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

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U.S. PRESIDENT'S MALARIA INITIATIVE

PRESIDENT'S MALARIA INITIATIVE

ZAMBIA

Malaria Operational Plan FY 2018

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ABBREVIATIONS and ACRONYMS

ACT	Artemisinin-based combination therapy
AIDS	Acquired Immuno-Deficiency Syndrome
AL	Artemether-lumefantrine
ANC	Antenatal care
ASAQ	Artesunate-amodiaquine
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
DDT	Dichloro-diphenyl-trichloroethane
DFID	U.K. Department for International Development
DHA-PQ	Dihydroartemisinin-piperaquine
DHIS2	District Health Information System 2
DHO	District Health Office
DHS	Demographic and Health Survey
E8	Southern Africa Malaria Elimination Eight Initiative
EDS	Electronic data system
eLMIS	Electronic Logistics Management Information System
EMLIP	Essential Medicines Logistics Improvement Program
EPI	Expanded Program on Immunizations
EUV	End-use verification
FANC	Focused antenatal care
FETP	Field Epidemiology Training Program
FY	Fiscal year
Global Fund	Global Fund to Fight AIDS, Tuberculosis and Malaria
GRZ	Government of the Republic of Zambia
HIV	Human Immunodeficiency Virus
HFCA	Health facility catchment area
HMIS	Health management information system
iCCM	Integrated community case management
IPTp	Intermittent preventive treatment for pregnant women
IRS	Indoor residual spraying
ITN	Insecticide-treated mosquito net
LMU	Logistics Management Unit
M&E	Monitoring and evaluation
MACEPA	Malaria Control and Elimination Partnership in Africa
MDA	Mass drug administration
MIP	Malaria in pregnancy
MIS	Malaria indicator survey
MoH	Ministry of Health
MOP	Malaria Operational Plan
MSL	Medical Stores Limited
NMEC	National Malaria Elimination Centre

NMEP	National Malaria Elimination Program
NMESP	National Malaria Elimination Strategic Plan
NMSP	National Malaria Strategic Plan
NGO	Non-governmental organization
OP	Organophosphate
OPD	Outpatient department
OR	Operational research
OTSS	Outreach training and supportive supervision
PCR	Polymerase chain reaction
PEPFAR	President's Emergency Plan for AIDS Relief
PMI	President's Malaria Initiative
RA	Resident advisor
RDT	Rapid diagnostic test
SBCC	Social behavior change communication
SM&E	Surveillance, monitoring, and evaluation
SMAG	Safe Motherhood Action Groups
SP	Sulfadoxine-pyrimethamine
TES	Therapeutic efficacy study
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 began implementation as a PMI focus country in FY 2007.

This FY 2018 Malaria Operational Plan presents a detailed implementation plan for Zambia, based on the strategies of PMI and the National Malaria Elimination Program (NMEP), previously the National Malaria Control Program. It was developed in consultation with the NMEP 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 NMEP and PMI, and provides a description of activities that are planned with FY 2018 funding.

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

Entomologic monitoring and insecticide resistance management:

PMI supported the NMEP 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, *Anopheles gambiae* s.l and *An. funestus*. The most recent susceptibility tests conducted in 2017 showed both vectors are still mostly resistant to pyrethroids throughout Zambia. With FY 2018 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 NMEP 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 NMEP, 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 2018 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 2016, PMI supported the NMEP IRS operations in 35 PMI focus districts (9 in Eastern Province, 7 in Muchinga Province, 9 in Northern Province, 10 in Luapula Province). Through the UNITAID grant, PMI is able to support IRS in Luapula Province in addition to the three other provinces. Approximately 559,550 structures were sprayed using organophosphate insecticide out of the targeted out of 612,929 structures that were found by spray operators (91% spray coverage) in targeted catchment areas, protecting more than 2.6 million people (approximately 10% of the Zambian population). With funding from the Zambian government and the Global Fund, the NMEP conducted IRS in 43 non-PMI supported districts using organophosphates. PMI supports enumeration of IRS eligible structures using satellite mapping and targeting of IRS using HMIS data in four provinces (Eastern, Luapula, Muchinga, and Northern Provinces). To date, close to 1 million structures have been mapped. In 2017, targeted spraying of eligible structures with IRS will continue in those four provinces. With FY 2018 funding, PMI will cover the cost of IRS in the 4 PMI-focus provinces where 559,550 structures in 36 districts 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

2018 funding, PMI will support supervision and training of health workers in the updated NMEP 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

In 2017, PMI procured over 3 million 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 2018 funding, PMI will procure 2 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 2017, approximately 16 million ACTs are expected with PMI providing over 9.7 million, Global Fund 1.8 million, and the Government of the Republic of Zambia (GRZ) approximately 4.5 million. With FY 2018 funding, PMI will procure 2 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 Ministry of Health (MoH), Medical Stores Limited (MSL), and other stakeholders to improve the collection, management, and use of logistics data through support of an electronic Logistics Management Information System (eLMIS). eLMIS training has been a focus in recent pharmaceutical management investments leading to increased visibility of stock management and improved commodity availability at the facility level. FY 2018 funding, will support the roll out of the eLMIS facility version to an additional 100 health facilities. This will bring the total trained to 450 health facilities.

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 NMEP capacity building. PMI has been providing technical assistance and capacity building at the NMEP including surveillance, monitoring, and evaluation (SM&E) and community health worker training in iCCM. With FY 2018 funding, PMI will continue to support NMEP capacity building as well as support one Zambian national through the Field Epidemiology Training Program.

Social and behavior change communication (SBCC):

The NMEP 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 NMEP'S SBCC strategy for 2011–2014 continues to be in effect until a new strategy document is developed. 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 MoH to strengthen malaria SBCC by developing and implementing national and community-level SBCC activities, which focus on malaria care-seeking and prevention. With FY 2018 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 management information system (HMIS) has been upgraded to the District Health Information System 2 (DHIS2) platform. Malaria surveillance systems were developed to support community surveillance and reactive case detection (referred to as Step D in Zambia National Malaria Elimination Strategic Plan (NMESP) 2017–2021) in Southern Province as a pre-elimination surveillance tool, which was expanded into Western Province in 2016 and 2017. Additional ongoing malaria surveillance in Southern Province includes the malaria rapid reporting system at the facility level, using weekly mobile phone reporting. PMI currently supports enhanced surveillance in Lusaka District. Although it was transitioned over to the Lusaka District Health Office in 2013, additional PMI funding was needed. The end-use verification survey collects data on malaria commodities quarterly 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 2018 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 NMEP in Zambia has many ongoing and planned research activities with a number of different partners. With FY 2015 funding, PMI supported the NMEP 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 NMEP. PMI is currently supporting a comparison-control trial to determine optimal IRS strategies in the limited-resource environment of Eastern Province. While Zambia emphasizes universal coverage of vector control with ITNs and IRS; this OR study will seek to shed light on how to determine where IRS would be best targeted in combination with universal ITN coverage.

Pre-elimination:

In 2017, Zambia's malaria elimination efforts gained significant traction, their National Malaria Elimination Strategic Plan (NMESP) 2017–2021 was officially launched and the National Malaria Control Centre was re-branded as the National Malaria Elimination Centre on World Malaria Day, April 25, 2017 to highlight the importance of and GRZ commitment to elimination of malaria in Zambia. Currently, most pre-elimination activities in Zambia are supported by GRZ and MACEPA, with support

in some districts from the Isdell Flowers Foundation. PMI continues to focus on malaria prevention and control in high burden provinces in support of the NMESP.

II. STRATEGY

1. Introduction

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

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2. Malaria situation in Zambia

The estimated 2017 population of Zambia is approximately 16.4 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, 2016, and 2017 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.l and *An. funestus* are the major vectors. All ten provinces of Zambia are endemic for malaria with 100% 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 6,036,433 (2010-2016) 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%. The NMEP has rolled out injectable artesunate to all districts in the country. Additional efforts have included training of health providers in the management of severe malaria. PMI supports these efforts in the four target provinces. Zambia has a large cadre of active community health workers (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 continue to make efforts to strengthen HMIS reporting.

Malaria parasite prevalence by smear microscopy from national 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

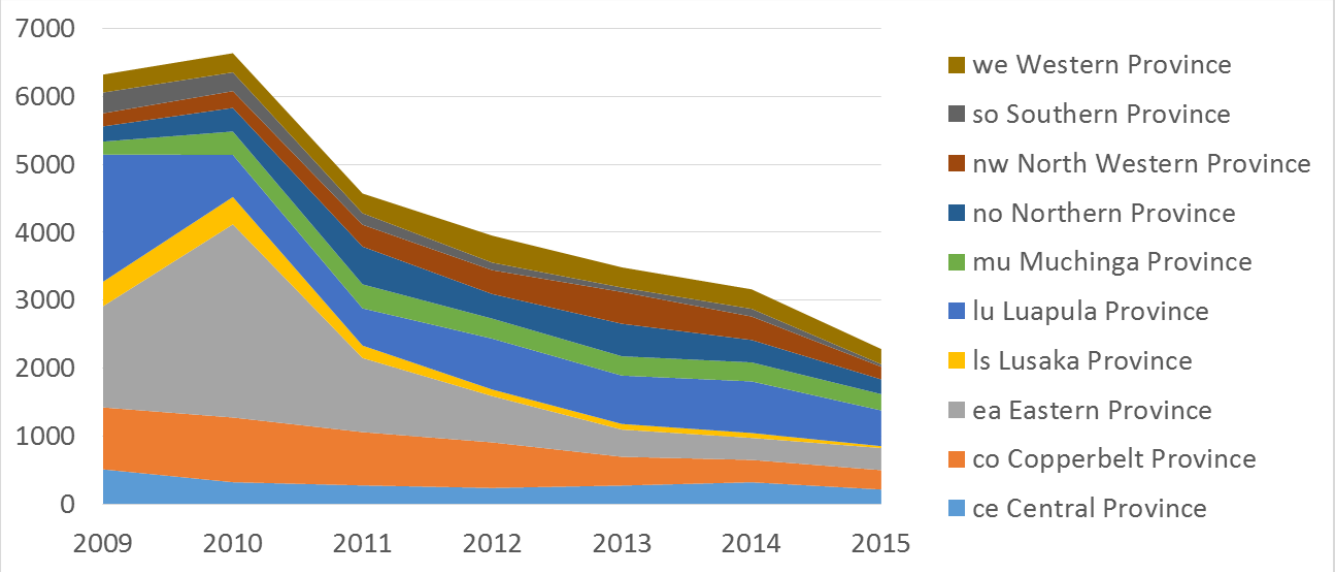


Figure 2. Map showing percentage malaria parasite prevalence (microscopy), among children under five years of age, by province (2015 MIS)

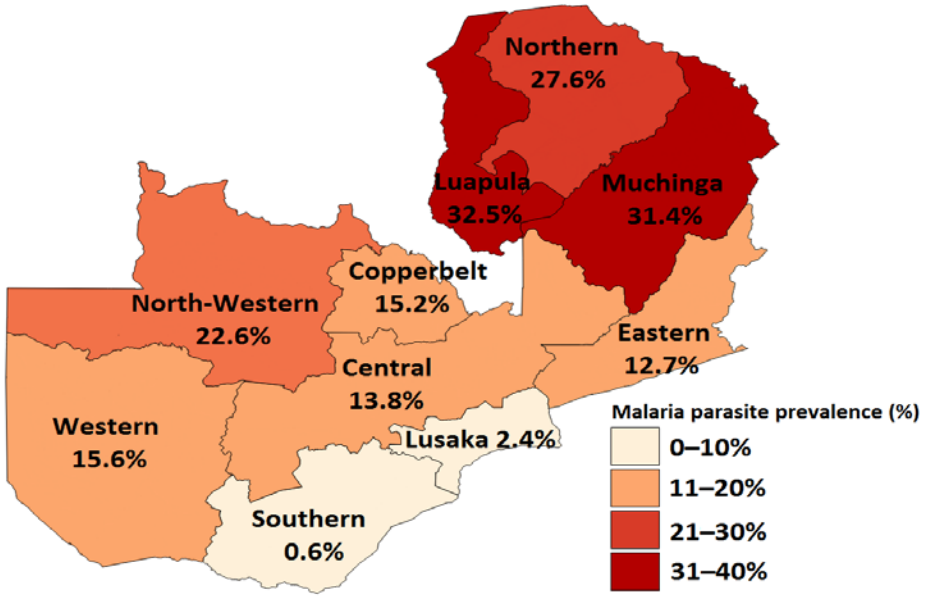


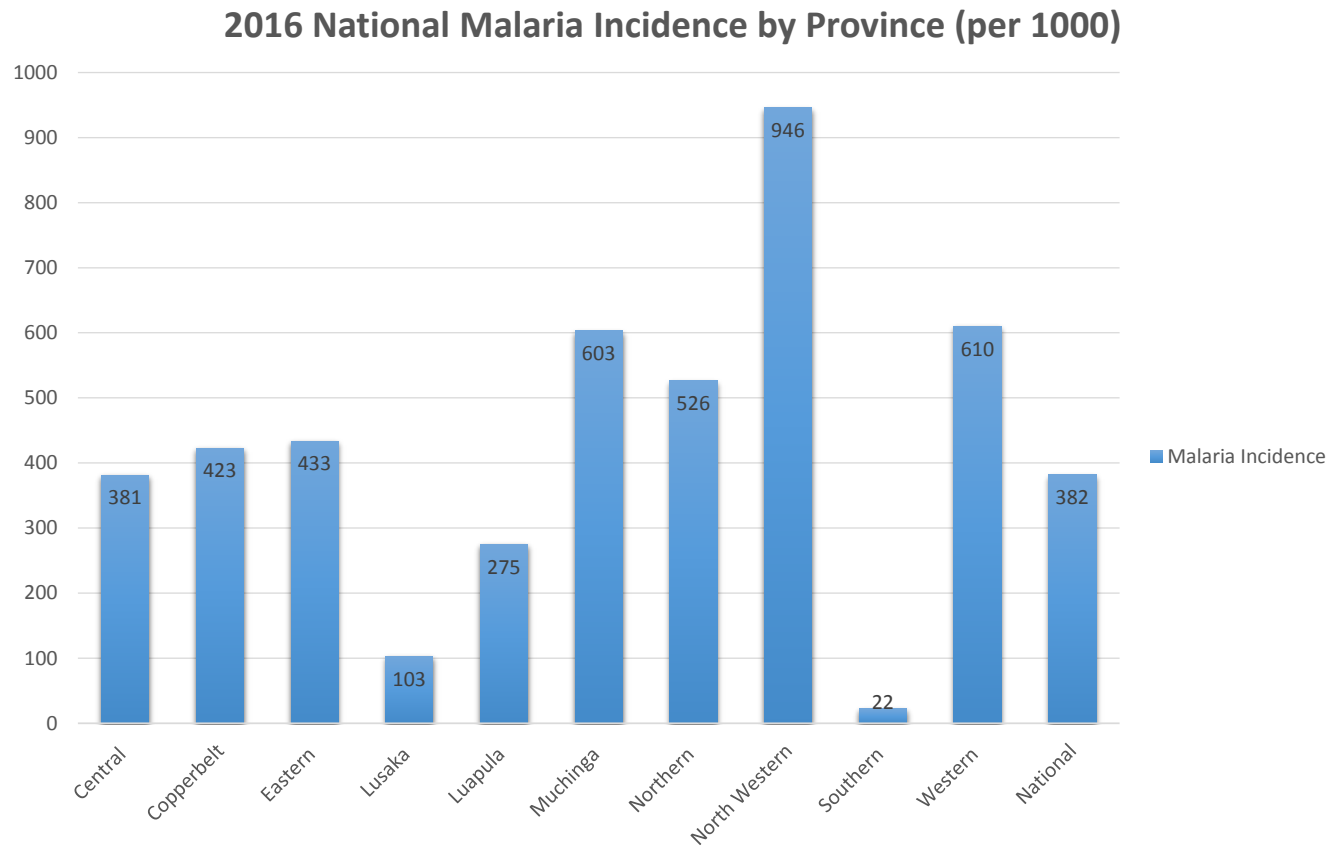
Table A: Malaria parasite prevalence in children under five years of age by background characteristic from Malaria Indicator Surveys (MIS). Rapid Diagnostic Test (RDT) results in parenthesis, 2006-2015

Background characteristic	Percentage with malaria parasites by microscopy 2006	Percentage with malaria parasites by microscopy 2008	Percentage with malaria parasites by microscopy (or RDT) 2010	Percentage with malaria parasites by microscopy (or RDT) 2012	Percentage with malaria parasites 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)
Average	**22.1**	**10.2**	**16.0 (26.7)**	**14.9 (29.5)**	**19.4 (30.7)**

In NorthWestern Province, the HMIS data also shows a trend similar to the MIS of increasing malaria incidence during the period of 2011–2014 and being the highest incidence of all provinces in 2016 (Figure 3). The malaria burden continues to be high 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, but Copperbelt Provinces increased most notably between 2015 and 2016. 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. In 2016, the national malaria incidence was 382 per 1,000 population (Figure 3).

Figure 3: Health Management Information System (HMIS) reported malaria incidence (per 1,000) by province during 2016



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

The MoH is responsible for all health functions in Zambia including policy, management, coordination and service delivery. 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 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 Health Offices (DHOs) 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 DHOs provide 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 DHOs. The National Malaria Elimination Centre (NMEC; previously National Malaria Control Centre) provides technical but not operational assistance at these levels.

In 2010, the Government of the Republic of Zambia (GRZ) introduced a cadre of community health assistant (CHA) trained for one year and on GRZ payroll 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 deployed at health posts which are the lowest level of formal health facilities intended to cover 500–1,000 households. 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. Furthermore, CHAs are expected to supervise the community health workers (CHWs) and other community health volunteers that work in their catchment areas. CHWs work at community level to

provide malaria diagnostic and treatment services through the integrated community case management (iCCM) program.

Health centers oversee health posts that are within their catchment areas, are staffed by a clinical officer, nurse, or environmental health technician, and 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 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 B) 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 B) 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 B: 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 elimination strategy

The 2011-2016 National Malaria Strategic Plan (NMSP) underwent an end-term review in 2016. The vision of the 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. Using the findings from the end-term review as guidance, the GRZ developed and launched a National Malaria Elimination Strategic Plan 2017–2021, a strategy to move from accelerated burden reduction to malaria elimination in Zambia.

The major goals and objectives of the new elimination plan include the following:

Goals

1. To eliminate local malaria infection and disease in Zambia by 2021.
2. To maintain malaria-free status and prevent reintroduction and importation of malaria into areas where the disease has been eliminated.

Objectives

1. Increase the malaria-free health facility catchment areas (HFCAs) from 0.5% in 2015 to 100% by 2021.
2. Reduce malaria deaths from 15.2 deaths per 100,000 in 2015 to less than 5 deaths per 100,000 population by 2021.
3. Achieve 100% malaria-free national certification of HFCAs by 2021.
    - Reduce malaria incidence from 336 cases per 1,000 population in 2015 to less than 5 cases per 1,000 population by 2021.
4. Increase the implementation rate of interventions from 36% in 2015 to 95% by 2021.
    - Strengthen capacity to plan and implement budgets, execute payments on schedule, and to rapidly reallocate or mobilize funds to deal with unexpected events.
    - Sustain national political support, technical and operational capacity, and financial resources for malaria elimination.
5. Maintain 100% malaria-free HFCAs, following certification in 2021.
    - Prevent the re-emergence of malaria transmission due to importation in HFCAs where it had been eliminated.

The NMEC 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 NMEC will continue to scale up vector control interventions and timely diagnosis and treatment, as well as increase coverage of at least 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 National Malaria Control Program and National Malaria Control Centre officially became the National Malaria Elimination Program and National Malaria Elimination Centre in April, 2017.
- The NMEP conducted an End-Term Malaria Program Review of the 2011–2016 NMSP in 2016, the results of which are summarized below in the "Other relevant evidence on progress" section below. Findings from this review fed into the National Malaria Elimination Strategic Plan 2017–2021, with a focus on moving from accelerated burden reduction to malaria elimination in Zambia.
- 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 re-elected President Lungu to a five-year term and National Assembly and vote on amendments to the Bill of Rights. At the time of MOP writing in May 2017, restructuring of the NMEP is underway.

6. Integration, collaboration, and coordination

The NMEP 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. PMI will continue to work with the Ministry of Health to contribute to both the National Health Strategic Plan (NHSP 2017-2021) being undertaken alongside the Community Health Strategic Plan and National Development Plan (NDP).

The new NHSP 2017 will form an important component of the NDP, which is being spearheaded and coordinated by the Vice President. While a new vision is expected in the NHSP, early signals indicate that a few areas will receive particular emphasis. The areas of focus are expected to include: a renewed emphasis on primary health care and universal health care coverage; 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.

In 2014, a universal campaign was conducted that distributed over 8 million ITNs nationwide. The campaign was a collaborative effort between the NMEP, PMI, DFID, Global Fund, MACEPA, and other partners. PMI contributed approximately 1 million ITNs for the campaign. In 2017, another universal ITN campaign will be conducted to replenish ITNs in households. The campaign will be undertaken with NMEP, PMI, and the Global Fund and the Against Malaria Foundation contributing to the effort. A total of over 10 million nets will be procured and distributed during the 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 , 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 C shows GRZ and partner commitments towards Zambia's malaria elimination agenda for the period 2018 to 2020.

Table C: GRZ and partner commitments (2018-2020)

Module	**Intervention**	**Commitments ($)**	
		GRZ	***Partners***
Vector control	IRS	54,547,060	39,608,752
	ITNs	4,712,356	22,549,151
	Entomology	-	2,635,107
Case management	ACTs	9,782,452	9,900,000
	RDTs	22,210,197	3,870,000
Health system strengthening		2,138,878	31,511,211
Program management		9,012,438	904,087
Total		**102,403,381**	**110,978,308**

Source: Global Fund Concept Note Application (2018-2020)

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 NMEPs 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 (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

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

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

8. Progress on coverage/impact indicators to date

At the national level, the 2015 MIS (Table D) 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 continued 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.

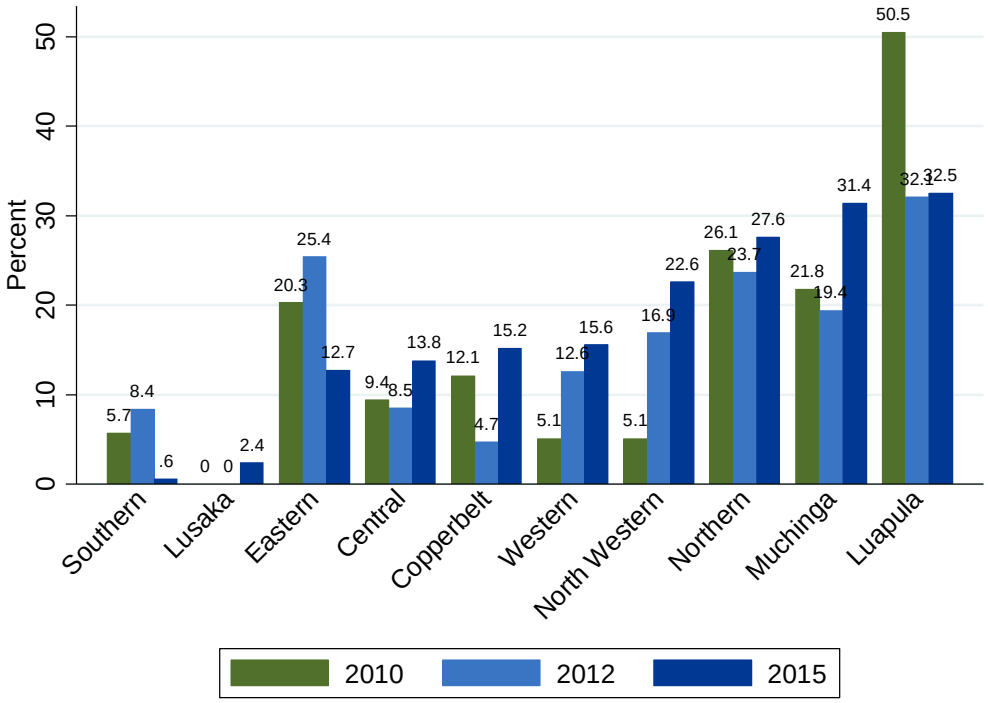
Table D: Evolution of Key Malaria Indicators in Zambia from 2006 to 2015

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.

*These indicators were modified and/or dropped in the 2015 MIS and could not be reported on.

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



The following table (Table E) shows HMIS reporting of cases (clinical and confirmed), inpatients, and deaths during the period of 2010–2016. Figure 5 illustrates an improvement in the proportion of confirmed to clinical cases. Figure 6 shows a decrease in the proportion of malaria cases in children under five years of age.

Table E: Evolution of Key Malaria Indicators reported through routine surveillance systems from health facilities in Zambia from 2010 to 2016

Year	2010	2011	2012	2013	2014	2015	2016
Cases (clinical and confirmed)							
HMIS malaria cases total clinical	3,075,902	2,286,765	2,146,346	2,666,405	2,052,763	1,019,267	1,215,888
HMIS malaria cases total confirmed	1,397,972	2,325,858	2,783,422	2,830,460	4,084,712	4,182,608	4,818,762
HMIS malaria cases total	4,473,874	4,612,623	4,929,768	5,496,865	6,137,475	5,201,875	6,034,650
HMIS malaria confirmation rate	31%	50%	56%	52%	67%	80%	80%
Inpatient cases and deaths							
HMIS malaria inpatient cases total	213,639	188,575	166,192	163,974	150,133	107,802	96,565
HMIS malaria deaths	6,640	4,573	3,954	3,485	3,162	2,337	1,783
Inpatient case fatality rate	3%	2%	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	44,977
HMIS malaria deaths, <5yrs	3,955	2,709	2,277	2,055	1,733	1,297	843

Figure 5: Reported Malaria Cases from Health Facilities (all ages, inpatient + outpatient)

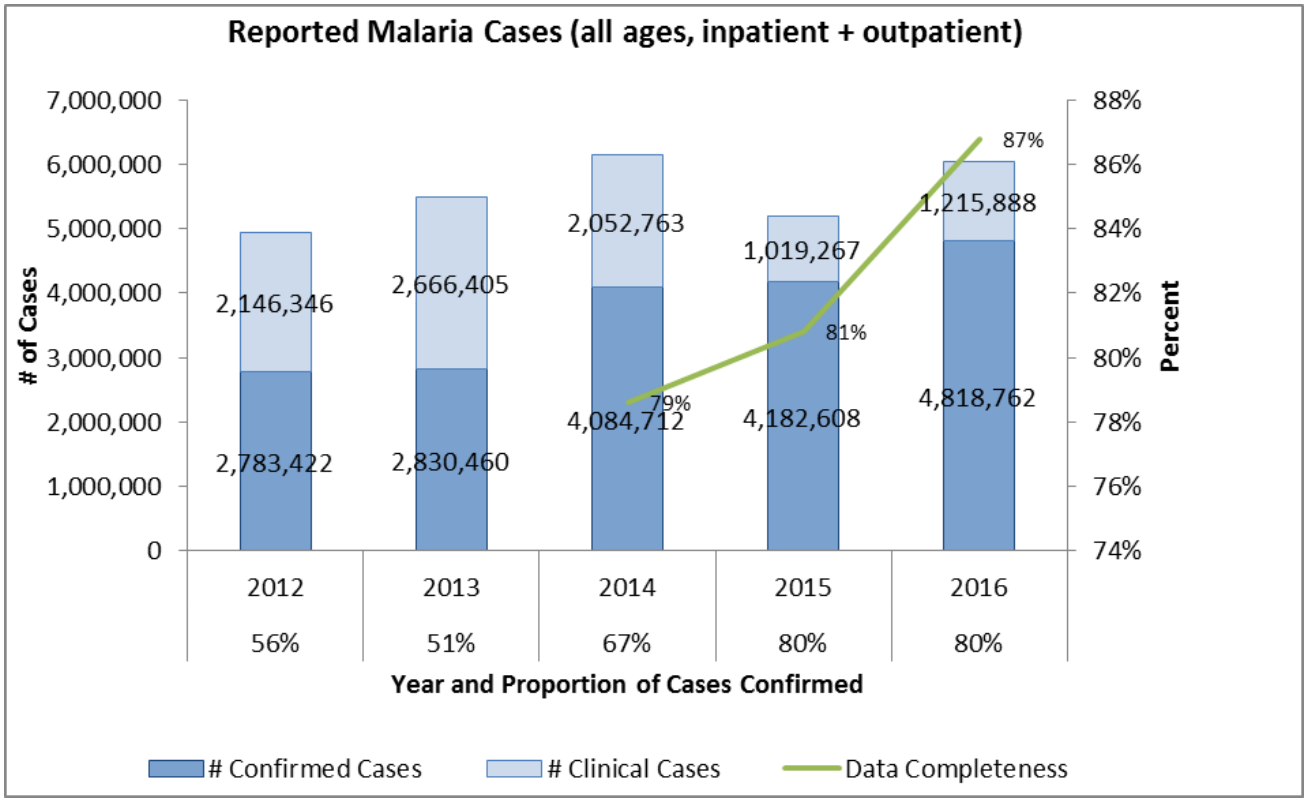
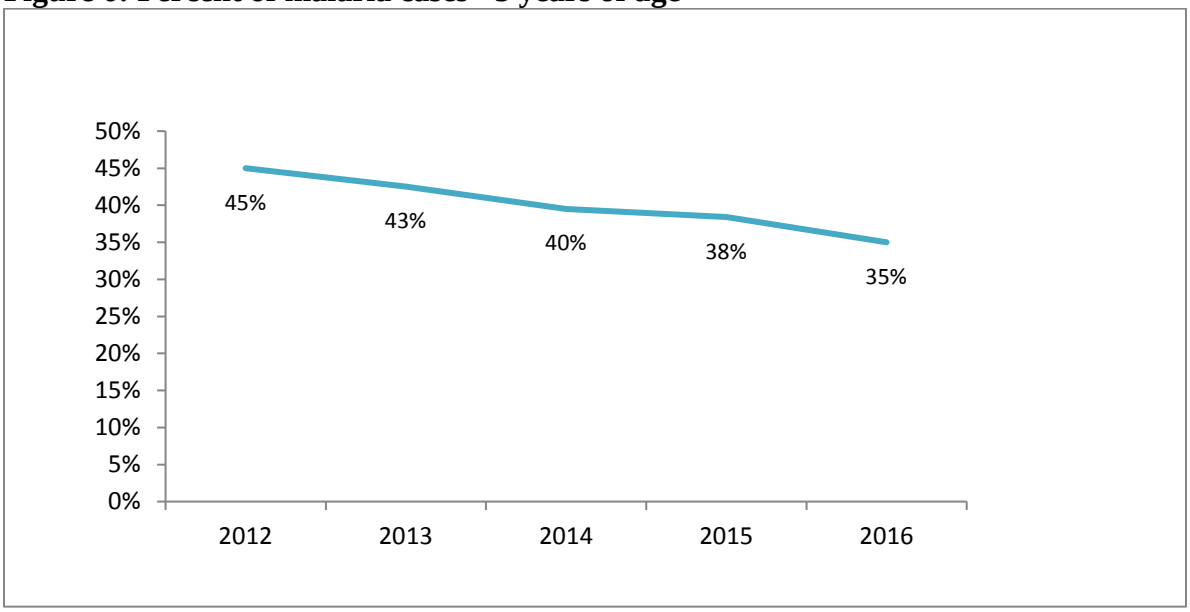


Figure 6: Percent of malaria cases <5 years of age



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. Key findings are:

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

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

The NMEP and partners conducted an end-term review in the last quarter of 2016 to assess the progress made in achieving the goals and objectives of NMSP 2011–2016. Key findings and recommendations from the review include:

- The national malaria incidence was not reduced significantly during the period under review. It declined marginally from 343 cases per 1,000 population in 2011 to 335 cases per 1,000 population in 2015. However, it is important to note that the national malaria incidence trend masks the local trends. Some provinces experienced dramatic reductions in incidence while others noted increases. Between 2012 and 2015, malaria prevalence in children under the age of five years increased from 14.9% to 19.4%. This increase was seen in both rural and urban areas, although rural areas are more malarious than urban areas.
- The reported severe malaria in-patient attendance declined significantly from 15.8 cases per 1,000 population in 2010 to 6.6 cases per 1,000 in 2015, a 58% reduction.
- Malaria deaths decreased by 70% from a baseline of 51.2 per 100,000 in 2010 to 15.5 per 100,000 in 2015.
- The availability of infrastructure, particularly functional insectaries, in some sites and an active Insecticide Resistance Technical Working Group and Technical Advisory Committee has led to the development and implementation of a national insecticide resistance management plan. However, the funding for nationwide epidemiological and entomological surveillance has been inadequate.

Recommendation:

- It will be imperative to strengthen malaria surveillance to better understand why severe malaria and mortality declined and yet the incidence remained unchanged.

Other findings, conclusions, and recommendations on the financing and capacity of the National Malaria Elimination Program were as follows:

- Funding for malaria control from the GRZ was not sufficient to sustain the various malaria control interventions. However, a major achievement was an increase in the domestic

contribution to malaria. The GRZ allocated US$24.8 million in 2014 and US$28 million in 2015 towards the procurement of antimalarial commodities.

- The review revealed that the overall capacity of the NMEP to implement planned activities of the NMSP 2011–2016 was low. Only 36% of the planned activities were fully implemented and 43% of the planned activities were partially implemented, while 21% of the planned activities were not implemented at all.
- Some possible contributors were fragmentation of program implementation due to pre-packaged partner projects, parallel planning between the center and districts leading to discordance, an absence of operational planning at all levels, lack of a system to track implementation in real time, and operations being too centralized.

Recommendations:

- Increase domestic funding for malaria elimination activities.
- Develop a business plan to facilitate resource mobilization and consider innovative mechanisms to improve investments in malaria elimination including mobilizing funds from the corporate/private sector.
- Establish an annual process that ensures that GRZ resources are aligned with partner resources against planned outputs (operational plans) at all levels for the year in support of the implementation of the malaria strategic plan.
- Develop a system for tracking implementation at all levels in real time (management tool).
- Develop a monitoring and evaluation (M&E) plan.

III. OPERATIONAL PLAN

1. Vector monitoring and control

NMEC/PMI objectives

In 2017, Zambia prioritized IRS as a primary vector control strategy. Zambia's National Malaria Elimination Strategic Plan (NMESP) 2017–2021 calls for vector control at high coverage (100% IRS coverage of eligible structures). The goal for the elimination strategy is to attain operation coverage of over 90% of eligible structures prior to peak transmission season, which would benefit up to 80% of the population of Zambia. The NMEC/PMI collaboration aims to provide access to evidence-based vector control to 100% of households and persons at risk in targeted areas. To mitigate vector resistance to insecticides, Zambia plans to ensure their Insecticide Resistance Management Plan (IRMP) includes rotation and resistance monitoring of WHOPES-approved insecticides. 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. 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. On-going entomologic surveillance will continue to be used to monitor vector habits, densities, and sensitivities to the insecticides being deployed.

Zambia's vector control strategy includes IRS and ITNs as principal interventions with the aim of achieving high vector control coverage. The strategy proposes ITNs for communities not reached or ineligible for IRS predominantly in hard to reach rural areas. Continuous distribution channels of ITNs will continue, such as routine distribution to pregnant women and children under-five years of age through ANC and EPI clinics. Further, in 2018, the NMEC plans to continue rolling out community-based distribution, as well as school-based distribution to enhance routine distribution efforts.

Although it is part of the Integrated Vector Management strategy, the NMEC has had limited implementation of larval source management, and they will continue to identify opportunities to conduct larval control by environmental management and larviciding as alternative vector control strategies. PMI does not support larviciding.

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 NMEP 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 NMEP should consider rotating to DDT in 2015 or 2016 as a means of managing resistance to organophosphates;
3) The NMEP 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. Previous insecticide resistance surveys have reported resistance in the two major malaria vector species, *An. gambiae* s.l and *An. funestus*. With PMI assistance, the most recent susceptibility tests conducted in 2017 showed both vectors are still mostly resistant to pyrethroids throughout the Northern and Eastern regions of Zambia, areas where resistance monitoring is being conducted. 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 7 and 8, below.

Figure 7. Insecticide susceptibility status *Anopheles funestus* s.l., 2017

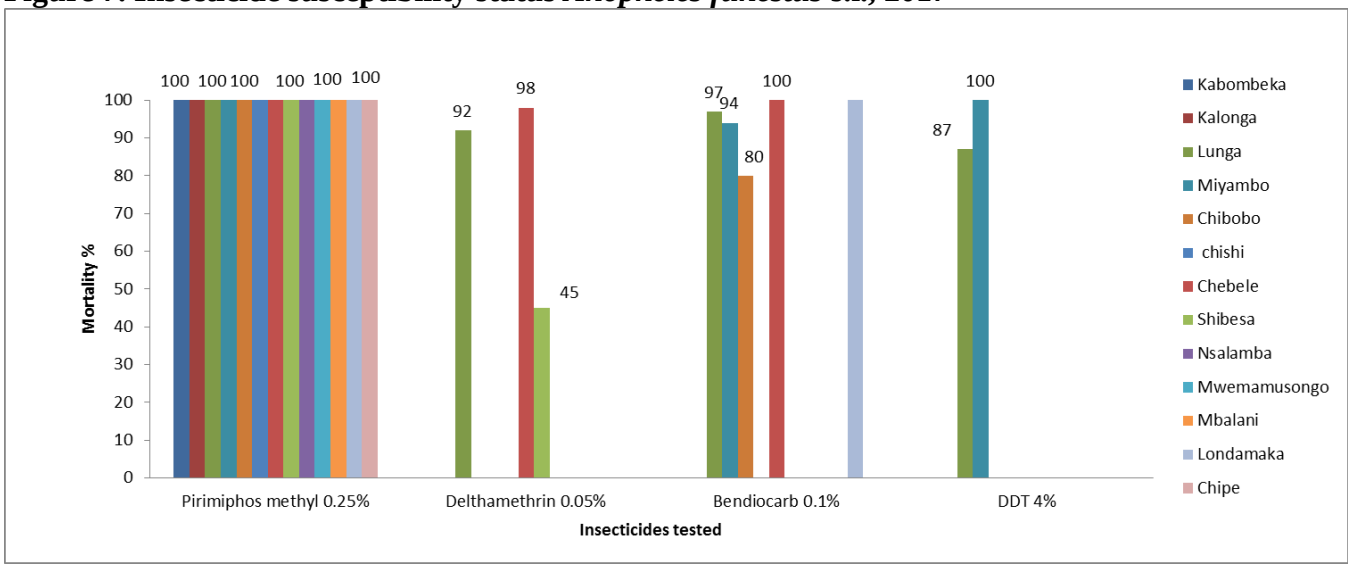
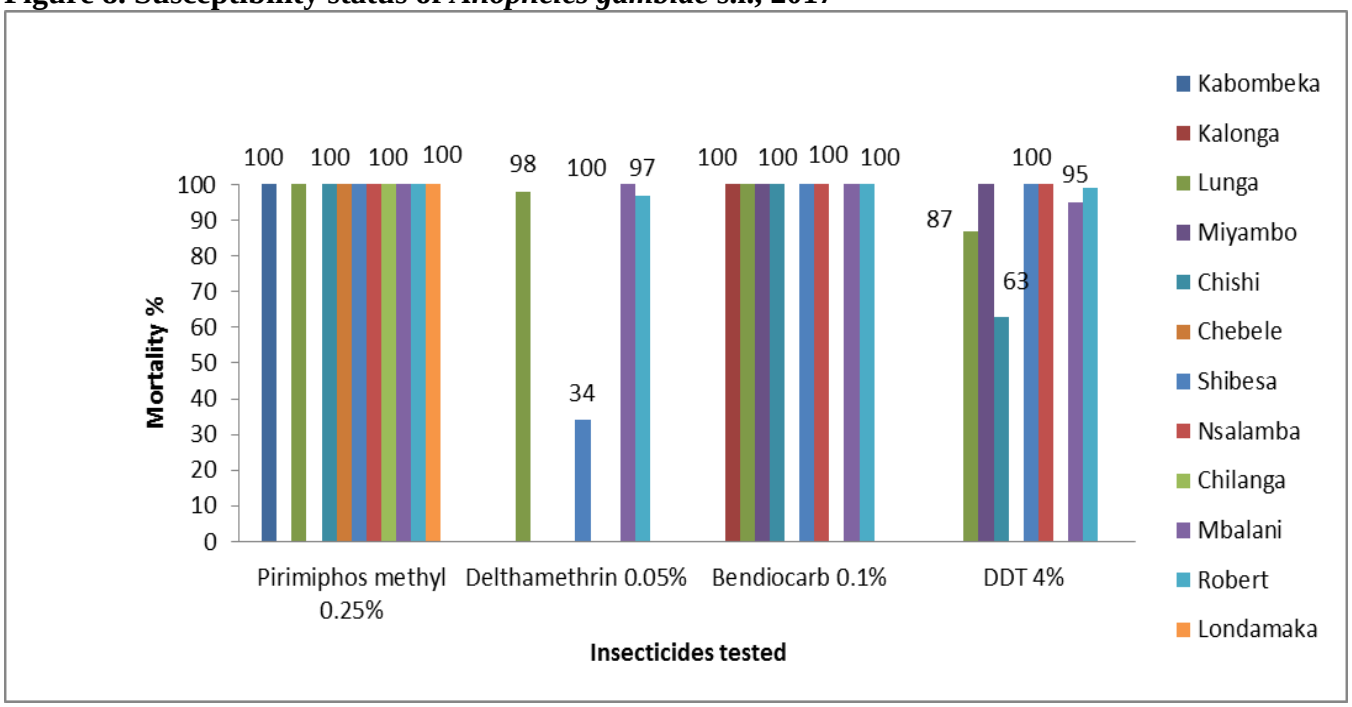


Figure 8. Susceptibility status of *Anopheles gambiae* s.l., 2017

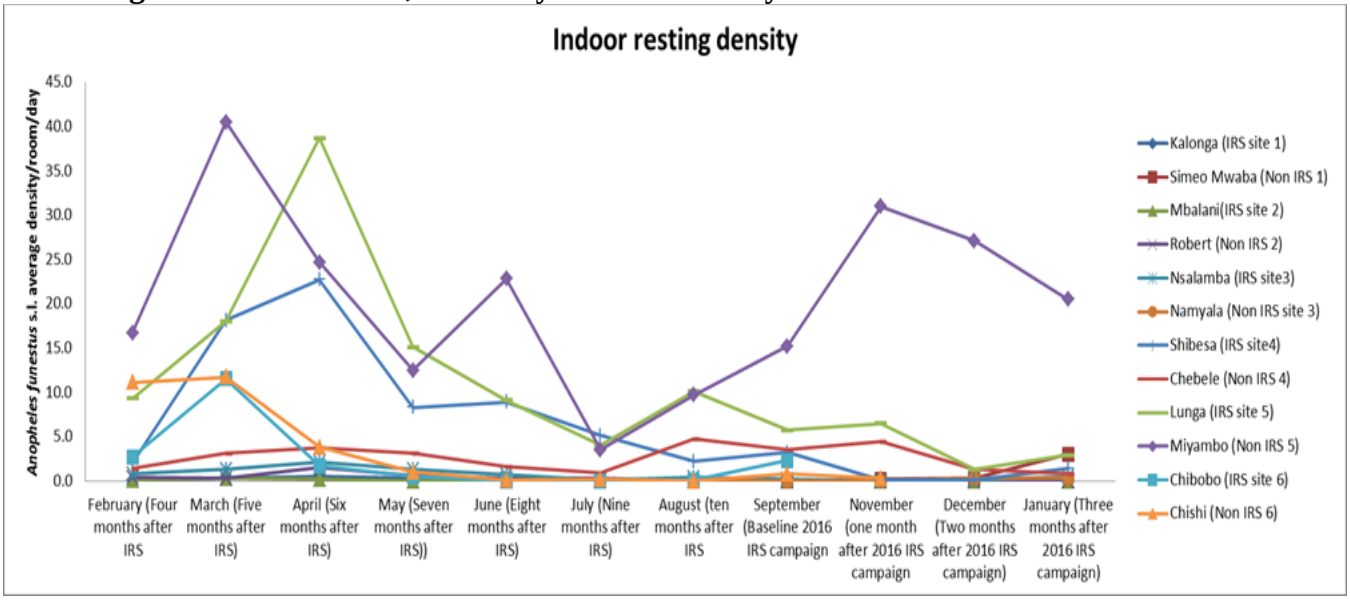


A pre-fabricated insectary, procured with PMI funds, is now operational at the NMEC campus. This facility has strengthened both IRS and ITN assessment capability. Currently, the NMEC does not have a staff entomologist. Once one is identified they will likely benefit from additional training and support.

Progress during the last 12-18 months

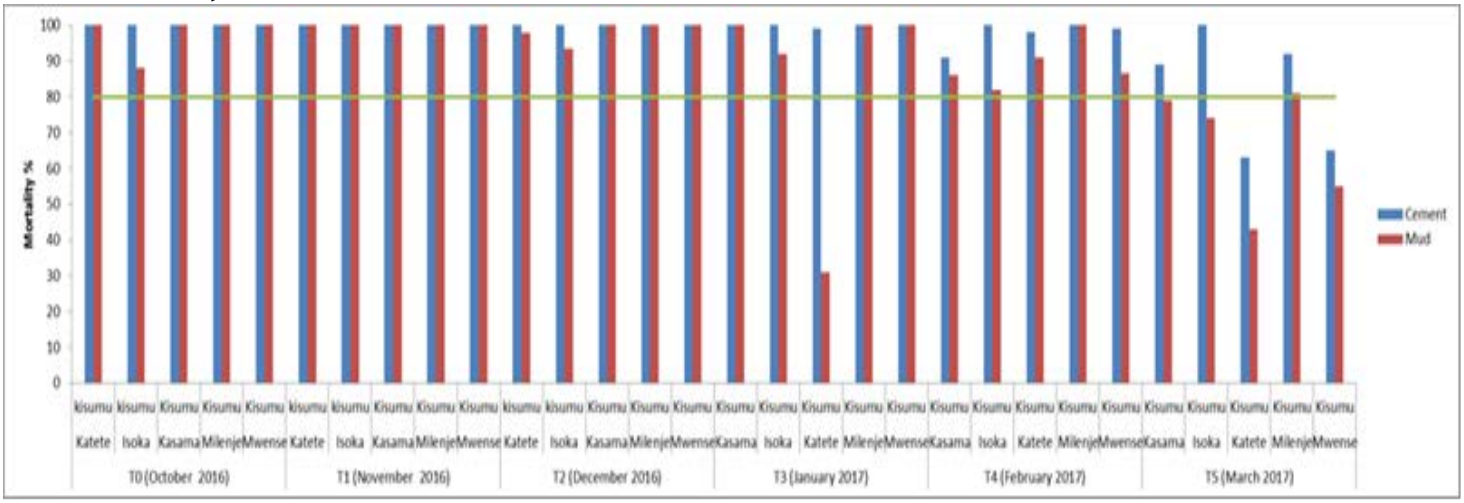
During the 2016 spray season (September through December 2016), organophosphates were used in the IRS program, the NMEC completed IRS implementation across the whole country by March 2017. Bioassays were conducted to assess the quality of spraying in PMI-supported target districts. The impact of the IRS campaign on the malaria vectors was assessed from February 2016 to January 2017, the changes in mean indoor resting density of *An. funestus* s.l. during this time is illustrated in Figure 9.

Figure 9. Average indoor resting density of *Anopheles funestus* s.l collected in PMI-supported entomologic surveillance sites, February 2016 to January 2017



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 in 5 of the 6 sentinel sites located where PMI-supported IRS activities occur. The WHO cone bioassay performed 24 hours after spraying showed 100% mortality of the susceptible malaria vectors exposed to the mud and cement walls, except in Isoka District where an investigation was conducted and additional IRS to improve the quality was conducted. Monitoring continued until March 2017, five months after the IRS was implemented. Pirimiphos-methyl appeared to be effective on both mud and cement in the entomology surveillance sites for four months after the spraying with the exception of Katete District, where the tested mosquito mortality rate was less than the 80% WHO threshold on the mud sprayed walls only three months after spraying. By five months post-spray, although three districts had mortality results greater than 80% on cement surfaces, the residual life of pirimiphos-methyl was at or below the 80% threshold in all mud surfaces and cement-sprayed walls from two sites (Figure 10).

Figure 10. Entomologic monitoring of pirimiphos-methyl decay rate from five sentinel surveillance sites in Zambia, October 2016 – March 2017



*Insecticide decay rates are not monitored at the Serenje District sentinel site since PMI no longer conducts IRS activities in Central Province

Plans and justification

The six PMI supported sentinel sites will be retained for 2018-2019 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, to provide information on resistance hot-spots, and to gather information on other entomologic metrics that influence resistance management decisions. Data on transects are currently being captured in Luapula and results will feed into future plans for entomological monitoring. The NMEC plans to scale up national entomologic surveillance to a total of 22 sentinel sites (inclusive of the 6 PMI-supported sites); the additional sites will be supported by Global Fund and MACEPA. PMI will review surveillance activities with the NMEP and stakeholders during the Insecticide Resistance Management Technical Working Group meeting in the fall of 2017. Molecular species identification with appropriate timeliness will be provided by CDC Entomology Branch until the NMEC lab refurbishment and training of NMEC personnel are complete, PMI plans to support needed training of entomology personnel to build entomologic capacity at the NMEC. Existing assistance of Macha Research Trust 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 PMI operational research projects 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

*Insecticide decay rates are not monitored at the Serenje District sentinel site since PMI no longer conducts IRS activities in Central Province

Proposed activities with FY 2018 funding: ($479,000)

- Entomological monitoring and insecticide resistance monitoring for six sentinel surveillance sites, support to the national insectary and support for a new NMEC entomologist to include training and capacity building. Conduct environmental monitoring, environmental assessments, and risk mitigation in IRS districts ($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 NMEP conducted a national mass ITN campaign in 2013-2014. The Government of the Republic of Zambia (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[3].

Following the mass ITN campaign in 2015, ITN use in children under five increased from 24% in 2006 to 58%. 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. Fifty-eight percent of pregnant women reported sleeping under an ITN in 2015, ranging from 37% in Lusaka to 84% in Eastern.[4]

Progress during the last 12-18 months

Zambia's vector control strategy includes IRS and ITNs as principal interventions with the aim of achieving high vector control coverage. The strategy proposes ITNs for communities not reached or ineligible for IRS predominantly in hard to reach rural areas. PMI supports both mass campaigns and continuous ITN distribution to vulnerable populations in Zambia. To sustain net coverage across the country, routine net distribution through ANC, EPI and schools was conducted in 2016 to distribute approximately 1.3 million ITNs nationwide. The routine distribution was a collaborative effort between the NMEP, PMI and Global Fund. PMI contributed over 800,000, Global Fund 313,160 and, NMEP 60,165 ITNs. Of these, 55,229 ITNs were distributed through a PMI supported pilot school-based distribution to first and fourth grades students at 395 schools in four districts. Lessons learnt from the pilot have informed the revision of the ITN distribution guidelines that will be used for the roll out to the rest of country.

PMI is also supporting the introduction of a community-based distribution channel. A PMI supported situational analysis showed that the addition of community and school-based channels to ANC and EPI

[2] Malaria Indicator Survey 2006, 2015
[3] Malaria Indicator Survey 2006, 2015
[4] Malaria Indicator Survey 2015

can maintain ITN ownership levels at 90%. The community-based ITN pilot distribution that had been initially planned to be conducted in 2016 will now be conducted in 2018 after the mass ITN distribution. 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.

In 2017, PMI will support the NMEP to conduct a mass ITN campaign aimed at achieving universal coverage. Over 10 million ITNs are planned for distribution countrywide based on a population of 16,405,229 in 2017 calculating 1 ITN per 1.8 population and an additional 10% buffer. The campaign will be a collaborative effort between the NMEP, PMI, the Global Fund and the Against Malaria Foundation. PMI will contribute 1,090,570, Global Fund over 6 million and Against Malaria Foundation 2.8 million ITNs.

The NMEP 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. However, nets will be distributed through ANC/EPI particularly in high burden provinces to maintain these channels and ensure that pregnant women and children missed during the mass campaign are catered for.

PMI will support ITN durability monitoring that will commence in 2017 following the mass ITN distribution campaign to examine the structural integrity of ITNs distributed in selected provinces.

Commodity gap analysis

Table G. ITN Gap Analysis

Calendar Year	2017	2018	2019
Total targeted population	16,405,229	16,887,720	17,381,168
Continuous Distribution Needs			
Channel #1: ANC	820,261	844,386	869,058
Channel #2: EPI	820,261	844,386	869,058
Channel #3: *School*	0	210,000	1,564,305
Channel #4: *Community*	0	50,000	350,000
Estimated Total Need for Continuous	1,640,522	1,948,772	3,652,421
Mass Distribution Needs			
2017 nation-wide mass distribution campaign	10,025,418	0	0
Estimated Total Need for Campaigns	10,025,418	0	0
Total Calculated Need: Continuous and Campaign	**11,665,940**	**1,948,772**	**3,652,421**
Partner Contributions			
ITNs carried over from previous year	0	0	286,684
ITNs from Government	0	0	0
ITNs from Global Fund	6,263,217	1,435,456	1,410,664
ITNs from Against Malaria Foundation	2,800,000	0	0
ITNs planned with PMI funding	1,090,571	800,000	694,000
Total ITNs Available	**10,153,788**	**2,235,456**	**2,391,348**
Total ITN Gap	**(1,512,152)**	**286,684**	**(1,261,073)**

Notes: Total ITN need for the mass campaign is based on 1 net per 1.8 population and a 10% buffer. ITN quantities to be distributed through ANC and EPI are based on a combined proportion of 10% of the national population. Deterioration rates = 8% first year, 20% second year, and 50% third year. ITN quantities to be procured by the GRZ and Global Fund in 2018 and 2019 are yet to be finalized.

Plans and justification

With FY 2018 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 10 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 2018 funding: ($ 2,740,000)

- Procurement of approximately 694,000 ITNs for 2019 continuous/routine distribution. ($2,000,000)
- Support the distribution of ITNs, including transportation and other logistics, to districts and health facilities. ($400,000)
- 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.

The GRZ has in recent years been increasing resource allocation to malaria control in general and IRS in particular. In 2013 the Ministry of Health (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 NMEP

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.

In 2015, PMI supported the NMEP 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 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.

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 NMEC to March–May 2016. The NMEC conducted IRS in 43 non-PMI supported districts using organophosphates. The NMEC 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 NMEC for environmental compliance including waste disposal, recycling of insecticide bottles, entomology, and planning for IRS activities in the non-PMI supported provinces.

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 2017 and 2018.

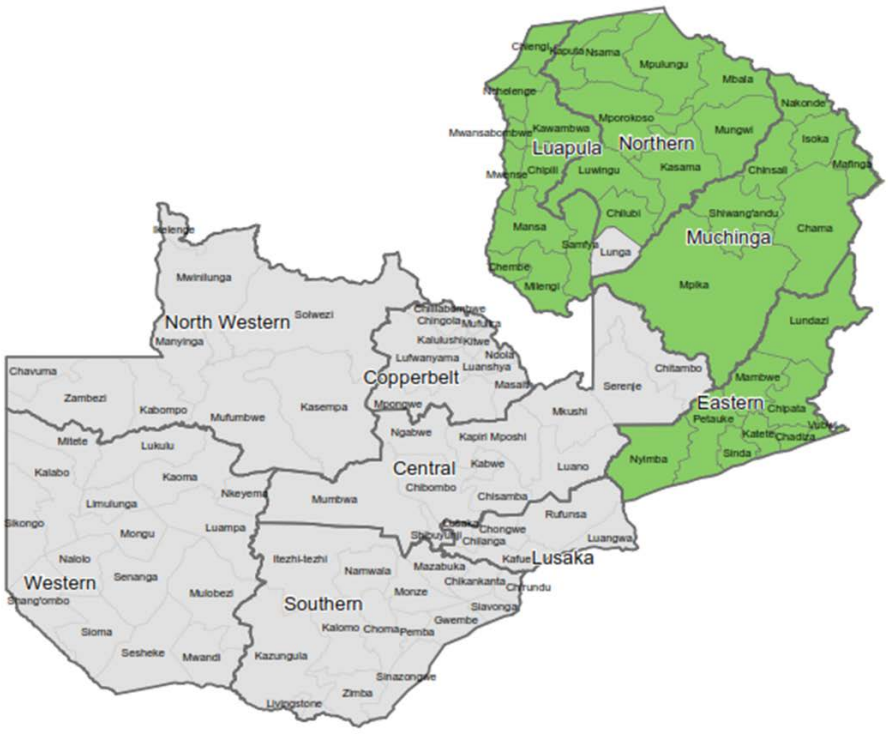
Table H: PMI and/or USAID-supported IRS activities 2006 – 2018

Calendar Year	Number of Districts Sprayed	Insecticide Used	Number of Structures Sprayed	Coverage Rate	Population Protected
2006	15#	DDT and pyrethroids	573,877	85%	—
2007	15#	DDT and pyrethroids	657,219	93%	—
2008	39^	DDT and pyrethroids	1,039,154	90%	—
2009	36	DDT and pyrethroids	1,191,517	90%	—
2010	25	DDT and pyrethroids	740,699	89%	2,721,166
2011	35	Carbamates and pyrethroids	814,706	83%	3,351,158
2012	20	Carbamates and organophosphates	460,358	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	520,551	95%	2,517,250
2016*	35	Organophosphates	559,550	91%	2,626,718
2017*	36**	Organophosphates	648,800 (target)	TBD	TBD
2018*	36**	TBD	559,550 (target)	TBD	TBD

Represents USAID-supported districts before PMI support began
^Represents 36 USAID-supported districts and 3-PMI supported districts
* Includes DFID-funded districts
** Represents projected targets based on national strategic plan and/or discussions with the NMEP

Progress during the last 12-18 months

Figure 11: PMI-Supported Districts for IRS implementation (shaded in green)



Until 2017, IRS was implemented using a targeted approach, which required 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 was conducted using 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 NMEC; however, adherence to these criteria has been variable.

In 2016, this targeted approach was used for the PMI-supported IRS program in 35 focus districts (9 in Eastern Province, 7 in Muchinga Province, 9 in Northern Province, and 10 in Luapula Province) (Figure 11). PMI supported 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. To improve the planning for IRS implementation, close to 1 million structures in the four provinces have been mapped via satellite enumeration by the mSpray spatial mapping program. Approximately 50-77% of the structures fitting within the inclusion criteria in the four PMI-supported high burden provinces were originally targeted for IRS in 2016 (Table I).

Table I. Total number of structures identified and targeted for IRS in 2016 for the four 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**

While implementing the IRS campaign in 2016, more structures were sprayed than had originally been targeted as some of the maps for Luapula Province were out of date and the total number of existing structures was largely underestimated in Eastern Province. During implementation, updated maps and targets enabled the IRS program to spray 559,550 structures out of 612,929 structures that were found by spray operators (91% spray coverage) in targeted catchment areas, protecting more than 2.6 million people (Table H). During the mop-up IRS campaign, the mSpray program enabled IRS managers to spray 96% of approximately 10,000 structures that were not sprayed during the first round of IRS in the seven mSpray districts in Luapula Province. Following the implementation a post-spray data quality audit (PSDQA) was conducted to validate the reported spray coverage. The data from the PSDQA indicate that overall 82.4% of eligible structures found by spray operators were sprayed compared to the 91.3% spray coverage that was reported, although this difference varied among districts sampled (Table J).

Table J. Spray coverage by district from the reported IRS campaign results and post-spray data quality audit results following the PMI-supported IRS campaign, September–December 2016

Geography		Spray Coverage					
Province	**District**	**IRS Campaign Results**	**PSDQA Estimate**	**Confidence Interval (CI)**	**Does the IRS Campaign Number Fall within the CI?**	**Does the CI Confirm a Minimum Spray Coverage of 85% Fell Within the Range?**	**Sampled Structures**
Eastern	Chipata	90%	79%	70.9, 87.1	No	Yes	100
	Petauke	91%*	92%	86.6, 97.4	Yes	Yes	100
Muchinga	Chinsali	97%	89%	82.8, 95.2	No	Yes	100
	Nakonde	92%	74%	65.3, 82.7	No	No	100
Northern	Kasama	85%	65%	55.5, 74.5	No	No	100
	Mungwi	86%	76%	67.5, 84.5	No	No	100
Luapula	Chipili	88%	78%	64.4, 87.4	No	Yes	50
	Milenge	87%*	88%	78.7, 97.3	Yes	Yes	50
	Nchelenge	86%*	86%	76.0, 96.0	Yes	Yes	50
	Samfya	90%*	82%	71.0, 93,0	Yes	Yes	50

* Falls within PSDQA 95% confidence interval

The PMI budget remaining in the last year of the IRS contract was able to implement IRS in more structures than was originally planned for, but this still represents fewer structures receiving IRS than the new NMEP policy. The difference in these eligible and sprayed structures in the PMI-supported IRS provinces is included in Table K.

Table K: **Total number of eligible structures identified and targeted for IRS in 2017 in the four PMI-supported provinces**

Province	Total eligible structures identified	Total number of structures targeted for 2017 IRS by PMI	Total number of remaining eligible structures in non-targeted catchment areas
Northern	229,996	131,037	98,959
Muchinga	134,679	76,499	58,180
Eastern	371,543	223,361	148,182
Luapula	217,402	217,903	-501
Total	**953,620**	**648,800**	**304,820**

Plans and justification

For the FY 2018 spray season, PMI will cover the cost of targeted IRS in 36 districts in four provinces: Eastern, Luapula, Muchinga, and Northern. Approximately 559,550 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/NMEC 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 NMEP teams to carry out monitoring and supervision during IRS implementation; procurement of insecticide, spray pumps, personal protective equipment, and other IRS commodities.

Proposed activities with FY 2018 funding: ($7,814,500)

- Procure insecticides (i.e., organophosphates) and other IRS supplies/equipment for spraying up to 559,550 structures in 36 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 36 PMI-funded districts. For the NMEC implemented IRS program, provide support for training of trainers, supervisory support, training materials development, TWG support, microplanning, post-IRS support; waste disposal. ($1,674,000)

2. Malaria in pregnancy

NMEP/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) with at least four doses of SP during pregnancy, free ITNs, and free prompt diagnosis and treatment of clinical malaria. These interventions are implemented as part of routine focused antenatal care (FANC).

Treatment for uncomplicated malaria is quinine in the first trimester and AL in the second and third trimesters. Severe malaria in pregnant women is treated with intravenous quinine in the first trimester and injectable artesunate in the second and third trimesters.

In 2014, the NMEP aligned the national policy on IPTp with the 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. In early 2017, a final decision was made to update the FANC guidelines to include low dose folic acid. The policy change has been official at the national level and is being disseminated to the provincial and district levels. The next step will be to update procurement policies to also include low dose folic acid for ANC.

IPTp is supported through the FANC platform. 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).

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. Nationally, IPTp for one dose, two doses and three doses stands at stands at 90%, 79% and 61%.[5]

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.

[5] 2015 Zambia Malaria Indicator Survey

A PMI-funded study[6] 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.

Progress during the last 12-18 months

In 2014, the NMEP aligned the national policy on IPTp with the updated WHO policy on IPTp. However, the national policy was yet to align with the recommendation for low dose folic acid. PMI/Zambia worked with the Safe Motherhood Technical Working Group to advocate for the change of policy to include low dose folic acid. In early 2017, a final decision was made to update the FANC guidelines to include low dose folic acid. The policy is now being disseminated to all levels of the health system. In addition, there are plans to update procurement plans to also include low dose folic acid.

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. In close collaboration with the Safe Motherhood unit at the MoH, PMI supported FANC trainings, with a focus on MIP in PMI's four focus provinces; Luapula, Muchinga, Northern and Eastern. A total of 114 district level ANC health care providers were trained in MIP (including IPTp), counseling on the use of ITNs and case management. PMI aims to support the training of a total of 668 district level ANC health care providers over the next five years.

GRZ procures SP for IPTp. Because the availability of SP is critical for IPTp, PMI has continued to invest in the Essential Medicines Logistics Improvement Program (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.

Monitoring SP resistance continues to be a priority for the NMEP. Discussions between PMI and NMEP on the selection of samples for molecular monitoring of SP resistance markers are underway so that updated data on prevalence of the *Pfdhfr/dhps* sextuple mutation can be generated.

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 Safe Motherhood Action Groups (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).

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

Table L. Status of IPTp policy in Zambia

Status of training on updated IPTp policy		Number and proportion of HCW trained on new policy in the last year if training on new policy is not yet completed	Are the revised guidelines available at the facility level?	ANC register updated to capture 3 doses of IPTp-SP	HMIS/ DHIS updated to capture 3 doses of IPTp-SP
Completed/Not Completed	Date (If completed, when, if not completed, when expected)				
Completed	2014	114	Yes	Yes	Yes

Commodity gap analysis

Table M. SP Gap Analysis for Malaria in Pregnancy

Calendar Year	2017	2018	2019
Total population	16,405,229	16,887,720	17,381,168
SP Needs			
National population of pregnant women	885,882	911,937	938,583
Total SP Need (in treatments)	**2,082,957**	**2,144,217**	**2,204,255**
Partner Contributions			
SP carried over from previous year	1,000,769	1,917,812	0
SP from Government	3,000,000	TBD	TBD
Total SP Available	**4,000,769**	**1,917,812**	**0**
Total SP Surplus (Gap)	**1,917,812**	**(226,405)**	**(2,204,255)**

Notes: Pregnant women account for approximately 5.4% of the national population. Total antenatal attendance is estimated at 97%. 100% of pregnant mothers attending antenatal clinics will receive first IPTp dose, 80% will receive second IPTp dose and 65% will receive the third IPTp dose (MIS 2015). It is estimated that 20% of the total antenatal attendances are likely to receive the fourth IPTp dose. SP quantities to be procured by GRZ in 208 and 2019 are yet to be finalized.

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 2018 funding: ($400,000)

- Support the training of provincial and district level health workers and supervision of provincial, district, and health facility level health workers on the implementation NMEP IPTp guidelines in four high malaria burden provinces (Eastern, Luapula, Muchinga, and Northern). These 4 provinces constitute 36 high burden malaria districts. ($400,000)
- 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)*
- Routine distribution of ITNs through ANC/EPI (*see full description under the ITN section, above)*

3. Case management

a. Diagnosis and treatment

NMEP/PMI objectives

The NMEP aims 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.

Table N. Status of Case Management Policy in Zambia

Status of Case Management Policy in Zambia according to National Malaria Diagnostic and Treatment Guidelines 2014 (Revised 2015)	
What is the first-line treatment for uncomplicated *P. falciparum* malaria?	Artemether-lumefantrine Dihydroartemisinin-piperaquine (alternate)
What is the second-line treatment for uncomplicated *P.falciparum* malaria?	None
What is the first-line treatment for severe malaria?	Injectable artesunate[1]
In pregnancy, what is the first-line treatment for uncomplicated *P. falciparum* malaria in the first trimester?	Oral quinine
In pregnancy, what is the first-line treatment for uncomplicated *P. falciparum* malaria in the second and third trimesters?	Artemether-lumefantrine
In pregnancy, what is the first-line treatment for severe malaria?	Intravenous quinine in the first trimester Injectable artesunate in second and third trimester
Is pre-referral treatment of severe disease recommended at peripheral health facilities? If so, with what drug(s)?	Rectal artesunate[2] Injectable artesunate[2]
Is pre-referral treatment of severe disease recommended for community health workers? If so, with what drug(s)?	Not currently recommended
If pre-referral rectal artesunate is recommended, for what age group? (note: current international guidelines do not recommend administrating to those ≥ 6 years)	For children 5 years old and below[3]

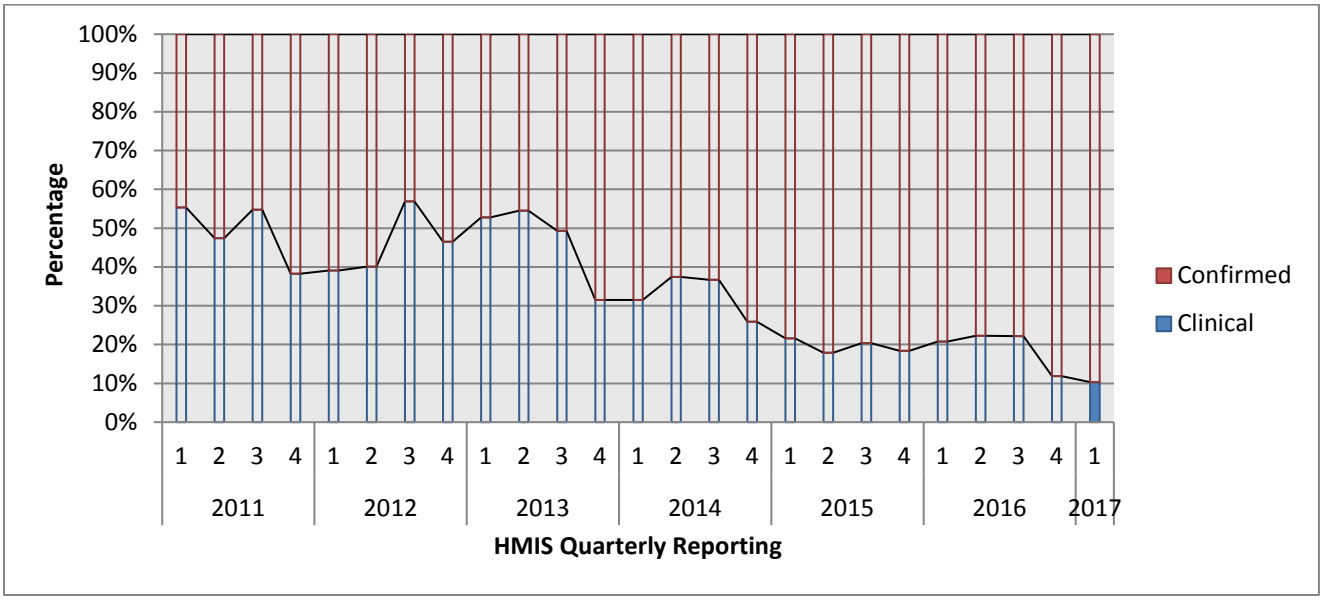
1: if injectable (intravenous-IV or intramuscular-IM) artesunate is unavailable, artemether (IM) or quinine (IV or IM) are suggested alternatives
2: if these two options are not available, IM quinine is recommended
3: per the 2017 draft Zambia Guidelines for the Diagnosis and Treatment of Malaria

Progress since PMI was launched

The NMEP, 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 12). Eighty percent of reported malaria cases were confirmed in 2016, compared with 31% in 2010, and 90% were confirmed nationally in the first quarter of 2017 (HMIS).

Figure 12. Diagnostic Confirmation Trend Total Malaria Cases in Zambia, 2011 - 2017 (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 supported EUV survey conducted in the first calendar year quarter of 2017 reported RDT stockouts in 10% of the 88 facilities visited.

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 2,700 clinicians.

Although iCCM training is supported by various partners, the provision of non-malaria commodities (oral rehydration solution, 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[7], 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 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. USAID has initiated discussions with partners and the MoH on plans to map CHWs, particularly those providing iCCM services. These discussions commenced recently and information from the mapping will be included in future MOPs.

In 2010, the GRZ 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

[7] These are clinicians who have undertaken three years training in clinical medicine

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, CHAs are expected to supervise the CHWs that work in their catchment areas. As of April 2017, over 2,000 CHAs have been trained with support from DFID with 1,200 included on GRZ payroll and deployed in health posts across the country and a further 1,403 supported through Global Fund. The GRZ aims to train and deploy 5,000 CHAs by December 2020.

All cadres listed above, including laboratory technicians, clinicians, and CHWs, 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 2016, there were no reported central level stockouts of either RDTs or ACTs in the country. However, some health facilities reported stockouts and central level stocks for some pack sizes of AL fell below the minimum stock level required. A total of 9,196,050 RDTs arrived in Zambia in 2016 from procurements by Global Fund (3,706,050), CHAZ (5,040,000), and DFID (450,000). The difference between the need and the quantities procured in 2016 was filled by RDTs carried over from 2015. In 2017, over 20 million RDTs are expected to arrive, with Global Fund providing the bulk of the supply (13,126,334). Additional support will be provided by PMI (7,210,875).

PMI procured 1,620,480 ACTs in 2016 for the treatment of malaria at health facility and community levels. In addition, 12,062,640 ACTs were procured by the Global Fund, 2,743,530 by DFID, 150,690 by Malaria No More, and 5,573,040 by GRZ s. In 2017, approximately 16 million ACTs are expected, with PMI providing over 9.7 million, Global Fund 1.8 million, and GRZ approximately 4.5 million.

In 2015, PMI introduced an electronic data system (EDS) in order to enhance OTSS data collection and use for decision-making. PMI supports OTSS in 8 out of 10 provinces in the country. In 2016, 289 provincial supervisors and 338 district supervisors from 8 provinces were trained on OTSS and EDS. The introduction of EDS has resulted in improved data quality. As the current PMI-supported case management partner project ends in September 2017, the transitioning of OTSS and EDS in four of the eight supported provinces to the NMEP is currently underway. The remaining four provinces will continue to receive OTSS support through PMI's bilateral partner. PMI is also supporting the establishment of a national malaria slide bank in order to enhance longer-term, national microscopy training and capacity building efforts. Laboratory technicians from sample collection sites were trained on WHO protocols for national slide banking. Slide preparation is planned to be concluded by June

2017. Furthermore, PMI conducted quality assurance visits to the sites to confirm species identity and parasite quantification for samples.

HMIS data has shown progressive improvement in malaria diagnosis confirmation. Confirmed malaria cases accounted for 90% of total malaria cases in the first quarter of 2017, up from 80% during the same period in 2016 and 78% in 2015. Furthermore, the MIS 2015 indicated that among children under five with fever that received an antimalarial drug, 80% reported receiving the recommended antimalarial (AL), up from 18% in 2006.

In 2014, the NMEP 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. Initial procurements of injectable artesunate were supported by PMI. However, subsequent procurements have been taken up by GRZ. The country currently has sufficient amounts of injectable artesunate. The GRZ has demonstrated ongoing commitment to procure injectable artesunate. Additionally, the malaria GF concept note includes a request to procure injectable artesunate. Training of health workers in the use of injectable artesunate has continued with all level 1 and 2 hospitals in all districts now trained. Although rectal artesunate is included in the current guidelines, procurement has yet to be conducted.

In 2016, PMI supported the NMEP to conduct a therapeutic efficacy study (TES) to ensure the efficacy of first-line malaria drugs. This TES included AL, artesunate-amodiaquine (ASAQ), and DHA-PQ and enrolled 289 patients (60% 5–15 years of age) from three sites around Zambia, Katete in Eastern Province, Mansa in Luapula Province, and Gwembe in Southern Province. Patients treated with AL and ASAQ were followed for 28 days and patients treated with DHA-PQ were followed for 42 days. PCR-corrected treatment efficacy was 100% across all three treatment arms. Adequate clinical and parasitological response rates were as follows: AL: 86% PCR-uncorrected, 100% corrected, ASAQ: 98% PCR-uncorrected, 100% corrected, DHA-PQ 87% PCR-uncorrected, 100% corrected. The results indicate all three drugs are well-tolerated, safe (no adverse events reported), and effective in Zambia for the treatment of uncomplicated P. falciparum infection. Additional analyses, including K13 resistance, are being conducted at CDC. The NMEP plans on performing a TES every two years in the same locations. Because the next TES was planned with FY 2017 funds, no FY 2018 funds are needed for this activity.

Table O. PMI-funded TESs

Completed TESs		
Year	**Site name**	**Treatment arm(s)**
2016	Katete, Mansa, Gwembe	AL 100% PCR-corrected ACPR; ASAQ 100% PCR-corrected ACPR; DHA-PQ 100% PCR-corrected ACPR
Ongoing TESs		
Year	**Site name**	**Treatment arm(s)**
N/A		
Planned TESs FY 2018		
Year	**Site name**	**Treatment arm(s)**
2018	TBD	AL, ASAQ, DHA-PQ

ACPR: Adequate clinical and parasitological response; TBD: To be determined

Commodity gap analysis

Table P: RDT Gap Analysis

Calendar Year	2017	2018	2019
RDT Needs			
Total country population	16,405,229	16,887,720	17,381,168
Population at risk for malaria	16,405,229	16,887,720	17,381,168
PMI-targeted at-risk population	16,405,229	16,887,720	17,381,168
Estimated Community cases	1,640,523	2,533,158	3,476,234
Estimated Outpatient department (OPD) attendances	38,933,159	40,023,288	41,143,941
Total Estimated Community cases and OPD	40,573,682	42,556,446	44,620,174
Total cases presenting with fever as a clinical symptom & requiring a test	24,344,209	25,533,868	26,772,104
Total cases presenting with fever as a clinical symptom - will do microscopy test	2,434,421	2,553,387	2,677,210
Percent of fever cases tested with an RDT	90%	90%	90%
Total RDT Needs	**21,909,788**	**22,980,481**	**24,094,894**
Partner Contributions			
RDTs carried over from previous year	4,600,000	3,027,421	0
RDTs from Government	0	10,841,674	12,479,433
RDTs from Global Fund	13,126,334	3,263,736	2,234,480
RDTs planned with PMI funding	7,210,875	3,000,000	2,000,000
Total RDTs Available	**24,937,209**	**20,132,831**	**16,713,913**
Total RDT Surplus (Gap)	**3,027,421**	**(2,847,650)**	**(7,380,981)**

Notes: OPD attendance was 37,872,723 in 2017. Applying a 2.8% population increment, it was assumed that OPD attendance will increase to 40,023,288 in 2018 and 41,143,941 in 2019. Note that true OPD attendance numbers are likely higher than indicated because 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 EUV data, it is assumed that 60% of OPD attendance will present with fever as a clinical symptom. RDT need for 2017 is inclusive of 6 months of pipeline to ensure adequate supply at the beginning of the next year. RDT quantities to be procured by GRZ and Global Fund in 2018 and 2019 are yet to be finalized.

Table Q: ACT Gap Analysis

Calendar Year	2017	2018	2019
ACT Needs			
Total country population	16,405,229	16,887,720	17,381,168
Population at risk for malaria	16,405,229	16,887,720	17,381,168
PMI-targeted at-risk population	16,405,229	16,887,720	17,381,168
Total projected number of malaria cases	6,300,000	6,000,000	5,700,000
Total ACT Needs	**12,861,544**	**12,218,467**	**11,607,543**
Partner Contributions			
ACTs carried over from previous year	261,000	3,307,161	2568,495
ACTs from Government	4,442,610	5,765,747	5,261,781
ACTs from Global Fund	1,800,000	2,714,054	1,787,584
ACTs planned with PMI funding	9,665,095	3,000,000	2,300,000
Total ACTs Available	**16,168,705**	**14,786,962**	**11,917,860**
Total ACT Surplus (Gap)	**3,307,161**	**2,568,495**	**310,317**

Note: ACT need is calculated based on "consumption data" as reported by the 106 EMLIP districts. Note that true ACT need is higher than total number of malaria cases indicated here since data shown were obtained from HMIS which has a report completion rate of approximately 70%. Additionally, ACT need for 2017, 2018 and 2019 is based on forecast to end the year with 6 months buffer ensuring adequate supply at the beginning of the next year. ACT quantities to be procured by GRZ and Global Fund in 2018 and 2019 are yet to be finalized.

Plans and justification

Government health facilities are the main providers of health services, including for malaria treatment, in Zambia. The private health care sector is small, accounting for just 14% of all health facilities which are found mostly in Lusaka and Copperbelt Provinces. Thus, the priority for PMI will be to improve diagnostics, supportive supervision, and overall malaria case management at government health facilities. Access to malaria treatment at community level will also be enhanced through iCCM, particularly for rural remote communities. With FY 2018 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. PMI will procure ACTs to contribute to filling the national need.

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 and clinical 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 2018 funding: ($4,580,000)

- Procure 2 million RDTs to be used at health facilities and by CHWs to contribute towards filling the national RDT need in 2019. ($740,000)
- Procure approximately 2 million AL treatment courses for uncomplicated malaria. ($2,000,000)
- Procure reagents and supplies to equip health centers for their malaria microscopy needs. ($40,000)
- Strengthen malaria case management at facility and community level including iCCM outside the current four targeted provinces. ($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)
- Support the supervision of healthcare providers in the treatment of uncomplicated malaria and the continued support of CHWs in iCCM in four targeted provinces. Where appropriate, iCCM support will include the surveillance and reporting components of 'Step D' (*see full description in the SM&E section*) ($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

NMEP/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 had been put on hold as MSL builds its capacity and develops a comprehensive strategic plan for its expanded mandate.

Progress since PMI was launched

PMI and partners have invested in several key areas related to pharmaceutical management: 1) procurement and distribution of ACTs, ITNs, and diagnostic commodities; 2) training of provincial, district and health facility staff in the use of the electronic Logistics Management Information System (eLMIS), in the use of logistics data for making informed supply chain decision and in the use of EMLIP; and 3) supporting the storage space expansion program at the central level.

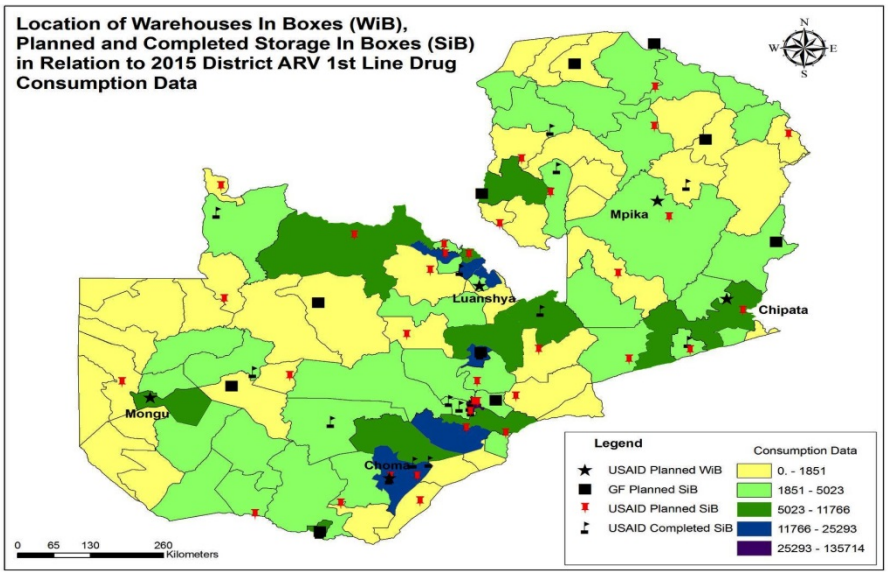
PMI provides support for capacity building and technical assistance with forecasting and quantification of malaria pharmaceuticals. PMI has provided support to the MoH and NMEC in the completion of long-term national forecasts and quantifications for malaria commodities, to complement procurement activities. The goal of this support was to facilitate a transition and to institutionalize the process of coordinated, transparent forecasting and quantification activities to the MoH. In addition, PMI provides support to the MoH, MSL, and other stakeholders to improve the collection, management, and use of logistics data through the development of an 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.

PMI has also worked closely with partners to improve in-country supply chain systems and capacity. A baseline survey conducted at the end of 2008 found high stockout rates at the health facility level for a range of essential medicines; for AL the stockout rate was approximately 40% for all four presentations. ACTs were managed as part of health center kits, which were allocated to facilities based on nationally-determined (population-based) allocations rather than consumption at individual facilities. To address this, PMI and other partners devised a new system, EMLIP[8], which was rolled out as a pilot to 16 districts in 2009. Product availability was significantly increased: the stockout rate for adult ACTs was reduced from 48% to 6% and for pediatric ACTs was reduced from 43% to 12%. In addition to reduced stockout rates, the number of days out of stock was reduced. Over time, Zambia has seen declining stockout rates of ACTs and RDTs at health facilities due to the use of EMLIP.

In order to strengthen MSL's capacity for last mile distribution, USAID, with funding from PEPFAR and in collaboration with the Global Fund, are supporting the constructing of five regional warehouses (Figure 14). This activity focuses on procurement and installation of warehouse in box units in Choma (Southern), Luanshya (Copperbelt), Mansa (Luapula), Mpika (Muchinga), and Mongu (Western). Construction and installation of the units are expected to be completed by end of FY 2017. The procurements of these units will increase storage capacity in target districts for medical supplies including malaria commodities. Currently, MSL hubs are only operational in 3 regions: Chipata, Mongu and Choma. Where the hubs exist MSL delivers commodities up to the facilities. In other areas they deliver up to DMOs who then picks up the tab to distribute commodities to the health facilities.

[8] EMLIP is a demand driven system, where facilities submit essential logistics data to their respective district medical offices (DMOs). The DMOs in turn follow a predetermined, fixed schedule for submission of reports to the Logistics Management Unit (LMU), housed at Medical Stores Limited (MSL). Once received, LMU determines the order quantities to be picked and packed at MSL for specific facilities. After the report is processed at LMU, MSL picks and packs by particular health facility and dispatches the consignment via the regional MSL hub (in collaboration with the respective DMO), following the MSL monthly distribution cycle. Each consignment is accompanied by documentation, issued to ensure tracking of commodities up to the final destination. The DMOs are then responsible for delivery of commodities to health facilities within their catchment areas.

Figure 13. Location of warehouse and storage in boxes



Progress during the last 12-18 months

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 increased 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. eLMIS is being rolled in phased approach starting with high volume facilities representing 20% of total facilities. Each year the plan is to add 100 additional facilities; 100 facilities will be added in FY 2018 and FY 2019 respectively to bring the total facilities to 450. In 2017, MoH, with support from partners will roll out the eLMIS facility version and train staff in additional 100 health facilities. This will bring the total trained to 350 health facilities. In 2018/2019, PMI in collaboration with other partners will support the roll out of the eLMIS facility version to additional 100 health facilities. This will bring the total trained to 450 health facilities. The use of the eLMIS has improved central level visibility and increased stock availability at both central and health facility level. In addition, health facility reporting rate has increase form 30% in 2016 to 98% in 2017. Furthermore, in 2016, the MoH with support from partners rolled out the redesigned EMLIP hybrid system[9] to 38 additional districts. This brings the total trained to 106 districts (100%).

The Logistics Management Unit (LMU) at the MoH recorded a 98% reporting rate and improved commodity facility level stock availability (100%) for malaria commodities in EMLIP districts for the period January to April 2017. In addition, according to monthly reports sent to the LMU from health facilities, no health facility reported a stockout of all presentations of ACT from February 2016 to April 2017

[9] The original design of EMLIP called for all commodities to be distributed via a pull system after health facilities had provided their monthly reports. However, this requires a full supply of all commodities at the central level. During the roll out of EMLIP there was a shortage of essential medicines, which limited the ability to roll out EMLIP as designed. As such, EMLIP was re-designed into a hybrid system in which some items were distributed via the pull system and other items are distributed via a push system.

PMI continued to provide support to the national core group led by the MoH/NMEP 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/NMEP staff.

To improve strategic management and planning for increased commodity security, PMI provided support to the NMEP Malaria Case Management technical working group. As part of this support, PMI contributed to the development and finalization of the Global Fund Malaria Concept note for Zambia. Technical assistance was also provided in support of transport optimization network assessment for MSL in view of its new mandate to operate as a commercial entity and, effectively and efficiently manage its distribution system.

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 2018 funding: ($1,000,000)

With FY 2018 funding, 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. ($100,000)

- 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 NMEC capacity building.

The NMEC is a Center under the Department of Public Health. The MoH provides technical and management oversight to malaria activities in public health facilities at the national, provincial, and district levels, as well as supporting and coordinating a wide range of partners, including research and training institutions. The NMEC has 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 and District Health Offices serve as an extension of the MoH. The MoH plans to ensure there is a malaria focal person at every district to support the elimination efforts.

The NMEC staff are committed to malaria elimination activities; however, they are currently understaffed, and need further support to effectively supervise provincial, district, and community-level activities and effectively coordinate the many partners contributing to malaria efforts in Zambia. In particular, the NMEC and partners recognize its need for additional support for expansion of IRS activities, iCCM, HMIS, advocacy and outreach efforts. The NMEC requires support to conduct lower-level visits for supervision and program management, which MACEPA and PMI are currently providing. PMI will support the IRS, iCCM, and SM&E programs in PMI provinces. The implementing partner will provide support for IRS training, mapping of households, entomology expertise, and assistance for NMEC 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 and CHAs into the community HMIS. PMI also supports capacity building through the Field Epidemiology Training Program (FETP).

NMEP/PMI objectives

The NMESP 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

Healthcare 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 2010–2016, 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 NMEC 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. 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 NMEC 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 2014). 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.[10] 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.

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 one FETP resident, placed at the NMEC. PMI supports a third-year Peace Corps Malaria Coordinator. Additionally, PMI Resident Advisors provide subject matter expertise to the Peace Corps Malaria Coordinator who helps inspire and coordinate the 300 Peace Corps volunteers (PCVs) and trainees in Zambia who are all expected to conduct malaria-related activities. In 2016, PCVs helped train over 1,000 community mobilizers in malaria behavior change communications and 62 teachers in malaria prevention.

Plans and justification

PMI plans to focus FY 2018 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 2018 funding: ($80,000)

- Provide support to strengthen NMEP 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)

[10]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.

- Provide support for one Zambian national to participate in a field epidemiology training program either at the intermediate or advanced level. *Funding included in previous fiscal years will be used to cover costs of the activity for this calendar year.* ($0)
- Provide support to enhance national capacity in health systems strengthening, PMI will support the NMEP for HMIS, CHW, and other elements of the public health system in Zambia. (*Costs included in case management and SM&E line items*)

Table R: 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 management information 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 technical and financial support for in-country malaria operational research. Support the development of a national malaria operations research priority setting roadmap.
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.

5. Social and behavior change communication

NMEP/PMI objectives

The NMEC is in the process of finalizing the 2017-2021 national malaria SBCC strategy in alignment with the National Malaria Elimination Strategic Plan (2017-2021) and the National Health Strategic Plan. However, the NMEC'S SBCC strategy for 2011 - 2014 continues to be in effect until a new strategy document is developed. The NMEC'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 NMEC'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 to conduct sensitization sessions on malaria prevention and treatment in their communities. The national SBCC strategy, training materials, and tools are used across the country including in PMI-supported provinces. PMI has also supported training of local NGO staff on SBCC related to malaria prevention, and supported PCVs 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 Safe Motherhood Action Groups (SMAGs). PMI resources complement funding with other donors and partners to support these activities. By the end of 2014, communities supported 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 will provide SBCC support in its four targeted provinces. Activities will include community mobilization and community dialogues focusing on increasing acceptance of IRS, increasing ANC attendance with higher IPTp uptake and improving health care-seeking behavior. PMI supported 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 until 2014. The provinces and districts covered by this activity 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 led to a 10% increase in regular ITN use compared to communities without a community

counseling agent.[11] PMI plans to implement similar activities in selected communities in the four target provinces.

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 women and children under age of five has also increased from 32% to 58% and from 32% to 58%, respectively. IPTp second dose coverage among pregnant women increased from 59% in 2006 to 79% in 2015.

Progress during the last 12-18 months

The NMEC is focused on the finalization of SBCC materials that will be used before, during, and after the universal ITN mass distribution campaign. These materials have been developed directly with PMI to be initially used in Luapula Province but will be adapted for use in other areas throughout the country. This campaign will build upon a pilot of school-based distribution that was conducted by PMI in 395 schools resulting in 55,229 ITNs distributed. During this distribution method, SBCC materials were tailored to zonal coordinators, teachers, and head-teachers to ensure that malaria messages were provided to the students in addition to ITNs

To maximize uptake of IRS at the community level, PMI worked with NMEC to develop radio messages for the four high-burden provinces that PMI supports. This was complimented with active demand creation and efforts to overcome misperceptions at the community level to decrease refusals. This effort was facilitated with data provided by the mSpray program that provided a decision-management tool targeting structures that were not sprayed during the initial round.

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 ITN use. PMI supported training of Teachers, Zonal Education Coordinators, District Education Officers, District Health Promotion Focal Point Persons, Provincial Health Education Officers and individuals and organizations involved in community-based health promotion from the 395 schools in four districts. 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. The intent is that CHAs spend 80% of their time 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.

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 DHOs also received a training video on community theater, which captures the

[11]Communications Support for Health: Final Report 2014

process of training community drama practitioners and documents the entire process of a community drama session.

As Zambia advances its efforts to eliminate malaria, the behavioral issues it will encounter will be more and more complex and likely demand further investments to resolve them. 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 research – is planned for 2017. The study will inform development of the new national malaria SBCC strategic plan 2017 - 2021. Development of the study research questions, concept note and protocol is underway. The malaria communication strategy will align with the national malaria elimination strategy and will outline strategies for monitoring and adapting to the changing malaria epidemiology.

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 (Luapula, Northern, Eastern, and Muchinga 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 NMEC for malaria focused SBCC strategies and materials in collaboration with other partners.

Proposed activities with FY 2018 funding: ($1,500,000)

The NMEC 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 as 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. 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. Going forward, NMEC will use routine distribution methods for ITNs. As a result, SBCC activities and information will need to be tailored to these specific risk groups. To improve IRS acceptance, activities and messages will need to be tailored for the engagement of key stakeholders including political and religious leaders, mass media, and community leaders and members. In urban and peri-urban areas which

usually have lower acceptance of IRS, messages will need to be adapted for this audience if coverage is to be expanded. In addition activities will also 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. NMEC will revive the Malaria Media Award, which recognizes a media member(s) that brings attention and advocates for malaria and implementing activities that impact the burden of disease. 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, awareness of and demand for appropriate malaria diagnosis, and adherence to treatment. ($500,000)

- Conduct community-based SBCC in four targeted provinces including through NGOs/faith-based organizations to increase ITN 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 of ANC attendance and demand for IPTp to meet the revised WHO Guidelines recommending IPTp at each visit after the first trimester. 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, adherence to treatment and use of treatment services at the community-level. Activities will be tailored as appropriate to changing malaria epidemiology, particularly in areas with falling malaria burden where risk perceptions may shift and require specific SBCC approaches. ($1,000,000)

6. Surveillance, monitoring, and evaluation

NMEP/PMI objectives

The new NMESP 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 NMEP 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 SM&E Plan has been developed to compliment the NMESP 2017–2021 and address the challenges in Zambia as it moves toward eliminating malaria. Three SM&E principles and assumptions that guide monitoring and evaluation in the NMESP 2017–2021 include:

- Progress on the path to malaria elimination in Zambia will be based on surveillance efforts;
- Progress will be measured using multiple data sources, including routine information systems, household and health facility surveys, and longitudinal studies;
- Progress will be monitored through a minimal set of outcome and impact indicators drawn from a larger set of indicators recommended by WHO and routinely tracked.

The objectives and strategies from the National SM&E Plan are:
Objectives

- To strengthen and enhance SME systems so that key indicators are reliable, can be accurately tracked and the data is used strategically to inform malaria programming at the national, provincial, district, facility and community levels.

- To assess the impact of the NMSP 2017-2021 and measure successes in reducing malaria burden

Strategies

- Strengthen capacities at community, facility, district, provincial, and national level for malaria surveillance and monitoring to provide feedback to the NMEP, Roll Back Malaria (RBM) partners, and other relevant authorities in order to improve malaria program planning, management, and accountability.
- Strengthen and enhance malaria data management systems at community, facility, district, provincial, and national levels and their ability to collect, process, analyze, manage, and use quality malaria-related and key indicator data for programming.
- Strengthen coordination in SME across the NMEP by working with each program area to enhance their capacity to manage and use data for programming.

PMI's support to SM&E in Zambia aligns with the NMESP and the National Malaria M&E Plan. PMI coordinates and collaborates with the NMEP 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 NMEP 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.

Nationwide MISs were carried out in 2006, 2008, 2010, 2012, and 2015 to provide information on the coverage of the four major malaria interventions, malaria parasite prevalence, and the prevalence of severe anemia, which is useful for measuring changes over time.

In 2014, the Institute for Health Metrics and Evaluation published an impact evaluation for the period 1990–2010. The evaluation found that rapid scale-up of key child health interventions, including malaria control interventions, including (ITNs and IRS), contributed to declines in under five mortality in Zambia during 1990–2010, but it was not statistically possible to quantify the individual impact of

these interventions on under five mortality.[12] However, "increased ITN coverage is associated with decreased malaria morbidity and use of health services for malaria illness in Zambia during 2009–2011."[13]

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 shows household and facility surveys implemented and planned from 2010 to 2019.

Progress during the last 12-18 months

HMIS: Malaria data from the HMIS are being used to follow trends in incidence at the province and district levels, with the NMEP changing approaches in provinces where the incidence has been increasing, 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. In select facilities, health care workers report malaria cases, laboratory testing, and drug availability by web-enabled cell phones or tablets on a weekly basis. 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 included rapid reporting and community-level response to investigate potentially locally-acquired infections in Lusaka District. This activity was not continued after it was transitioned over to the Lusaka District Health Office. Additional PMI support was re-initiated in 2017 to improve participation and reporting from the health centers around Lusaka District to better track clustering of malaria cases and target control interventions throughout the district.

Step D (community surveillance and reactive case detection): Community-level malaria case management (passive case detection) and reporting by CHWs along with reactive case detection (active case detection) by the same CHWs continues in low burden areas and as part of a MDA program in Southern Province; in 2016 it was expanded into parts of Western Province with plans to roll out Step D to additional districts in Western province by 2017. Step D involves training both facility and

[12] 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.

[13] 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

community health workers on the process of testing with RDTs and antimalarial treatment, as well as development and training on use of a malaria surveillance system to collect the data from both passive and active activities using DHIS2. For Step D to work well in Zambia, good coverage and oversight of CHWs is needed, especially if the malaria burden is high. Step D also requires a strong reporting system with monthly reporting of a minimal list of indicators. A data CHW is identified to report individual CHW data for a group of up to five CHWs, via mobile phone, but each CHW's data is reported individually. The active component of Step D involves creating the expectation that passive RDT positive cases (index cases) should be followed up by the CHW to test the household of the passive positive individual, and surrounding households, and treat anyone found to be positive. It has been determined that individual CHWs are able to follow up 5-10 passive positives in a month.

End-Use Verification: The EUV collects data quarterly on malaria commodities from facilities to assess availability. The last report for EUV is from the first quarter of 2017, reflecting data from 88 health facilities visited in February 2017. On the day of the visits 43% of all sampled records were malaria cases, of those 88% were diagnosed with an RDT, 11% clinically diagnosed, and 1% by microscopy. 97% of health facilities had all four ACT presentations on the day of visit, while the other 3% had 3 of the presentations.

Table S. Surveillance, Monitoring, and Evaluation Data Sources

Data Source	Survey Activities	Year									
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
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)	(X)
	KAP survey								X		
Malaria Surveillance and Routine System Support	Support to malaria surveillance system					X*	X*	X*	X*	(X)*	(X)*
	Electronic Logistics Management Information System (eLMIS)					X	X	X	X	(X)	(X)
	Support to HMIS/DHIS2				X*	X*	X	X	X	(X)	(X)
Therapeutic efficacy monitoring	In vivo efficacy testing				X			X		(X)	
Entomology	Entomological surveillance and resistance monitoring		X*	X	X	X	X	X	X	(X)	(X)
Other malaria-related evaluations	Malaria Program Review	X			X			X			(X)

Other Data Sources	Malaria Impact Evaluation					X*					
National level supply chain survey	National Supply Chain Assessment								X*		

*Not PMI-funded ; ( ) Planned activity; ZAMPHIA: Zambia Population-based HIV Impact Assessment; KAP: Knowledge, Attitude, and Practice

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 2018 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; PMI-support for this activity is included in previous MOPs. 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 and the reduced FY 2018 support the transition plan to the district will be initiated. PMI support at the national level will continue as it has been instrumental in restarting TWG meetings for all of the areas of focus. The success of the NMEP is dependent on the ability of the MOH to effectively manage implementation of malaria control and elimination activities. The National level TWGs related to malaria are important structures, linked to government systems and leadership roles, and provide a critical framework for advancing technical theme alignment, coordination and planning, as well as development, dissemination and mainstreaming of national strategic and technical guidance on malaria. Through the TWGs PMI supports the NMEP and its partners in ensuring that existing policies and guidelines are in line with current technical standards, collecting and reviewing evidence to inform program implementation, and ensuring that program activities are well-coordinated and implemented. In addition to support for the TWGs, other national support included strengthening malaria policies and guidelines which included conducting the end term review and development of the new elimination strategic plan. In Zambia, community-level case management through iCCM is continuing to improve, and as the malaria burden decreases, active case follow up and community surveillance reporting (termed ‘Step D’) will become an important foundation for elimination activities. With FY 2018 funds, PMI will support the following activities:

Proposed activities with FY 2018 funding: ($1,827,330)

- 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: supporting districts to hold monthly malaria data review meetings, conduct quarterly malaria supervisory visits, supporting provinces and their respective districts to conduct routine data quality audits, and conduct workshops with MOH M&E staff to

orient and train provincial and district staff on the development of malaria surveillance bulletins, 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. All of these activities are critical in improving timeliness and accuracy of reporting malaria data, identify gaps and possible solutions, and ultimately will strengthen provincial and district HMIS to improve data reporting, analysis and use for decision-making. ($750,000)

- Provide resources for central-level NMEC personnel to conduct and follow up on data quality audits (DQAs) 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 for M&E technical working group meetings, and technical assistance to enhance standardization and reporting of data in HMIS, including standardization of platforms for collection of community-level and active case detection data across provinces and partner projects. ($500,000)
- 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 transitioned to Lusaka District following this last year of support. ($100,000)
- Support for the community-based surveillance and reporting components of Step D in select PMI-supported districts with reduced burden. This activity will build on the iCCM platform to strengthen collection and reporting of data by CHWs to feed into DHIS2, and lay the foundation for potential future inclusion of active case reporting data. ($367,330)
- Provide CDC technical assistance in monitoring and evaluation activities. ($10,000)

7. **Operational research**

NMEP/PMI objectives

The NMEP in Zambia has many ongoing and planned research activities with a number of different partners. In 2017 PMI supported the NMEP 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 NMEP. The outcomes of this road mapping exercise will guide future PMI OR activities in Zambia.

Table T: 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
Modeling the impact and cost-effectiveness of focal IRS with pirimiphos-methyl in Nchelenge District: Identifying targeting strategies to maximize protection while minimizing cost	December 2015	December 2016	$324,299
Association between malaria control scale-up and micro-economic outcomes: evidence from a retrospective analysis in Zambia*	December 2015	December 2016	$220,000
Ongoing OR Studies			
Title	**Start Date**	**End Date**	**Budget**
Comparison of different indoor residual spraying strategies to maximize finite resources in Zambia: a comparison-control trial, Eastern Province, Zambia*	May 2017	September 2018	$700,000
Planned OR Studies FY 2018			
Title	**Start Date**	**End Date**	**Budget**
None			

*PMI Core-funded OR studies

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.[14] These data fed into a PMI-wide pooled analysis that identified factors influencing ITN durability across countries. Additionally, a PMI-funded study of the efficacy of SP for IPTp in Mansa, Zambia was completed in 2013. The study indicated that IPTp with SP retains some efficacy in the site tested, but suggested that regular resistance monitoring is needed especially in light of the emergence of the sextuple mutation. As a result, PMI and NMEC are currently working to identify opportunities for regular molecular monitoring of SP resistance. (*See the MIP section for more information.*)

[14] 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

Modeling the impact and cost-effectiveness of focal IRS with pirimiphos-methyl in Nchelenge District: Identifying targeting strategies to maximize protection while minimizing cost, Phase I.
The first phase of the study modelled the potential effectiveness of different targeted IRS strategies. To improve initial analyses of the IRS implementation in Nchelenge District to better inform targeted IRS strategies. Phase 1 funding built the targeting strategies that will be applied in Phase 2, as a trial of targeted IRS strategies is only as effective as the targeting methodology.

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. This study assessed 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 examined whether the scale-up of these activities in Zambia is associated with improved micro-economic outcomes at the household level. Results indicated that micro-economic outcomes increased (33% increase in food spending) concurrently with malaria control coverage (62% increase) from 2006 to 2010[15]. Despite using data from all 72 districts, both analytic methods yielded wide confidence intervals that do not conclusively link outcomes and malaria control coverage increases. The researchers concluded that while it is technically possible to use routinely available survey data to relate malaria control scale-up and micro-economic outcomes, meaningful results may not be obtained when survey data are highly aggregated. Therefore, the feasibility of disaggregating existing survey data should be assessed prior to embarking on similar analyses.

<u>Ongoing OR studies</u>

Comparison of different indoor residual spraying strategies to maximize finite resources in Zambia: a comparison-control trial, Eastern Province, Zambia.

> Despite implementing epidemiologically targeted IRS in Eastern Province, questions remain about how to best distribute the finite IRS resources as well as what targeting strategy is most appropriate. The study will examine the effect of different district-level IRS targeting strategies on measures of malaria transmission by comparing three IRS scenarios in groups of two districts for each scenario: 1) blanket spray is applied to one district and the other receives no spray, 2) both districts receive health facility targeted IRS, and 3) both districts receive ecologically targeted IRS. These groups have been chosen to mimic the choices presented to malaria control programs when they are faced with finite resources and the question of which districts should conduct IRS operations and at what coverage intensity.
>
> 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

[15] Exploring the use of routinely-available, retrospective data to study the association between malaria control scale-up and micro-economic outcomes in Zambia.
Alison Comfort, Anthony Leegwater, Sharon Nakimovsky, Henry Kansembe, Busiku Hamainza, Benson Bwalya, Martin Alilio, Ben Johns and Lauren Olsho. *Malaria Journal* 2017, 16:15

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 informed by the results of the modeling study. The second phase is designed to provide information that would guide implementation of the proposed policy change by NMEP. 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.

Plans and justification

All new OR activities will be developed with the NMEC following the outcomes of the Operational Research Roadmap expected mid-2017.

Proposed activities with FY 2018 funding: ($0)

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

8. Pre-elimination

NMEP/PMI objectives

Zambia's NMESP 2017–2021 was officially launched and the National Malaria Control Centre was re-branded as the National Malaria Elimination Centre on World Malaria Day, April 25, 2017 to highlight the importance of and GRZ commitment to elimination of malaria in Zambia. The NMESP 2017-2021 also highlights the GRZ commitment to elimination.

The major goals and objectives of the new elimination plan include the following:

Goals

1. To eliminate local malaria infection and disease in Zambia by 2021.
2. To maintain malaria-free status and prevent reintroduction and importation of malaria into areas where the disease has been eliminated.

Objectives

1. Increase the malaria-free health facility catchment areas (HFCAs) from 0.5% in 2015 to 100% by 2021.
2. Reduce malaria deaths from 15.2 deaths per 100,000 in 2015 to less than 5 deaths per 100,000 population by 2021.
3. Achieve 100% malaria-free national certification of HFCAs by 2021.
    - Reduce malaria incidence from 336 cases per 1,000 population in 2015 to less than 5 cases per 1,000 population by 2021.
4. Increase the implementation rate of interventions from 36% in 2015 to 95% by 2021.

- Strengthen capacity to plan and implement budgets, execute payments on schedule, and to rapidly reallocate or mobilize funds to deal with unexpected events.
- Sustain national political support, technical and operational capacity, and financial resources for malaria elimination.

5. Maintain 100% malaria-free HFCAs, following certification in 2021.
    - Prevent the re-emergence of malaria transmission due to importation in HFCAs where it had been eliminated.

The elimination strategy aims to target different areas and implement activities in a step by step approach based on transmission levels. The NMEC will continue to scale up vector control interventions and timely diagnosis and treatment, as well as increase coverage of at least three doses of SP for IPTp; MDA may be deployed in certain circumstances, the details of which are currently under discussion by NMEC and partners. In addition, the strategic plan notes the need to strengthen information systems for better quality and timely reporting of infections through establishing a robust 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.

PMI's focus in Zambia continues to be on malaria prevention and control in high burden provinces in support of the NMESP. As the malaria burden falls in these areas, PMI will support the strengthening of surveillance systems in preparation for the implementation of increased community reporting and investigation activities, similar to those currently being supported by other partners in lower burden provinces. This support of the surveillance components of Step D will lay the foundation for the eventual addition of response activities such as reactive case detection, and reporting of associated data.

Progress since PMI was launched

Most pre-elimination activities to date in Zambia are primarily supported by GRZ (including Global Fund) and MACEPA, with support in some districts from the Isdell Flowers Foundation.

A PATH/MACEPA-supported study, which took place 2014 to 2016 to evaluate MDA and focal mass drug administration in a population of approximately 300,000, showed that MDA targeting the whole population with DHA-PQ, 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 that MDA could be a promising strategy for accelerating toward malaria elimination in certain transmission settings as a short-term solution where community-led sustainable interventions can maintain the pressure produced from the MDA program.

Progress during the last 12-18 months

NMEP and MACEPA continue to evaluate the impacts of programmatic implementation of MDA in Southern Province. If areas in Southern Province are able to sustain elimination, beginning in 2017 MACEPA will evaluate means to assess elimination through 'Step E', which includes testing serology for malaria exposure and assessing different sampling strategies including community surveys and convenience sampling from health facilities in areas reporting zero transmission. This activity will build on the existing 'Step D' reactive case detection and community-based surveillance platform supported by MACEPA in Southern and Western Provinces.

Zambia is a member of the Southern Africa Malaria Elimination Eight (E8) Initiative and is listed as a 2nd line elimination country (elimination by 2030). E8 is supporting the establishment of border health facilities in all E8 countries by 2017 to evaluate the impact of border health facilities on maintaining elimination. There will be two supported border health facilities in Zambia; a static primary health facility in Livingstone District, Southern Province and a mobile facility in Sesheke District in Western Province.

Table U: Pre-Elimination Activities

Technical Area	Description of Activity	Geographic Coverage
Prevention	MDA	Southern and Western Province
Case management/OR	OR on test and treat, Reactive Case Detection, and focal MDA with evaluation of highly sensitive RDTs	Southern Province
SBCC	SBCC targeting migrant people needing to access to border health facilities SBCC tailored to meet needs in areas where malaria burden has fallen (see SBCC section)	Southern and Western Province PMI-supported districts with falling malaria burden
SM&E	Step D Community-based and Enhanced Surveillance component (see SM&E section). Step E – Elimination through documentation and marinating zero through strong surveillance and response systems as the underlying tools necessary for maintaining zero transmission.	Southern and Western Province Lusaka District PMI –supported districts with decreasing malaria burden

Note: The majority of items on this table are funded by either GRZ or MACEPA

Plans and justification
PMI is supporting training to ready different health catchment areas to strengthen surveillance and prepare for Step D activities within districts with declining malaria burden, but is not supporting actual implementation of any targeted screen/treat or MDA. PMI support, through a bilateral partner, will be used to work with districts to help identify criteria for Step D qualification and provide technical assistance to ensure it is implemented according to national standards as outlined in the NMESP. Planned activities for SBCC are described in the SBCC section of the MOP. Plans for Step D: Community-based enhanced surveillance are described in the SM&E section of the MOP.

Proposed activities with FY 2018 funding: ($ **0***)*
Please refer to SBCC and SM&E section of the MOP for proposed activities.

9. Staffing and administration

Three health professionals oversee PMI in Zambia. A USAID Infectious Diseases Advisor, a position created in 2017, 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.

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 Advisor. The two PMI RAs, one from USAID and one from CDC, and the Infectious Disease Advisor 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 NMEP and implementing partners, including time in the field monitoring program implementation and impact.

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

Proposed activities with FY 2018 funding: ($1,579,170)

- Support for in-country PMI CDC resident advisor with support encompassing salaries, benefits, travel, and other staff support related costs. ($439,286)
- Support for in-country PMI staff including a USAID Infectious Disease Advisor and one USAID PMI resident advisor with support encompassing salaries, benefits, travel, and other staff support related costs. In addition, support is provided for general administrative costs that enables Mission-wide assistance from which PMI benefits. ($1,139,884)

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

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	6,180,000	28.7%
TBD-Vector Control IDIQ	Targeted districts	Procurement of insecticides for IRS. Support environmental monitoring, insecticide resistance monitoring	8,264,500	38.3%
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	4,540,000	21.1%
TBD - SBCC	National	Support for national level BCC activities	500,000	2.3%
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	1,139,884	5.3%

CDC-IAA	NA	Entomologic monitoring and insecticide resistance, M&E, net durability, operations research and FETP training	49,000	0.2%
TBD - Surveillance	Lusaka and TBD	Enhanced Lusaka surveillance, reactive case detection, community surveillance	467,330	2.2%
TBD - iCCM	TBD	Strengthen malaria case management at facility and community level, including iCCM	400,000	1.9%
Total			**21,560,714**	**100%**

Table 2: Budget Breakdown by Activity
President's Malaria Initiative – ZAMBIA
Planned Malaria Obligations for FY 2018

Proposed Activity	Mechanism	Budget ($)		Geographic Area	Description
		Total	Commodity		
PREVENTIVE ACTIVITIES					
VECTOR MONITORING AND CONTROL					
Entomologic monitoring and insecticide resistance management					
Entomological monitoring and insecticide resistance monitoring, support to insectary and training and capacity building for new NMEC entomologist. Environmental Monitoring and Compliance.	TBD-Vector Control IDIQ	450,000		NA	Support entomological monitoring and insecticide resistance monitoring and support to insectary. Support environmental monitoring and environmental assessment, to include use of DDT, organophosphates, or carbamates. Support NMEC capacity in entomological monitoring. Conduct environmental monitoring, environmental assessments, and risk mitigation in IRS districts
CDC technical assistance on entomological monitoring and insecticide resistance	CDC-IAA	29,000		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	2,000,000	2,000,000	National	Procure approximately 694,000 ITNs for 2018 continuous/routine distribution.
Distribution of ITNs	GHSC-PSM	400,000		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		Luapula, Northern, Eastern and Muchinga	Provide technical assistance to expand continuous distribution channels for sustaining high ITN coverage in selected provinces/districts).
Routine net durability monitoring	PAMO	180,000		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		NA	Provide CDC technical assistance for routine monitoring of net durability.
Subtotal ITNs		**2,740,000**	**2,000,000**		
Indoor Residual Spraying					
Procurement of IRS commodities and support to other components of the program.	TBD-Vector Control IDIQ	6,140,500	6,140,500	36 districts (Luapula, Northern, Muchinga, Eastern)	Procure insecticides (i.e., organophosphates) and other IRS supplies/equipment for spraying in 36 districts
Implementation of PMI-supported IRS program, monitoring and evaluation, storage/incinerator, community sensitization, geocoding, BCC. National level support to the NMCE IRS program.	TBD-Vector Control IDIQ	1,674,000		36 districts (Luapula, Northern, Muchinga, Eastern)	Support the implementation of the PMI-supported 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 36 PMI-funded districts. Training, monitoring and evaluation, and BCC for IRS; pesticide storage, waste disposal. For the NMEC implemented IRS program, provide support for Training of trainers, supervisory support, training materials development, TWG support, microplanning, post-IRS support; waste disposal.
Subtotal IRS		**7,814,500**	**6,140,500**		
SUBTOTAL VECTOR MONITORING AND CONTROL		**11,033,500**	**8,140,500**		

Malaria in Pregnancy					
Strengthening FANC for IPTp	PAMO	400,000		National, Northern, Luapula, Eastern and Muchinga	Support the training of provincial and district level health workers and supervision of provincial, district, and health facility level health workers on the implementation NMEP IPTp guidelines in four high malaria burden provinces (Eastern, Luapula, Muchinga, and Northern). These 4 provinces constitute 36 high burden malaria districts
Subtotal Malaria in Pregnancy		**400,000**	**0**		
SUBTOTAL PREVENTIVE		**11,433,500**	**8,140,500**		
CASE MANAGEMENT					
Diagnosis and Treatment					
Procurement of RDTs	GHSC-PSM	740,000	740,000	National	Procure 2 million RDTs for health facilities and iCCM
Procurement of ACTs	GHSC-PSM	2,000,000	2,000,000	National	Procure 2.3 million ACTs (artemether-lumefantrine) for the treatment of malaria in facilities and communities
Procurement of reagents and supplies	GHSC-PSM	40,000	40,000	National	Procure reagents and supplies
Strengthen malaria case management at facility and community level	TBD - Malaria Service Delivery	400,000		Selected provinces TBD	Strengthen malaria case management at facility and community level, including iCCM, outside the current four targeted provinces

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 PHC 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.
Strengthen facility- and community-based treatment with ACTs	PAMO	1,000,000		Luapula, Northern, Eastern and Muchinga	Support the supervision of healthcare providers in the treatment of uncomplicated malaria and the continued support of CHWs in iCCM in four targeted provinces; Where appropriate, iCCM support will include the surveillance and reporting components of 'Step D'
Subtotal Diagnosis and Treatment		**4,580,000**	**2,780,000**		
Pharmaceutical Management					
Provide technical assistance to strengthen pharmaceutical and supply chain management systems	GHSC-PSM	1,000,000		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		**1,000,000**	**0**		

SUBTOTAL CASE MANAGEMENT		**5,580,000**	**2,780,000**		
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., S, M&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	0		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. Funding included in previous fiscal years will be used to cover costs of the activity for this calendar year.
SUBTOTAL HSS & CAPACITY BUILDING		**80,000**	**0**		
SOCIAL AND BEHAVIOR CHANGE COMMUNICATION					

Support for national SBCC activities	TBD - SBCC	500,000		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 appropriate malaria diagnosis and increased adherence to treatment for malaria
Provide support for community-based SBCC	PAMO	1,000,000		Luapula, Northern, Eastern and Muchinga	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 community level
SUBTOTAL SBCC		**1,500,000**	**0**		
SURVEILLANCE, MONITORING, AND EVALUATION					
Support improved provincial, district and community reporting and utilization of data	PAMO	750,000		National	Strengthen routine malaria data reporting at community, health facility, district, and provincial levels in four targeted high burden provinces. Activities will include support for training and mentorship of community health workers, staff at health facilities and district health offices in data collection, reporting, and use for 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	TBD	500,000		National	Support national-level M&E activities, including HMIS strengthening, national-level coordination with partners such as MACEPA, CHAI, etc. for their M&E activities, support national M&E technical working group meetings, provide technical assistance to enhance standardization and reporting of national, facility, and community-level data
Support enhanced surveillance in Lusaka District	TBD	100,000		TBD	The Lusaka enhanced surveillance activity served as a model for the Step 1, 2, 3 strategy that the current enhanced surveillance program in the southern half of the country evolved from. 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.
Support reactive case detection and community surveillance	TBD	367,330		TBD	Implement reactive case detection and strengthened malaria reporting by CHWs in areas where burden has been reduced.
Technical assistance for M&E	CDC-IAA	10,000		NA	Provide CDC technical assistance in monitoring and evaluation activities
SUBTOTAL SM&E		**1,827,330**	**0**		
OPERATIONAL RESEARCH					
SUBTOTAL OR		**0**	**0**		
IN-COUNTRY STAFFING AND ADMINISTRATION					
USAID		1,139,884	0		Support for in-country PMI management and operational costs

CDC		439,286			Support for CDC annual staffing costs
SUBTOTAL IN-COUNTRY STAFFING		**1,579,170**	**0**		
GRAND TOTAL		**22,000,000**	**10,920,500**		