection: The previously PMI-supported enhanced surveillance in Lusaka District, which was transitioned over to the Lusaka District Health Office, has not continued as expected and will require additional PMI support to improve participation and reporting from the health centers. Community-level malaria reactive case detection continues in low burden areas and as part of a MDA program in Southern Province; it is being considered for expansion into parts of Western Province.

End-Use Verification: The EUV collects data on malaria commodities from facilities to assess availability. The last report for EUV is from the first quarter of 2016, reflecting data from 41 health facilities visited in February 2016. On the day of the visits 90% of health facilities had at least one AL presentation. Stockouts of individual AL presentations ranged from 17-32%, and 10% of facilities had no AL presentations. These facilities were in districts where the EMLIP had not yet been rolled out. RDTs and SP were stocked out in 10% and 7% of facilities, respectively, on the day of visit.

Table O. Monitoring and Evaluation Data Sources

Data Source	Survey Activities	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			X			(X)
	EPI survey		X							
	ZAMPHIA HIV Survey							X*		
Health Facility and Other Surveys	School-based malaria survey									
	Health facility survey		X						(X)*	
	SPA survey						X*			
	EUV survey	X	X	X	X	X	X	X	(X)	(X)
	KAP survey								(X)	
Malaria Surveillance and Routine System Support	Support to malaria surveillance system					X*	X*	X*	(X)*	(X)*
	Electronic Logistics Management Information System (eLMIS)					X	X	X	(X)	(X)
	Support to HMIS/DHIS2				X*	X*	X	X	(X)	(X)
Therapeutic Efficacy monitoring	In vivo efficacy testing				X			X		(X)
Entomology	Entomological surveillance and resistance monitoring		X*	X	X	X	X	X	(X)	(X)
Other malaria-related evaluations	Malaria Program Review	X			X			X		
Other Data Sources	Malaria Impact Evaluation					X*				

*Not PMI-funded ; ( ) Planned activity

Table P. Routine Surveillance Indicators

Indicators	Value	Comments
1. Total number of reported malaria cases Data source:	5,201,875	OPD and IPD cases combined, excludes deaths.
Total diagnostically confirmed cases	4,182,608	
Total clinical/presumed/unconfirmed cases	1,019,267	
If available, report separately for outpatients and inpatients		
Outpatient number of reported malaria cases	5,094,073	
Diagnostically confirmed	4,094,878	
Clinical/presumed/unconfirmed	999,195	
Inpatient number of reported malaria cases	107,802	
Diagnostically confirmed	87,730	
Clinical/presumed/unconfirmed	20,072	
2. Total number of reported malaria deaths Data source:	2,337	
Diagnostically confirmed	1,983	
Clinical/presumed/unconfirmed	354	
3. Malaria test positivity rate (outpatients) Data source:	57%	This exclude pregnant woman from the numbers because there is not an option for total tests for pregnant women.
Numerator: Number of outpatient confirmed malaria cases	4,050,631	
Denominator: Number of outpatients receiving a diagnostic test for malaria (RDT or microscopy)	7,127,093	
4. Completeness of monthly health facility reporting Data source:	N/A	The server indicator groups and categories have recently been changed around quite a bit. There was previously a preset reporting completeness report for HIA1 and 2 forms but it is no longer available.
Numerator: Number of monthly reports received from health facilities		
Denominator: Number of health facility reports expected (i.e., number of facilities expected to report multiplied by the number of months considered)		

Plans and justification

Monitoring and evaluating malaria prevention and control activities will rely on a combination of routine malaria data through the HMIS and surveys. Although the DHIS has been in Zambia for quite some time, not all health posts and health facilities are using DHIS2 and the quality and timeliness of data is lower than expected. Sustained effort and leadership is needed to ensure that all facilities use DHIS, incorporating the DHIS community component, and that the GRZ provides leadership and strategic vision of utilizing the data from the national level down.

With FY 2017 funds, PMI will provide support to strengthen routine malaria data collection at the community, health facility, district, provincial, and national levels through the HMIS. The objective is to achieve 100% on-time reporting of malaria cases by districts and 90% by health facilities in PMI-targeted provinces. PMI will ensure the SM&E activities at the national level and in the four PMI-supported provinces are complementary. The next national MIS is planned for 2018. Support for the Lusaka District Enhanced Surveillance activity will be evaluated in terms of producing high-quality surveillance data to be used for evidence-based deployment of interventions in the area of support. The support for this activity may be reconsidered as additional pre-elimination activities or priorities are identified. With FY 2017 funds, PMI will support the following activities:

Proposed activities with FY 2017 funding: ($1,960,000)

- Strengthen routine M&E systems (HMIS) in four targeted high burden provinces. PMI will help strengthen the HMIS at health facility, community, district, and provincial levels. Implementation activities will include: support for training of data clerical staff at health facilities and district community health offices to correctly perform all aspects related to collecting and reporting HMIS data and in using DHIS2 and support HMIS supervision, and monitoring and mentoring visits; improving collection and reporting of routine malaria indicators at community level; and strengthening malaria data analysis and use for planning and decision making. ($500,000)

- Provide resources for central-level NMCP personnel to conduct and follow up on data quality audits in all districts and provincial offices in one year. This activity entails visiting officers responsible for collecting, collating, and reporting data from health facilities to higher levels of the health system and ensuring that appropriate quality procedures are followed. No other donors are currently funding this activity. ($100,000)

- Support will be provided for national-level HMIS strengthening including capacity building for central level M&E staff for DHIS2, national-level coordination with partners such as MACEPA and CHAI on their M&E activities, support M&E technical working group meetings, provide technical assistance to enhance standardization and reporting of data in HMIS. ($750,000)

- Support national 2018 Malaria Indicator Survey. The MIS has been conducted every two to three years in Zambia. The survey provides the NMCP with standard population-based indicators for monitoring and evaluating malaria interventions. This will be the sixth survey with standard methodology and malaria indicators. ($400,000)

- Support enhanced surveillance in Lusaka District. The Lusaka enhanced surveillance activity served as a model for the Step 1, 2, 3 strategy from which the current enhanced surveillance program in the southern half of the country evolved. The support for Lusaka District will be used

to restart the rapid reporting and community-level response to investigate potentially locally-acquired infections in Lusaka District. ($200,000)

- Provide CDC technical assistance in monitoring and evaluation activities. ($10,000)

7. Operational research

The NMCP in Zambia has many ongoing and planned research activities with a number of different partners. In 2016 PMI supported the NMCP to develop an operational research roadmap to plan out current and future operations research activities and prioritize goals. This will be used to help coordinate current research activities and for planning purposes to align future research activities with the goals of the NMCP. The outcomes of this road mapping exercise will guide future PMI OR activities in Zambia.

Table Q: Summary of Operations Research

Completed OR Studies			
Title	**Start Date**	**End Date**	**Budget**
The efficacy of SP for IPTp, Mansa, Zambia	January 2010	Published June 2014	$200,000
ITN prospective durability study	2011	Published February 2016	$50,000
Ongoing OR Studies			
Title	**Start Date**	**End Date**	**Budget**
Association between malaria control scale-up and micro-economic outcomes: evidence from a retrospective analysis in Zambia	December 2015		$220,000
Impact and cost-effectiveness of focal IRS with pirimiphos-methyl in Nchelenge District: Identifying targeting strategies to maximize protection while minimizing cost	December 2016	December 2018	$324,299
Planned OR Studies FY 2017			
Title	**Start Date**	**End Date**	**Budget**
Targeted IRS with long-lasting ITNs	2016		$300,000

Completed OR studies

PMI supported an operational research project on ITN durability that was completed in 2013 (see ITN section). This study examining structural integrity of ITNs distributed in Northern and Luapula Provinces was started in 2011 and the field work was completed by the end of 2013. The data showed a lack of increase in total hole area as nets aged and suggested that this is likely due to ITN attrition that might occur between two and three-and-a-half years. At 27-30 months, ITNs already had a large total hole surface area that was equivalent to the oldest nets observed. Nets were often tucked under reed mats which may explain the finding that the largest hole area was found in the lower half of the net.[9]

[9] Long-lasting insecticidal nets in Zambia: a cross-sectional analysis of net integrity and insecticide content
Allen S. Craig*, Mbanga Muleba, Stephen C. Smith, Cecilia Katebe-Sakala, Gershom Chongwe, Busiku Hamainza, Batuke Walusiku, Megan Tremblay, Maureen Oscadal, Robert Wirtz and Kathrine R. Tan *Malaria Journal* 2015, 14:239

Additionally, a PMI-funded study of the efficacy of SP for IPTp in Mansa, Zambia was completed in 2013. (*See the MIP section for more information*.)

Ongoing OR studies

Association between malaria control scale-up and micro-economic outcomes: evidence from a retrospective analysis in Zambia:

While substantial attention has been devoted to understanding the effectiveness of malaria control strategies on health outcomes, there has been less focus on understanding the economic impact of malaria control interventions. As malaria control interventions are scaled up and malaria episodes decrease, households may experience economic benefits such as improved household income and consumption, worker productivity, schooling attendance, and poverty status. This study assesses the associations between malaria control scale-up and micro-economic indicators in Zambia, where significant progress has been made in scaling up effective malaria control strategies, but also where malaria continues to be an important public health concern. Using data from 2006 to 2010 on the distribution of ITNs and IRS, this study examines whether the scale-up of these activities in Zambia is associated with improved micro-economic outcomes at the household level. Specifically, the study will try to determine whether or not these activities affect household spending on food, household spending on medical care, schooling attendance, agricultural production, and household savings and borrowing.

Impact and cost-effectiveness of focal IRS with pirimiphos-methyl in Nchelenge District: Identifying targeting strategies to maximize protection while minimizing cost

This study was delayed due to protocol development, but started during the 2016 IRS campaign and will assess the impact and cost-effectiveness of focal IRS with pirimiphos-methyl in Nchelenge District through measurement of changes in parasite prevalence, vector density, and insecticide resistance in areas targeted for spraying, neighboring communities and distant communities. The main goal is to identify optimal strategies to target IRS guided by readily available data on population demographics, malaria epidemiology, vector bionomics and ecological characteristics that can be implemented throughout Zambia. The study will: a) Measure the impact of focal IRS with pirimiphos-methyl in Nchelenge District on the number of confirmed malaria cases presenting to health facilities, parasite prevalence, vector density and insecticide resistance; b) Measure the cost-effectiveness of focal IRS with pirimiphos-methyl in Nchelenge District; and c) Identify demographic, epidemiological, entomological, and ecological factors associated with the effectiveness of focal IRS with pirimiphos-methyl in Nchelenge District.

Impact and cost-effectiveness of focal IRS with pirimiphos-methyl in Nchelenge District: Identifying targeting strategies to maximize protection while minimizing cost.

While Zambia's vector control strategy remains the same, a recent policy clarification now emphasizes universal coverage of ITNs with targeted IRS. Historically, vector control was split, with IRS reserved for urban and peri-urban areas while ITNs were targeted to rural areas. This approach in vector control has been ineffective, leading to increases in malaria cases in several districts throughout the country.

The new approach to vector control may be more cost-effective and ultimately could have a greater impact on malaria control and prevention in Zambia. Unfortunately, little data exist to help drive the decision-making process of determining where IRS would be best targeted in

combination with universal ITN coverage. The OR study proposed would help shed light on this issue in Zambia. It will also contribute to the limited scientific body of knowledge regarding the added benefit of IRS in combination with ITNs. This will be a second phase of the ongoing study. The second phase is designed to provide information that would guide implementation of the proposed policy change by NMCP. The study seeks to provide an evidence base for the designing focal IRS campaigns capable of delivering maximum impact to areas of high transmission. By matching IRS impact to parasite prevalence and mosquito vector abundance, the cost-effectiveness of two focal IRS strategies in reducing parasite prevalence will be measured. The primary outcome will be parasite prevalence by PCR. Secondary outcomes will include parasite prevalence by RDT, anopheline mosquito density per household, insecticide resistance profiles, and cost effectiveness.

Planned OR studies

All new OR activities will be developed with the NMCC following the outcomes of the Operational Research Roadmap expected late 2016.

Proposed activities with FY 2017 funding: ($0)

- PMI will use the outcomes of the OR road mapping to determine the NMCC operational research priorities to support in the future.

8. Staffing and administration

Three health professionals oversee PMI in Zambia. A USAID Infectious Diseases Specialist is responsible for the overall PMI portfolio. Two others serve as Resident Advisors (RAs), one representing CDC and one representing USAID. 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 with support from the Infectious Disease Specialist. The two PMI RAs, one from USAID and one from CDC, and the Infectious Disease Specialist will report to the USAID Health Office Director for day-to-day leadership, and work together as a part of a single interagency team. PMI staff will work across the Health Office, particularly with the Maternal and Child Health Division, the Health Systems Strengthening Division, and the Monitoring and Evaluation Division to maximize the efficient utilization of PMI programming dollars. 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: ($1,579,170)

- Support for in-country PMI CDC resident advisor with support encompassing salaries, benefits, travel, and other staff support related costs. ($688,581)

- Support for in-country PMI USAID staff including a USAID Infectious Disease Specialist and one USAID PMI RA with support encompassing salaries, benefits, travel, and other staff support related costs. In addition, support is provided for general administrative costs that enable Mission-wide assistance from which PMI benefits. ($890,589)

Table 1: Budget Breakdown by Mechanism

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

Mechanism	Geographic Area	Activity	Budget ($)	%
GHSC-PSM	National	Procurement of ACTs, RDTs, nets, lab supplies, provide technical assistance to strengthen pharmaceutical and supply chain management systems	8,267,330	33.1%
TBD-IRS Project	Targeted districts	Procurement of insecticides for IRS. Support environmental monitoring, insecticide resistance monitoring	8,264,500	33.1%
PAMO	National and four target provinces	At the national and in four target districts, improve the quality of parasitological diagnosis in the public sector; strengthen FANC, community-based BCC, roll out additional continuous ITN distribution channels in selected districts, technical assistance to strengthen HMIS. District and provincial data audits, M&E, support for health facility survey.	4,940,000	19.8%
TBD - SBCC	National	Support for national level SBCC activities	450,000	1.8%
TBD - Diagnostics	National	Strengthen malaria diagnostic capacity and quality assurance nationally through the training of malaria microscopists and support for OTSS.	400,000	1.6%
TBD	NA	Support for therapeutic efficacy study	300,000	1.2%
TBD	NA	Support national 2018 Malaria Indicator Survey	400,000	1.6%
TBD	NA	Support enhanced surveillance in Lusaka District	200,000	0.8%
TBD-Environmental Management	Targeted districts	Conduct environmental monitoring, environmental assessments, and risk mitigation in IRS districts	30,000	0.1%

Peace Corps		Support for third year volunteer, provincial training of trainers and small project assistance grants	20,000	0.1%
USAID/CDC Staff	NA	Personnel	1,579,170	6.3%
CDC-IAA	NA	Entomologic monitoring and insecticide resistance, SM&E, net durability, operations research and FETP training	149,000	0.6%
Total			**25,000,000**	**100%**

Table 2: Budget Breakdown by Activity

President's Malaria Initiative–ZAMBIA
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 monitoring and insecticide resistance monitoring and support to the insectary	TBD-IRS Project	450,000	0	NA	Support entomological monitoring and insecticide resistance monitoring and support to the insectary.
CDC technical assistance on entomological monitoring and insecticide resistance	CDC-IAA	29,000	0	NA	Provide CDC technical assistance on entomological monitoring and insecticide resistance.
Subtotal Ento monitoring		**479,000**	**0**		
Insecticide-treated Nets					
Procurement of ITNs	GHSC-PSM	2,280,000	2,280,000	National	Procure approximately 800,000 ITNs for 2018 continuous/routine distribution.
Distribution of ITNs	GHSC-PSM	550,000	0	National	Support the distribution of ITNs, including transportation and other logistics, to districts and health facilities.
Provide technical assistance to expand continuous distribution through schools and community	PAMO	150,000	0	Eastern, Muchinga, Luapula, Northern	Provide technical assistance to expand continuous distribution channels for sustaining high ITN coverage in selected provinces/districts).
Routine net durability monitoring	PAMO	180,000	0	TBD	Conduct the routine monitoring of the durability and physical integrity of ITNs in

					two sites following the 2017 mass campaign.
Technical assistance for routine monitoring of nets	CDC-IAA	10,000	0	NA	Provide CDC technical assistance for routine monitoring of net durability.
Subtotal ITNs		**3,170,000**	**2,280,000**		
Indoor Residual Spraying					
Procurement of IRS commodities and support to other components of the program.	TBD-IRS Project	6,140,500	6,170,500	35 districts (Eastern, Muchinga, Luapula, Northern)	Procure insecticides (i.e., organophosphates) and other IRS supplies/equipment for spraying up to 540,000 structures in 35 districts, inclusive of districts previously supported by DFID. Support environmental monitoring and environmental assessment to include use of DDT, organophosphates, or carbamates.
Implementation of IRS program, monitoring and evaluation, storage/incinerator, community sensitization, geocoding, BCC	TBD-IRS Project	1,674,000	0	35 districts (Luapula, Northern, Muchinga, Eastern)	Support the implementation of the IRS program, including activities to: train spray operators, supervisors, and store keepers; monitoring and evaluation; SBCC for IRS; pesticide storage; waste disposal; and pay for spray operations in 35 PMI-funded districts.
Environmental monitoring and compliance	TBD-Environmental Management	30,000	0	35 districts (Eastern, Muchinga, Luapula, Northern)	Conduct environmental monitoring, environmental assessments, and risk mitigation in IRS districts.
Subtotal IRS		**7,844,500**	**6,170,500**		
SUBTOTAL VECTOR MONITORING AND CONTROL		**11,493,500**	**8,450,500**		
Malaria in Pregnancy					

Strengthening FANC for IPTp	PAMO	500,000		National, Eastern, Muchinga, Luapula, and Northern	Training provincial and district level health workers on then updated NMCP IPTp guidelines in four high malaria burden provinces (Eastern, Luapula, Muchinga, and Northern). These four provinces constitute 36 high burden malaria districts.
Subtotal Malaria in Pregnancy		**500,000**	**0**		
SUBTOTAL PREVENTIVE		**11,993,500**	**8,450,500**		
CASE MANAGEMENT					
Diagnosis and Treatment					
Procurement of RDTs	GHSC-PSM	967,330	967,330	National	Procure 3 million RDTs for health facilities and iCCM.
Procurement of ACTs	GHSC-PSM	3,300,000	3,300,000	National	Procure 3.3 million ACTs (artemether-lumefantrine) for the treatment of malaria in facilities and communities.
Procurement of microscopes, regents and supplies	GHSC-PSM	70,000	70,000	National	Procure microscopes, reagents and supplies.
Strengthen malaria diagnostic capabilities at the health center level	TBD - Diagnostics	400,000		National	Strengthen malaria diagnostic capacity and quality assurance centrally and in areas outside the four higher malaria burden provinces through the training of malaria microscopists and support for OTSS.
Improve the quality of parasitological diagnosis in the public sector for four provinces	PAMO	400,000		Luapula, Northern, Eastern and Muchinga	Improve the quality of parasitological diagnosis in the public sector in four targeted provinces through training and supportive supervision of healthcare providers at primary health care and community levels. PMI will work at the provincial, district, and community level to improve the appropriate use of diagnostics including interpreting test results and managing patients based on results.

Support Therapeutic Efficacy Study	TBD	300,000		NA	Conduct therapeutic efficacy study to detect any problems with any problems with resistance to the first-line antimalarial
Strengthen facility- and community-based treatment with ACTs	PAMO	1,000,000		Eastern, Muchinga, Luapula, and Northern	Support the supervision of healthcare providers in the treatment of uncomplicated malaria and the training of CHWs in iCCM in four targeted provinces. Also, support the training of health workers at health facilities with inpatient services on the use of injectable artesunate for severe malaria.
Subtotal Diagnosis and Treatment		**6,437,330**	**4,337,330**		
Pharmaceutical Management					
Provide technical assistance to strengthen pharmaceutical and supply chain management systems	GHSC-PSM	1,100,000		National	Provide technical assistance to strengthen pharmaceutical and supply chain management systems, including: quarterly forecasting and quantification; strengthening of EMLIP system; semi-annual end-use verification activities; supporting MSL to ensure successful adoption of its new tasks, including forecasting and supply planning capacity, as well as the improvement of the storage and distribution of malaria commodities.
Subtotal Pharmaceutical Management		**1,100,000**	**0**		
SUBTOTAL CASE MANAGEMENT		**7,537,330**	**4,337,330**		
HEALTH SYSTEM STRENGTHENING / CAPACITY BUILDING					

Training and capacity building	PAMO	60,000		National	Provide support to strengthen NMCP staff capacity through professional development activities. Activities will include training workshops (e.g., SM&E, commodity quantification) and regional/global meetings (e.g., American Society for Tropical Medicine and Hygiene).
Peace Corps	Peace Corps	20,000		National	Support for Peace Corps third year volunteer. Housing and travel for one Peace Corps volunteer to assist in malaria activities and operational research as a third year or response volunteer. Provide support for Peace Corps activities including provincial training of trainers courses and small project assistance grants.
Field Epidemiology Training Program	CDC-IAA	100,000		National	Provide support for one Zambian national to participate in a field epidemiology training program either at the intermediate or advanced level. This activity will support long-term local capacity within the MOH.
SUBTOTAL HSS & CAPACITY BUILDING		**180,000**	**0**		
SOCIAL AND BEHAVIOR CHANGE COMMUNICATION					
Support for national SBCC activities	TBD - SBCC	450,000	0	National	Support for national SBCC activities to maintain ownership and proper use of ITNs, increase ANC attendance and demand for IPTp, increase early care seeking behavior and demand for proper malaria diagnosis and increased adherence to treatment for malaria.

Provide support for community-based SBCC	PAMO	1,300,000	0	Eastern, Muchinga, Luapula, and Northern	Provide support for community-based SBCC through NGOs/FBOs to increase net ownership and use, increase ANC attendance and demand for increase ANC IPTp, increased early care seeking behavior and demand for proper malaria diagnosis and adherence to treatment for malaria at the community level.
SUBTOTAL SBCC		**1,750,000**	**0**		
SURVEILLANCE, MONITORING, AND EVALUATION					
Technical assistance to strengthen HMIS	PAMO	500,000		National	Strengthen routine M&E systems (HMIS) at health facility, district, and provincial levels in four targeted high burden provinces. Activities will include support for training staff at health facilities and district community health offices in data collection, reporting, and use of DHIS2; supporting HMIS supervision, and monitoring and mentoring visits; improving collection and reporting of routine malaria indicators at community level; and strengthening malaria data analysis and use for planning and decision making.
District and provincial data audits	PAMO	100,000		National	Provide resources for central-level NMCP personnel to conduct and follow up on data quality audits in all districts and provincial offices in one year. This activity entails visiting officers responsible for collecting, collating, and reporting data from health facilities to higher levels of the health system and ensuring that appropriate quality procedures are followed.

Technical assistance to enhance standardization and reporting of national, facility, and community-level data	PAMO	750,000		National	Support will be provided for national-level HMIS strengthening including capacity building of central level M&E staff for DHIS2, national-level coordination with partners such as MACEPA, CHAI, etc. for their M&E activities, support M&E technical working group meetings, provide technical assistance to enhance standardization and reporting of national, facility, and community-level data in HMIS.
Support national 2018 Malaria Indicator Survey	TBD	400,000			The MIS has been conducted every two to three years in Zambia. The survey provides the NMCP with standard population-based indicators for monitoring and evaluating malaria interventions. This will be the sixth survey with standard methodology and malaria indicators.
Support enhanced surveillance in Lusaka District	TBD	200,000			The Lusaka enhanced surveillance activity served as a model for the Step 1, 2, 3 strategy from which the current enhanced surveillance program in the southern half of the country evolved. The support for Lusaka District will be used to restart the rapid reporting and community-level response to investigate potentially locally-acquired infections in Lusaka District.
Technical assistance for M&E	CDC-IAA	10,000		NA	Provide CDC technical assistance in monitoring and evaluation activities
SUBTOTAL SM&E		**1,960,000**	**0**		
OPERATIONAL RESEARCH					
SUBTOTAL OR		**0**	**0**		
IN-COUNTRY STAFFING AND ADMINISTRATION					

CDC/USAID		1,579,170	0		Support for in-country PMI management and operational costs
SUBTOTAL IN-COUNTRY STAFFING		**1,579,170**	**0**		
GRAND TOTAL		**25,000,000**	**12,787,830**		