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 2019 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 2019

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS

ACT	Artemisinin-based combination therapy
AIDS	Acquired immunodeficiency syndrome
AL	Artemether-lumefantrine
AMF	Against Malaria Foundation
ANC	Antenatal care
ASAQ	Artesunate-amodiaquine
CDC	U.S. Centers for Disease Control and Prevention
CHA	Community health assistant
CHAZ	Churches Health Association of Zambia
CHMIS	Community health management information system
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
DQA	Data quality audit
E8	Southern Africa Development Community's Malaria Elimination Eight Initiative
EIR	Entomological inoculation rate
eLMIS	Electronic Logistics Management Information System
EMLIP	Essential Medicines Logistics Improvement Program
EPI	Expanded Program on Immunizations
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
MCH	Maternal and child health
MDA	Mass drug administration
MIP	Malaria in pregnancy
MIS	Malaria indicator survey
MOP	Malaria Operational Plan

MRRS	Malaria rapid reporting system
MTAT	Mass test and treat
MSL	Medical Stores Limited
MoH	Ministry of Health
NMEC	National Malaria Elimination Centre
NMEP	National Malaria Elimination Program
NMESP	National Malaria Elimination Strategic Plan
NGO	Non-governmental organization
OP	Organophosphate
OPD	Outpatient department
OR	Operational research
OTSS	Outreach training and supportive supervision
PCR	Polymerase chain reaction
PCV	Peace Corps volunteer
PMI	U.S. 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	U.S. 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 U.S. President's Malaria Initiative (PMI) was to reduce malaria-related mortality by 50 percent across 15 high-burden countries in sub-Saharan Africa through a rapid scale-up of four proven and highly effective malaria prevention and treatment measures: insecticide-treated mosquito nets (ITNs); indoor residual spraying (IRS); accurate diagnosis and prompt treatment with artemisinin-based combination therapies (ACTs); and intermittent preventive treatment of pregnant women (IPTp). With the passage of the Tom Lantos and Henry J. Hyde Global Leadership against HIV/AIDS, Tuberculosis, and Malaria Act in 2008, PMI developed a U.S. Government Malaria Strategy for 2009–2014. This strategy included a long-term vision for malaria control in which sustained high coverage with malaria prevention and treatment interventions would progressively lead to malaria-free zones in Africa, with the ultimate goal of worldwide malaria eradication by 2040-2050. Consistent with this strategy and the increase in annual appropriations supporting PMI, four new sub-Saharan African countries and one regional program in the Greater Mekong Subregion of Southeast Asia were added in 2011. The contributions of PMI, together with those of other partners, have led to dramatic improvements in the coverage of malaria control interventions in PMI-supported countries, and all 15 original countries have documented substantial declines in all-cause mortality rates among children less than five years of age.

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

In 2017, consistent with an increase in annual appropriations, PMI again launched new country programs in Cameroon, Côte d'Ivoire, Niger, and Sierra Leone, and expanded an existing program in Burkina Faso to PMI focus country status. With the addition of these new focus countries, PMI now has programs in 24 countries in sub-Saharan Africa, in addition to two bilateral programs and targeted support in the Greater Mekong Subregion in Asia.

Zambia began implementation as a PMI focus country in FY 2007.

This FY 2019 Malaria Operational Plan (MOP) 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 elimination 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 2019 funding.

The proposed FY 2019 PMI budget for Zambia is $28 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. The most recent susceptibility tests conducted in 2017 and 2018 showed that both *Anopheles gambiae s.l* and *An. funestus* are still mostly resistant to pyrethroids throughout Zambia. With FY 2019 funding, PMI will support routine IRS entomologic monitoring in seven sites in five provinces in Zambia (see the Pre-Elimination Section for more information). Support will also be provided for training of entomology personnel in order to build entomologic capacity at the National Malaria Elimination Center (NMEC).

Insecticide-treated nets
In 2017-2018, the NMEP, with support from partners including PMI, the Global Fund and the Against Malaria Foundation (AMF), conducted a country-wide mass ITN distribution campaign. Over 9 million ITNs were distributed during the campaign, resulting in ITN household ownership of more than 70 percent in all provinces other than Copperbelt. In 2019, PMI will support the introduction of a community-based distribution channel. In addition, antenatal care (ANC)/Expanded Program on Immunizations (EPI) distribution, which was suspended during the mass campaign due to a shortage of ITNs, has resumed nationwide. With FY 2019 funding, PMI will procure and distribute ITNs to support the mass ITN campaign in Luapula province in 2020. Additionally, PMI will procure and distribute ITNs through ANC/EPI and community channels, support the final year of durability monitoring for ITNs distributed during the 2018 mass campaign, and continue to support related social and behavior change communication (SBCC) activities at both local and national level.

Indoor residual spraying
The Government of the Republic of Zambia (GRZ) resumed IRS in 2003 and has been increasing resource allocation to malaria control in general, and IRS in particular, in recent years. PMI has supported IRS since 2009 and was preceded by three years of USAID-funded IRS. By 2015, PMI was supporting IRS operations in 25 PMI focus districts. Since 2016, Zambia has benefitted from the UNITAID-funded NgenIRS project and subsidy, and in 2017, the PMI-supported campaign targeted 648,800 structures in the same four high burden provinces and aimed to protect a population of 2,626,718. In 2018, PMI plans to support IRS with pirimiphos-methyl in 630,000 structures in three provinces, reducing the number of provinces but aiming for higher coverage of populations in those provinces in line with NMEC expectations for IRS going forward. The areas no longer covered by PMI are to be taken over by the GRZ program, which intends to spray using clothianidin in the Eastern Province, following the NMEP's plans to rotate away from long-used products (notably pirimiphos-methyl). The NMEP is calling for IRS implementation in a mosaic approach at the provincial level, beginning in 2018 as much as possible and ramping up in 2019 and 2020. With FY 2019 funds, PMI will support the spraying of around 500,000 structures in the 2020 season.

Malaria in pregnancy

PMI supports three main strategies to address malaria in pregnancy (MIP): IPTp, ITNs, and case management. The 79 percent 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 sulfadoxine-pyrimethamine (SP), which is procured by GRZ. PMI continues to invest in the Essential Medicines Logistics Improvement Program (EMLIP) to improve distribution of malaria commodities, including SP. PMI has supported the training of provincial- and district-level clinical care teams in providing supervision for IPTp, training of healthcare workers in IPTp, and SBCC activities to encourage early and frequent ANC attendance to receive IPTp. The Ministry of Health (MoH) recently announced adoption of the 2016 WHO ANC guidelines, and is currently reviewing and revising national guidelines to bring them into alignment. With FY 2019 funding, PMI will support supervision and training of health workers in IPTp based on the revised ANC guidelines in four high malaria burden provinces and communication-related activities to promote healthy and effective malaria control behaviors during pregnancy. Support for routine distribution of ITNs through ANC/EPI will also continue.

Case management

In 2017, PMI procured more than 3 million rapid diagnostic tests (RDTs) and reagents and supplies for microscopy, as well as 9.7 million courses of ACTs, to fill national needs along with Global Fund and GRZ. PMI will procure 2 million RDTs and 2 million ACTs with FY 2018 funding and over 3 million RDTs and ACTs, respectively, with FY 2019 funds. PMI has continuously supported the training of clinical and laboratory personnel in diagnosis and treatment and community health workers in integrated community case management (iCCM), as well as training of national, provincial, and district level staff in providing outreach training and supportive supervision (OTSS) for quality assurance of malaria diagnostics and case management. With FY 2019 funding, PMI will continue to strengthen diagnosis, treatment, and iCCM through support for training and supervision in the four PMI focus provinces, as well as in additional provinces not supported with other resources.

Pharmaceutical management

PMI and other partners continued to provide support to the MoH, Medical Stores Limited (MSL), and other stakeholders to improve the collection, management, and use of logistics data through 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. In 2017, the MoH, with support from partners, rolled out facility and central versions of the eLMIS to reach 450 health facilities and all District Health Offices (DHOs). FY 2019 funding will support the roll out of the eLMIS facility version to an additional 200 health facilities. This will bring the total number of trained health facilities to 650. PMI will also continue to support monitoring and strengthening of GRZ's commodity supply and logistics systems at the central, provincial, district, and health center level.

Social and behavior change communication

The NMEC launched the National Communication Strategy for Malaria Elimination on World Malaria Day in April 2018. This strategy is in support and alignment with the National Malaria Elimination Strategic Plan 2017–2021 (NMESP) and the National Health Strategic Plan. In the National Communication Strategy for Malaria Elimination, target audiences are identified and

measurable communication objectives are clearly stipulated. All institutions working on malaria, including NGOs, PMI, and public and private organizations, are required to follow the strategy. In 2017-2018, PMI worked with the NMEC to develop and use SBCC materials to support IRS, a universal ITN campaign, and uptake of MIP and case management interventions. In support of the NMESP, PMI also worked with the NMEC to design a formative research study aimed at addressing behavioral issues related to the country's changing malaria epidemiology and lower transmission. With FY 2019 funds, PMI will continue to support SBCC implementation for malaria at both the health facility and community levels in four target provinces (Luapula, Northern, Eastern, and Muchinga Provinces) in order to increase uptake across interventions and drawing from the findings of the formative research study where appropriate. At the national level, PMI will support the NMEC on malaria focused SBCC strategies and materials in collaboration with other partners.

Surveillance, monitoring, and evaluation

The recently launched NMESP 2017–2021 strongly emphasizes the importance of a robust surveillance, monitoring, and evaluation (SM&E) system to ensure timely availability of quality, consistent, and relevant data on malaria control performance. A revised National SM&E Plan has been developed to complement the NMESP 2017–2021 and address the challenges in Zambia as it moves toward eliminating malaria. In 2017-2018, PMI is supporting the MoH to conduct data quality audits (DQAs) in health facilities and community health worker (CHW) programs, covering both the health management information system (HMIS) and malaria rapid reporting system (MRRS), with the aim of enhancing data quality in order to improve timeliness, accuracy, and completeness of malaria data. In 2017, PMI also supported the training of health facility staff in HMIS and District Health Information System 2 (DHIS2) training for Provincial Health Office (PHO) and DHO staff in the four PMI focus provinces in order to improve data reporting and use. At the national level, PMI is providing technical assistance to clean and enhance standardization of national, facility, and community-level data in the HMIS, and to coordinate with partners through the SM&E Technical Working Group. PMI was also a major partner in supporting the 2018 Zambia National Malaria Indicator Survey (MIS). With FY 2019 funds, PMI support will continue to strengthen routine malaria data collection at all levels through the HMIS, carry out DQAs as a proven tool for improving system performance, strengthen community-based surveillance activities, and provide resources for coordination and technical support to the NMEP for national level activities. Finally, partial support for the 2021 MIS will be included in the FY 2019 MOP.

Operational research

In 2017, PMI supported the NMEP to develop a list of priority malaria research topics by thematic area for the 2017-2021 timeframe. The NMEP is now considering how to prioritize and initiate activities on topics that are not currently being addressed.

Phase I of the IRS targeting study was completed and identified the targeting methods to be tested in Phase II. Phase II, titled "Comparison of different IRS strategies to maximize finite resources in Zambia: A comparison-control trial, Eastern Province, Zambia," is currently testing the effect of different district-level IRS targeting strategies on malaria transmission by comparing three IRS scenarios in groups of two districts for each scenario: (1) geographically concentrated spraying is applied to one district and the other receives no spray, (2) both districts receive HMIS data-targeted IRS, and (3) both districts receive ecologically targeted IRS. Preliminary results are expected in July 2018, with final results expected in September 2018.

Other health systems strengthening
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 strengthening, and health information systems strengthening. In addition, PMI has been providing technical assistance and capacity building at the NMEC, including support for training and professional development needs and to strengthen management capacity of provincial and district MoH personnel in otfrt to improve their oversight and coordination of malaria prevention and control interventions. PMI has also provided support for the Field Epidemiology Training Program (FETP) and the Peace Corps Stomp Out Malaria Initiative. With FY 2019 funds, PMI will focus on capacity strengthening and malaria health system improvements at the provincial, district, facility, and community levels, including data driven decision-making at the national and sub-national level. PMI will continue to provide support to strengthen NMEP staff capacity through professional development activities. Support will also be provided for one Zambian national to participate in the FETP program at either the intermediate or advanced level.

Pre-elimination
Beginning in FY 2017, PMI Zambia has been fortunate to receive an additional ~$5 million per year in funding marked for investments in pre-elimination districts. A set of reduced-burden districts on the plateau of Eastern Province (Katete, Sinda, and Chadiza, along with parts of neighboring Petauke and Chipata) were identified as potential pathfinders, who with enhanced malaria control investments might be able to achieve pre-elimination status in a relatively short period of time. Proposed activities in these districts will be refined based on progress made in Years 1 and 2 (2018-2019), but currently include an additional entomological monitoring site, ITN distribution in three districts as part of the 2020 mass campaign, IRS in three districts, deployment of iCCM including malaria diagnosis and treatment for all ages, additional RDTs, ACTs, and supply chain strengthening to ensure good stock levels, community surveillance, and reporting in five districts, and additional support for SBCC with a focus on community-based interventions.

II. STRATEGY

1. Introduction

When it was launched in 2005, the goal of the U.S. President's Malaria Initiative (PMI) was to reduce malaria-related mortality by 50 percent 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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Elimination Strategic Plan (NMESP) 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 2019 funding.

2. Malaria situation in Zambia

General context

Zambia's population in 2018 is estimated at approximately 17.5 million people (Central Statistics Office), with a low population density (averaging less than 25 persons per square kilometer). The country has one of the highest levels of urbanization in Africa, with 40 percent of individuals residing in urban centers such as Lusaka and mining towns. The country is divided into 10 provinces and 109 districts, with frequent redistricting continuing to increase that number. In Zambia, the last 13 years of generally strong economic growth raised the average per capita income to over $1,700, making Zambia a lower-middle income nation. Relatively speaking, Zambia is an example of peace and security in sub-Saharan Africa, following 26 years of multi-party democracy, two peaceful transitions between ruling political parties, and avoidance of warfare. The literacy rate of 15-24 year olds stands at 81 percent. There are positive trends in child health indicators. According to the Zambia Demographic and Health Survey (DHS) of 2007 and 2014, the infant mortality rate decreased from 70 to 45 per 1000 live births and the under-5 mortality rate decreased from 119 to 75 per 1000 live births, respectively.

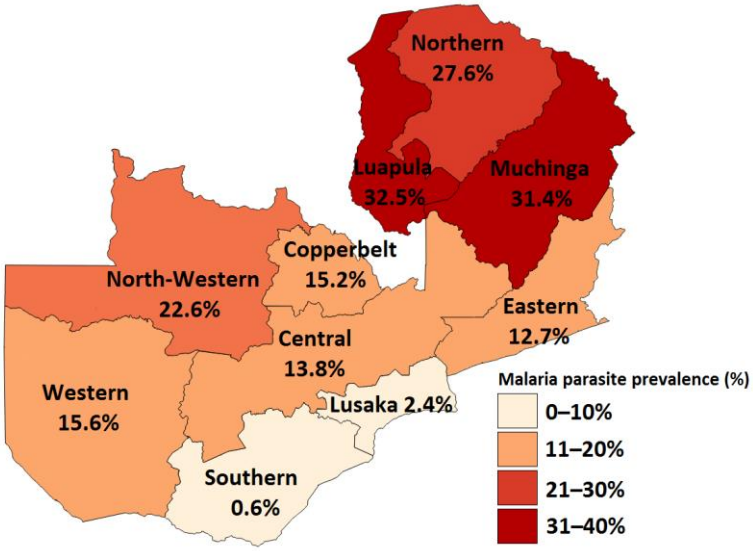
However, much remains to be done to advance equitable development in Zambia. Three out of four Zambians still live in extreme poverty and the country faces major challenges, including high unemployment, low agricultural productivity, inadequate transportation and energy infrastructure, poor education outcomes, and a burgeoning youth population (46 percent of the population is under 15 years old). The country's persistently high neonatal mortality rate of 24 per 1000 live births is unsurprising when seen in the light of the current high maternal mortality rate of 398 per 100,000 live births. The 2014 Zambian DHS found that 40 percent of children under age five are chronically malnourished (stunted), while 6 percent are acutely malnourished (wasted) and 15 percent are underweight. HIV prevalence is high even by regional standards, but the rates have stabilized, dropping from 14.3 percent in 2007 to 11.6 percent among adults ages 15 to 49, with major contributions from the U.S. President's Emergency Plan for AIDS Relief and other partners. Zambia still faces a critical human resource shortage, with up to 40 percent of clinical positions vacant, although the situation has improved with recent Ministry of Health (MoH) investments. The ratio of clinical health workers to the general population is estimated to be approximately 1 per 10,000, far below the WHO recommended ratio of 23 per 10,000 population. There also continues to be an economic divide between urban and rural populations, with the proportion of population living in extreme poverty at 13.1 percent in urban are and 57.7 percent in rural areas (MDG Progress Report, Zambia, 2013).

Against this mixed socio-economic picture, malaria control faces the challenge of high transmission potential across much of the landscape. Malaria transmission in Zambia occurs year round with peak transmission during the rainy season (November–April). Malaria remains endemic in all ten provinces, with 100 percent of the population considered to be at risk. However, marked heterogeneity in malaria risk is observed and associated with notable gradients along the urban-rural divide (3-4 times greater risk in rural communities); the wealth divide (5-10 times greater risk in the poorest wealth quintile); and the environmental contrast between the poorly drained, humid Congo Basin in the north versus the higher, drier plateau of the central and southern areas (Table A). Combined, these trends are reflected in the high burden of rural, impoverished provinces along the northern borders, namely North-Western, Northern, Luapula, and Muchinga (prevalence 23-32 percent in the 2015 MIS), contrasted with much lower burden in Lusaka (2.4 percent) and Southern Province (0.6 percent) (Figure 1).

Broadly similar geographic patterns are observed when routine health management information system (HMIS) data is mapped to depict case incidence at health facility catchment areas (HFCAs). As shown in Figure 3, the finer granularity of HFCA malaria incidence mapping in the period 2014-2017 also captures the higher burden of rural districts within the northern portions of Western and Central Province, the rural districts of the Copperbelt, and the low-lying areas of Eastern Province. A noteworthy exception to these geospatial trends is the low-lying rural districts along the humid northern shores of Lake Kariba in Southern Province, which would be expected to have persistent high burden, but since 2014 have witnessed remarkable reductions in response to intensive focal malaria elimination interventions supported by the Government of the Republic of Zambia (GRZ), the Global Fund, and PATH's Malaria Control and Elimination Partnership in Africa (MACEPA).

Although all four species of *Plasmodium* that infect humans are present, *Plasmodium falciparum* accounts for 98 percent of all infections. *Anopheles (An.) gambiae s.l* and *An. funestus* are the major vectors throughout the country, with *An. arabiensis* also important in Southern Province. Of note, *An. funestus* is noted to have essentially disappeared in parts of Southern Province as a result of intensified vector control efforts and recurrent drought.

Figure 1: Map Showing Percentage of Malaria Parasite Prevalence (Microscopy) Among Children Under-5 Years of Age by Province (2015 MIS)



Trends in malaria prevalence

Malaria parasite prevalence by smear microscopy from national MIS declined from 22 percent in 2006 to 15 percent in 2012, but increased slightly during the period of 2012-2015 (15 percent to 19 percent) (Table A and Figure 2). Severe anemia for children under-5 years of age (measured at <8 g/dL) also declined from 14 percent in 2006 to 7 percent in 2012 and 6.4 percent in 2015. This was most notable in provinces that reported higher ITN coverage compared to 2010, as well as in the higher prevalence area of Luapula Province. Results from the 2018 MIS for parasitemia and anemia at national and provincial levels were not available at the time of FY 2019 MOP preparation.

It is important to note that national-level numbers are not representative of all trends across the country at provincial and district level. For instance, between 2012 and 2015 the largest relative decline in parasite prevalence by microscopy was observed in Eastern Province (25 percent to13 percent). Declines in microscopy prevalence in Southern Province (8 percent to 0.6 percent) were also encouraging. However, between 2012 and 2015 increases in microscopy prevalence were observed in seven provinces (Central, Copperbelt, Lusaka, Muchinga, Northern, North-Western, and Western) while Luapula Province remained relatively unchanged (32 percent). Updated data from the 2018 MIS is expected to become available by the end of calendar year 2018 (Figure 2).

Trends in malaria case data also reveal a mixed picture, with progress in certain indicators and geographical areas. That data is reviewed in Section 8.

Figure 2: Recent Trends in Microscopic Malaria Prevalence (%) Among Children Under-5 by Province (MIS 2010, 2012, and 2015)

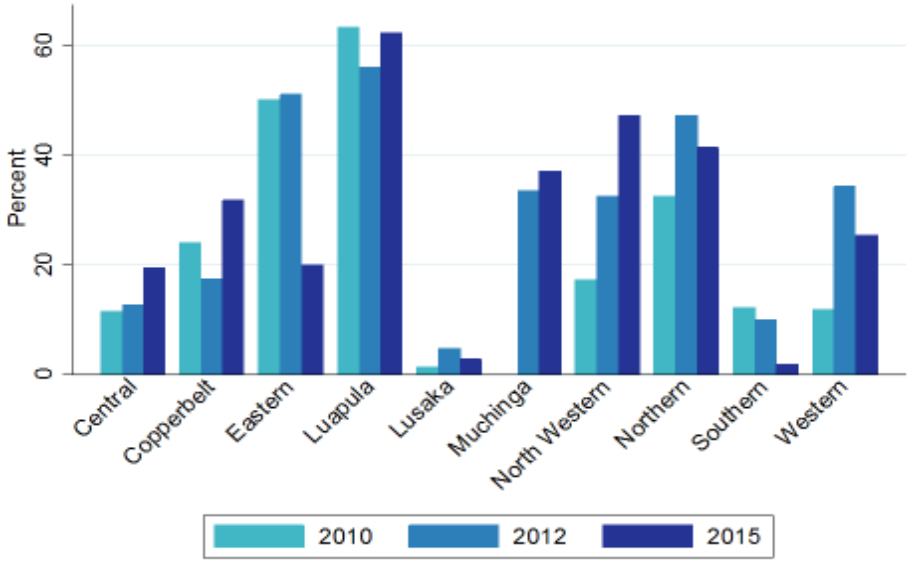


Table A: Malaria Parasite Prevalence in Children Under-5 Years of Age by Background According to MIS, 2006-2015

Background Characteristic	Percentage with Malaria Parasites by Microscopy		Percentage with Malaria Parasites by Microscopy (or RDT)*		
	2006	2008	2010	2012	2015
***Age** (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)**

* RDT results in parenthesis.

3. Country health system delivery structure and Ministry of Health 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 (PHOs) are responsible for coordinating health service delivery in their respective provinces.

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

- *Community Level*: At the community level, Neighborhood Health Committees been established to facilitate linkages between communities and the health system. The committees were established under past administrations, but have functioned inconsistently in recent years and are moribund in many localities.

Government-run health facilities, which provide the majority of healthcare in Zambia, offer a basic healthcare package of high-impact interventions. Services included in the basic healthcare 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.

In 2017, the National Health Insurance Act was enacted by the Parliament of Zambia. The act is intended to provide financing for a national health system that will provide universal access to healthcare services in Zambia. Once implemented, the act will establish a National Health Insurance Scheme and provide for its systems, procedures, and operations. The act is in early stages of implementation and PMI will continue to monitor developments, including the extent to which act affects Zambia's approach to malaria control and elimination, as they become available

The following are the levels of healthcare facilities offered throughout the country; malaria control interventions are delivered in all of them.

- Community
- Health posts (district level)
- Health centers (district level)
- Level one hospitals (district level), level two hospitals (provincial level), and level three hospitals (central level)

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. As mentioned, Zambia faces a serious health system human resource shortage, with up to 40 percent of clinical positions vacant. The most recent country-wide health facility listing exercise in

Zambia was conducted in 2012. At that time, a total of 1,956 health facilities were enumerated. However, since then, additional facilities have been constructed, including 650 additional health posts and second and third level hospitals. Additionally, a number of second level health facilities have been upgraded to third level. A more recent country-wide health facility listing exercise has yet to be conducted. Table B shows the 2012 breakdown by type of facility and provider.

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 one hospitals, health centers, and in the community are implemented through DHOs. The National Malaria Elimination Center (NMEC; previously National Malaria Control Center) provides technical but not operational assistance at these levels.

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 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 deployed at health posts which are the lowest level of formal health facilities, intended to cover 500–1,000 households. CHAs are expected to spend 80 percent of their time in the community carrying out disease prevention and health promotion activities and 20 percent at the health post carrying out curative services. For malaria, CHAs are expected to diagnose malaria using rapid diagnostic tests (RDTs), treat malaria with appropriate medication, and support malaria prevention activities, including social and behavioral change communication (SBCC) and distribution of ITNs. Furthermore, CHAs are expected to supervise the community health workers (CHWs) that work in their catchment areas. After receiving training supported by the U.K. Department for International Development (DFID), more than 2000 CHAs were included on the GRZ payroll and deployed in health posts across the country by early 2018. However, onboarding CHAs has been a slow process, with many trained but not yet on the MoH payroll. For example, of 738 CHA graduates in 2017, none were employed as of March 2018. The GRZ aims to train and deploy 5,000 CHAs by December 2020. Non-PMI USAID health programs provide some support for CHA salaries during the two-year gap between training and placement on the MoH payroll.

Health centers oversee health posts that are within their catchment areas. They 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 approximately 99 percent of urban households are within five kilometers of a health facility, compared to 50 percent of rural households. 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 healthcare in Zambia. CHAZ is an interdenominational umbrella organization responsible for coordinating church health services in Zambia. It 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 GRZ

health workers. Altogether, these institutions are responsible for more than 50 percent of formal health services in rural areas of Zambia and about 30 percent of healthcare in the country as a whole.

There are more than 250 for-profit private health facilities (Table B) in Zambia, most of which are clinics attending to outpatients only and are located in urban districts. In addition, private mining companies provide preventive and curative medical services for workers and their families, as well as surrounding communities in some cases. Historically, several of the larger mining companies, such as Konkola and Mopani Copper Mines, carried out IRS within and around their compounds. However, following nationalization, then re-privatization, the role of mines in IRS has greatly diminished.

According to the National Human Resources for Health Planning and Development Strategy Framework (2017), Zambia has 1,814 clinical officers, 1,514 medical doctors, 3,141 midwives, 11,666 nurses, 912 laboratory technicians, and 1,159 pharmacists. Training for clinicians includes information on national malaria diagnosis and treatment guidelines, 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. In four PMI focus provinces, PMI has supported provinces, districts, and the NMEP to determine the CHW need based on national guidelines (1 CHW per 500 persons), as well as gaps by district. Partners, including PMI, are now using this information to plan CHW training in order to meet identified gaps.

Table B: Summary of Health Facilities in Zambia by Level and Type, 2012

Health Facilities By Level	**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 Type		
MoH	1,590	81%
Mission	116	6%
Private	250	13%
Total	**1,956**	**100%**

Source: Ministry of Health, 2012

4. National malaria control strategy

The 2011–2016 National Malaria Strategic Plan underwent an end-term review in 2016. The vision of the 2011–2016 National Malaria Strategic Plan 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 the NMESP 2017–2021, a highly ambitious strategy to move from accelerated burden reduction to malaria elimination in Zambia. Of note, PMI Zambia's approach is closely aligned with the NMESP, but does differ in some details, notably in PMI's more conservative approach to mass drug administration, especially in higher-burden settings. 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 malaria-free HFCAs from 0.5 percent in 2015 to 100 percent by 2021.
2. Reduce malaria deaths from 15.2 deaths per 100,000 in 2015 to less than 5 deaths per100,000 population by 2021.
3. Achieve 100 percent 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 percent in 2015 to 95 percent by 2021.
    - Strengthen capacity to plan and implement budgets, execute payments on schedule, and 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 percent 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 NMESP calls for:

- Strengthening of national, provincial, and district-level capacity to plan, manage, and implement malaria activities; address human resource needs;
- Ensuring that there is an established planning and forecasting framework for projecting funding needs and tracking health expenditures;
- Developing capacity at all levels of the health system to manage the storage and distribution of malaria commodities; and
- Reinforcing coordination among partners.

The elimination strategy aims to target different areas and implement activities in a step-by-step approach based on transmission levels. It uses five different levels based upon the malaria burden levels within an HFCA. In higher transmission settings (levels two through four), the strategy is to

scale-up coverage of existing interventions and strengthen information to drive down transmission. In low transmission settings (levels 0 and 1), there is a focus on surveillance, response, and other interventions to interrupt transmission and eventually eliminate malaria. The strategic plan recognizes that only when all of these important interventions are in place can elimination be possible.

While setting forth ambitious goals, the NMESP recognizes that "the goal of elimination is still distant in some areas, due to the relatively high disease burden, low coverage of interventions, insufficient development of the local health system, and technical and operational constraints" and delineates "tactical approaches" for high burden settings, versus low burden settings

For *high-transmission settings,* the tactical approach is focused on the following:

- Achieve effective coverage with malaria curative and preventive services;
- Improve the quality and timeliness of information systems for decision-making to further reduce malaria transmission; and
- Reduce the malaria burden to a sufficiently low level to enable the implementation of parasite-clearance strategies.

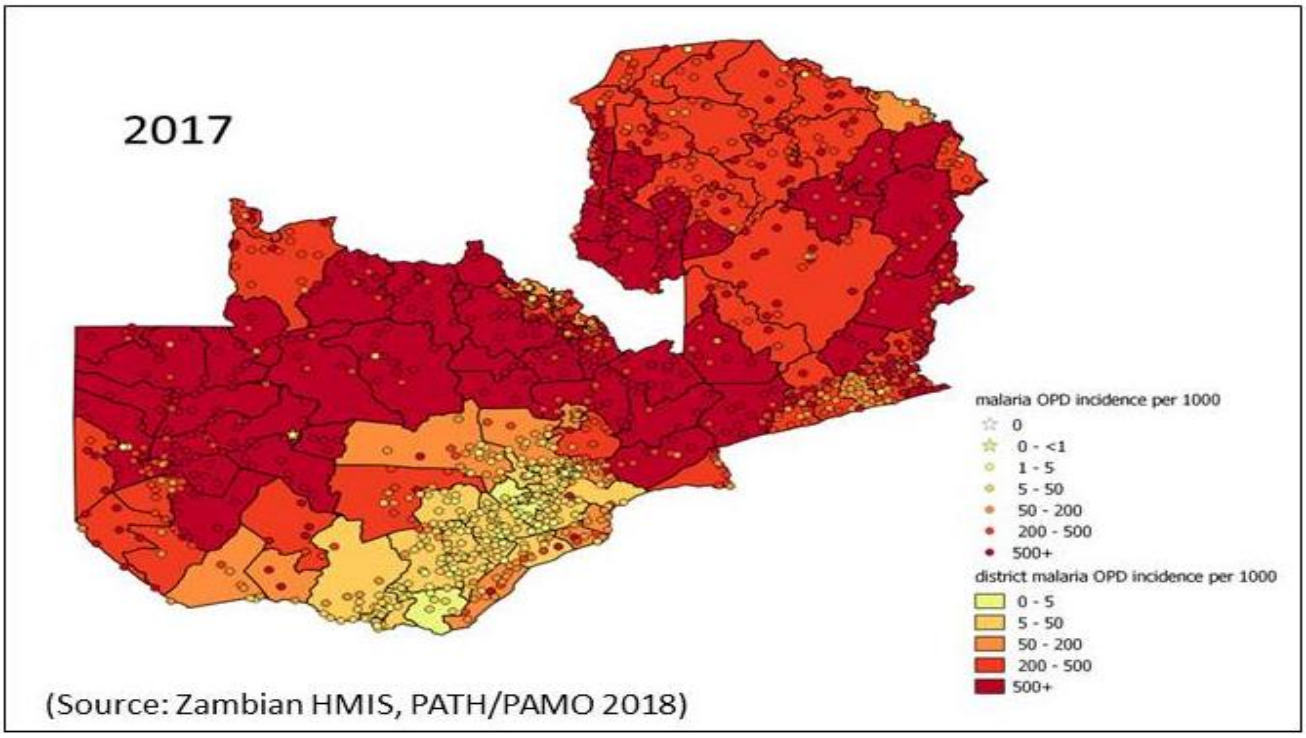
On the other hand, in *low-transmission settings* or "where recent progress has markedly reduced transmission," the NMESP states that "priority should be given to elimination" and recommended actions include:

- "Interrupting malaria transmission;
- Reporting and responding to all confirmed cases, and preventing continued transmission;
- Determining the underlying causes of residual transmission; and
- Maintaining and documenting malaria elimination."

The GRZ's ambitious goal of eliminating malaria nationwide is largely inspired by sustained success in the Southern Province, as well as the past gains, albeit transient, in the Copperbelt Province, Eastern Province, and elsewhere. Prevalence in Southern Province was reduced from 13.6 percent in 2006 to 0.6 percent in 2015. Most districts there now count monthly malaria cases in the single digits. Even though portions of the province may be considered unusually conducive to reductions in malaria transmission given their drier climate and relative prosperity, the dramatic drops in prevalence are nonetheless a remarkable achievement given the historically high burden in areas along the Zambezi River (including Lake Kariba) and the Kafue River.

Southern Province's success has been attributed to the achievement of sustained high coverage of a package of interventions, namely universal ITNs, targeted IRS, community case management, SBCC with good community engagement, and intensive surveillance by 2012-2014. A series of Global Fund grants to the MoH and CHAZ provided resources to help with the scale-up. Malaria control efforts in the Southern Province have benefitted from significant technical assistance from the Macha Institute (affiliated with Johns Hopkins University and the National Institutes of Health) and the Gates Foundation's Malaria Control and Elimination Partnership in Africa (MACEPA) Project (implemented by PATH). The efforts also had technical assistance from international centers of excellence in malaria mapping and modelling, such as the Imperial College (United Kingdom) and the Institute for Disease Modelling (United States).

Table C: Zambia's Stratified Approach to Applying Malaria Control Interventions



LEVEL	MALARIA INDICATOR	INTERVENTION PACKAGE/ACTIVITIES	ACCELERATOR
LEVEL 0	0 cases, no local transmission	No malaria, maintenance of malaria-free zone • High quality surveillance and vigilance • Vector control and case management • Epidemic Preparedness package • Case investigation capacity maintained • Chemoprophylaxis	
LEVEL 1	1–49 cases/1,000 population/yr; Typical range <1% parasite prevalence	Very-Low malaria transmission • High quality surveillance • Vector control (possibly enhanced) • Community and facility-based case management • Case and foci investigation	• Mass drug administration
LEVEL 2	50–199 cases/1,000 population/yr; Range 0.5%–<5% parasite prevalence	Low malaria transmission • Build high quality surveillance • Vector control (possibly enhanced) • Community and facility-based case management • Establish case and foci investigation capacity	• Mass drug administration
LEVEL 3	200–499 cases/1,000 population/yr; Range 5%–<15% parasite prevalence	Moderate malaria transmission • Improve quality surveillance • Vector control (possibly enhanced) • Facility-based case management; build community case management and outreach • Establish case and foci investigation capacity	• Mass drug administration (may be considered for specific areas with case investigation capacity) • Enhanced vector control if relevant
LEVEL 4	>500 cases/1,000 population/yr; Range >15% parasite prevalence	High malaria transmission • Build quality surveillance • Vector control to high coverage (100% coverage of IRS or sustained high coverage of LLINs) • Facility-based case management; begin to build community case management and outreach • Prepare for case and foci investigation capacity	• Prepare for mass drug administration • Enhanced vector control if relevant

The NMEP and its partners are interested in adapting and scaling up the Southern Province package to benefit other provinces and to provide an expanding buffer, which would protect the gains in Southern Province. In the adjacent areas of Central and Western Province, the GRZ with funding from the Isdell:Flowers Initative, and limited technical assistance from MACEPA, has been scaling up community-based surveillance with monthly reporting, as well as reactive case follow-up (termed "Step D") and facility-based weekly rapid reporting of malaria indicators. Southern and adjacent areas of Western Province have seen pioneering efforts in cross-border malaria control activities under the auspices of the Southern African Development Community's Malaria Elimination Eight (E8) Initiative, for which Zambia is listed as a second-line elimination country (elimination by 2030).

Meanwhile the higher, drier portions of Eastern Province, where PMI has long been active, have been identified as a promising focus for taking low burden districts (levels two and three) to pre-elimination status within a period of 1-3 years. PMI Zambia has developed an integrated strategy for new, earmarked investments in this locality. This is presented in the Pre-Elimination section at the end of this FY 2019 MOP (see Figure 15 and following pages).

As a major partner of the Zambian NMEP, PMI aims to help the country accelerate toward its goal of malaria elimination as aggressively as resources, epidemiologic realities, and local constraints allow. PMI will continue to prioritize reducing disease burden in high burden areas in Zambia, while beginning to invest a small portion of its budget (approximately 16 percent in FY 2019) in pre-elimination settings. PMI's approach is consistent with the NMESP and the WHO Global Technical Strategy's emphasis on phased planning and implementation along a continuum. All are in agreement that planners at all levels (national, districts, and HFCAs) should prioritize efforts which are most effective for the local epidemiologic stratum, while also preparing for the next phase.

5. Updates in the strategy section

- As mentioned earlier, the NMEP officially launched its NMESP 2017–2021 in 2017 and is currently adopting a new organizational structure to support execution of the plan.

- The NMEP developed a series of strategies in support of the NMESP. These include the National Communication Strategy for Malaria Elimination (January 2018), Guidelines for the Diagnosis and Treatment of Malaria in Zambia (2017), Guidelines on the Distribution and Utilization of Long-Lasting ITNs for Malaria Prevention (2017), and the National Malaria Elimination Business Plan 2018-2010 (April 2018).

- In 2017, with PMI support, the NMEP convened a forum to develop a priority listing of malaria research questions by thematic area for the years 2017-2021. This activity served as the basis for identifying research priorities in Zambia that are in support of the NMESP. The NMEP and its partners have finalized this priority list and will use it as the basis to design research that will inform strategies focused on malaria elimination. Thematic areas for research include vector control, case management, malaria in pregnancy (MIP), health systems/program management, SBCC, monitoring and evaluation, elimination, and epidemic response.

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 vector control, surveillance, monitoring, and evaluation (SM&E), and case management. PMI will also engage in the Monitoring and Evaluation Technical Working Group at the MoH and collaborate on the CHA programming, which ensures quality community-based healthcare for malaria. PMI will continue to work with the MoH to contribute to the National Health Strategic Plan 2017–2021(NHSP), as well as the Community Health Strategic Plan and the National Development Plan. With PMI-support, the NMEP developed and rolled out a workplan harmonization tool, which aids planners at all levels (from national to health facility and community) in developing costed, time-linked plans for malaria control activities. Its launch in Ndola in February 2018 was followed by a cascade of provincial and district planning exercises. The tool shows promise for improving coordination and integration nationwide.

The NHSP 2017–2021 forms an important component of the National Development Plan. The areas of focus include: a renewed emphasis on primary healthcare and universal healthcare coverage; improved planning and monitoring of health investments at the district level through the Medium Term Strategic Framework, which ensures to the extent 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 MoH, as well as across ministries.

The Government of Zambia (GRZ) has historically invested in malaria control and elimination efforts. Table D below illustrates the commitment by the government to support malaria activities and how it compares to the total health budget for the country.

Table D: Comparison of GRZ Investment in Health Sector and Malaria

Government Funding	2015	2016	2017	Source of Data
Total Health Budget *(% of National Budget)*	$290,315,789 (9%)	$477,894,737 (8%)	$603,473,684 (9%)	Ministry of Finance
Government Funding for Malaria	$24,800,000	$25,500,000	$28,000,000	Ministry of Health

Zambia's periodic mass ITN campaigns serve as an example of the close coordination that exists among partners in the country. In 2017-2018, a universal campaign was conducted that distributed over 10 million ITNs nationwide. The campaign was a collaborative effort between the NMEP, PMI, the Global Fund, the Against Malaria Foundation (AMF), MACEPA, and other partners. PMI contributed more than 1 million ITNs for the campaign, concentrating on Luapula. AMF procured the nets for Eastern, Central, Copperbelt, and North-Western, while Global Fund, CHAZ, and other partners supported the other provinces. In calendar year 2020, another ITN campaign will be conducted to replenish ITNs in households. The campaign will be undertaken with NMEP, PMI, the Global Fund, and AMF contributing to the effort.

As illustrated by the ITN campaign example, Zambia's malaria partnership tends to organize itself along geographic lines. When it comes to technical assistance and training in case management and SM&E, PMI has historically concentrated its support in Luapula, Northern, Muchinga, and Eastern; The Bill and Melinda Gates Foundation/MACEPA have focused on Southern, and more recently, on Western Province; CHAZ, with its own and Global Fund resources, has tended to focus on Eastern, Southern, and North-Western; Isdell:Flowers on Western Province; and the E8 on the border communities of Western and Southern Province. The MoH with its own and Global Fund resources have provided support throughout the nation. Of note, Copperbelt and Central Province have in recent years lacked an external partner to complement MoH investments. IRS is another area where partners coordinate their contributions by dividing support along geographic lines (see Figure 12 in the IRS section).

The following table is an estimate of the total investment by GRZ and other malaria partners by intervention area during the years 2018-2020. It illustrates the significant investments made by various organizations within the malaria community, as well as the overarching commitment to reducing the burden and pushing towards elimination in Zambia. This commitment is embodied not only by funding but also by the collaboration that occurs as all partners are considered part of the NMEP and are asked to embed themselves within the NMEC. The NMEC also works with partners to plan activities that cut across organizations and impact interventions that will be conducted at the national level or in provinces and districts where there may be a combination of partners working together to implement malaria activities.

Table E: GRZ and Partner Commitments, 2018-2020

Module	Intervention	Commitment (US$)	
		GRZ	Partners
Vector Control	IRS	54,527,060	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 Systems Strengthening		1,430,878	18,313,516
		708,000	13,197,695
Program Management		9,012,438	904,087
Total		**102,383,381**	**110,978,308**

PMI, as part of a larger U.S. Government, works to ensure that every opportunity is maximized to reach women and children and collaborates across USAID Zambia's Health Office to integrate appropriate and evidence-based interventions that assist PMI in reaching its goals.

Zambia has a rich tradition of malaria research and continues to benefit from the ongoing work of several well-established research institutions with longstanding ties to the NMEP, the National Institutes of Health, and U.S. universities. Notable among these are the Tropical Disease Research Center facilities in Ndola (Copperbelt) and Nchelenge (Luapula), and the Macha Malaria Research Institute in Namwala District (Southern). PMI aims to leverage National Institutes of Health investments in malaria research through the International Centers of Excellence for Malaria Research in Macha and Nchelenge.

PMI also continues to collaborate and coordinate with other key stakeholders in Zambia. The PMI team meets regularly with representatives form WHO, UNDP, UNICEF, the Global Fund, AMF, MACEPA, the International Centers of Excellence for Malaria Research, the Clinton Health Access Intiative, Isdell:Flowers Initiative, the MoH, and other organizations.

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

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

1. Reduce malaria mortality by one-third from 2015 levels in PMI-supported countries, achieving a greater than 80 percent reduction from PMI's original 2000 baseline levels.
2. Reduce malaria morbidity in PMI-supported countries by 40 percent from 2015 levels.
3. Assist at least five PMI-supported countries to meet the WHO criteria for national or sub-national pre-elimination.[1]

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

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; and
5. Building capacity and health systems towards full country ownership.

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

- Proportion of households with at least one ITN
- Proportion of the population with access to an ITN
- 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 the population that slept under an ITN the previous night
- 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 antenatal care (ANC) visits during their last pregnancy
- Proportion of women who received three 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 F) showed encouraging malaria prevention and control coverage. Key findings were as follows:

- Seventy-seven percent of households have at least one ITN, the majority of which are long-lasting insecticidal nets.
- Twenty-nine percent of households reported that they had received IRS during the past 12 months.
- Eighty-one percent of households reported availability of at least one vector control method (IRS or ITN), with 25 percent having both.
- On the night before the survey, 59 percent of children under age five slept under an ITN. Fifty-five percent of all household members slept under an ITN.
- Ninety percent of women who had their last birth in the five years preceding the survey reported taking one dose of IPTp during their pregnancy; 61 percent of women reported taking three or more doses of IPTp.
- Ninety-two percent 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 94 percent in Eastern Province to 52 percent in Lusaka Province, and the percentage of households with at least one ITN per sleeping space varied from 84 percent in Eastern Province to 49 percent in Northern Province. Eastern Province's high ITN coverage likely contributed to a large drop in parasite prevalence. Lusaka Province's 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. In 2018, the NMEP and partners, including PMI, are conducting the sixth countrywide MIS, with results expected in the fourth quarter of calendar year 2018.

Table F: Evolution of Key Malaria Indicators in Zambia, 2008 to 2015

Indicator	2008, MIS[1]	2010, MIS[2]	2012, MIS[3]	2014, DHS[4]	2015, MIS[5]
% Households with at least one ITN	62%	64%	68%	73%	77%
% Population with access to an ITN	N/A	N/A	N/A	47%	N/A
% Children under five who slept under an ITN the previous night	41%	50%	57%	41%	59%
% Pregnant women who slept under an ITN the previous night	43%	46%	58%	41%	N/A*
% Households with at least one ITN per sleeping space	33	34	55	27	63.9
% Population that slept under an ITN the previous night	N/A	N/A	N/A	35%	N/A
% Children under five years old with fever in the last two weeks for whom advice or treatment was sought	64%	31%	25%	75%	N/A*
% Children under five with fever in the last two weeks who had a finger or heel stick	11%	17%	32%	49%	36%
% Children receiving an ACT among children under five years old with fever in the last two weeks who received any antimalarial drugs	30%	76%	85%	91%	92%
% Women who received two or more doses of IPTp during their last pregnancy in the last two years	66%	70%	72%	73%	79%
% Women who received three or more doses of IPTp during their last pregnancy in the last two years	N/A	N/A	52%	N/A	61%
Under-5 mortality rate per 1,000 live births	N/A	N/A	N/A	75	N/A
% children under five with parasitemia (by **microscopy,** if done)	10%	16%	15%	N/A	19%
% children under five with parasitemia (by **RDT**, if done)	N/A	27%	30%	N/A	31%

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

Table G shows HMIS reporting of cases (clinical and confirmed), inpatients, and deaths during the period of 2011–2017. Figure 3 illustrates a progressive improvement in the proportion of confirmed to clinical malaria cases. Figure 4 shows a decrease in the proportion of malaria cases in children under 5 years of age.

Table G: Evolution of Key Malaria Indicators Reported through Routine Surveillance Systems from Health Facilities in Zambia from 2011 to 2017

Period	2011	2012	2013	2014	2015	2016	2017
Cases *(clinical and confirmed)*							
HMIS Malaria Cases Total Clinical	2,286,765	2,146,346	2,666,405	2,052,763	1,019,267	1,215,888	625,075
HMIS Malaria Cases Total Confirmed	2,325,858	2,783,422	2,830,460	4,084,712	4,182,608	4,818,762	5,503,010
HMIS Malaria Cases Total	4,612,623	4,929,768	5,496,865	6,137,475	5,201,875	6,034,650	6,128,085
HMIS Malaria Confirmation Rate	50%	56%	52%	67%	80%	80%	90%
Inpatient Cases and Deaths							
HMIS Malaria Inpatient Cases Total	188,575	166,192	163,974	150,133	107,802	96,565	74,264
HMIS Malaria Deaths	4,573	3,954	3,485	3,162	2,337	1,783	1,410
Inpatient Case Fatality Rate	2%	2%	2%	2%	2%	2%	1.9%
Inpatient Cases and Deaths *(<5yr)*							
HMIS Malaria Inpatient Cases Total, <5yrs	103,975	87,819	85,185	68,228	52,477	44,977	35,187
HMIS Malaria Deaths, <5yrs	2,709	2,277	2,055	1,733	1,297	843	689

Figure 3: Reported Malaria Cases from Health Facilities (All Ages, Inpatient + Outpatient)

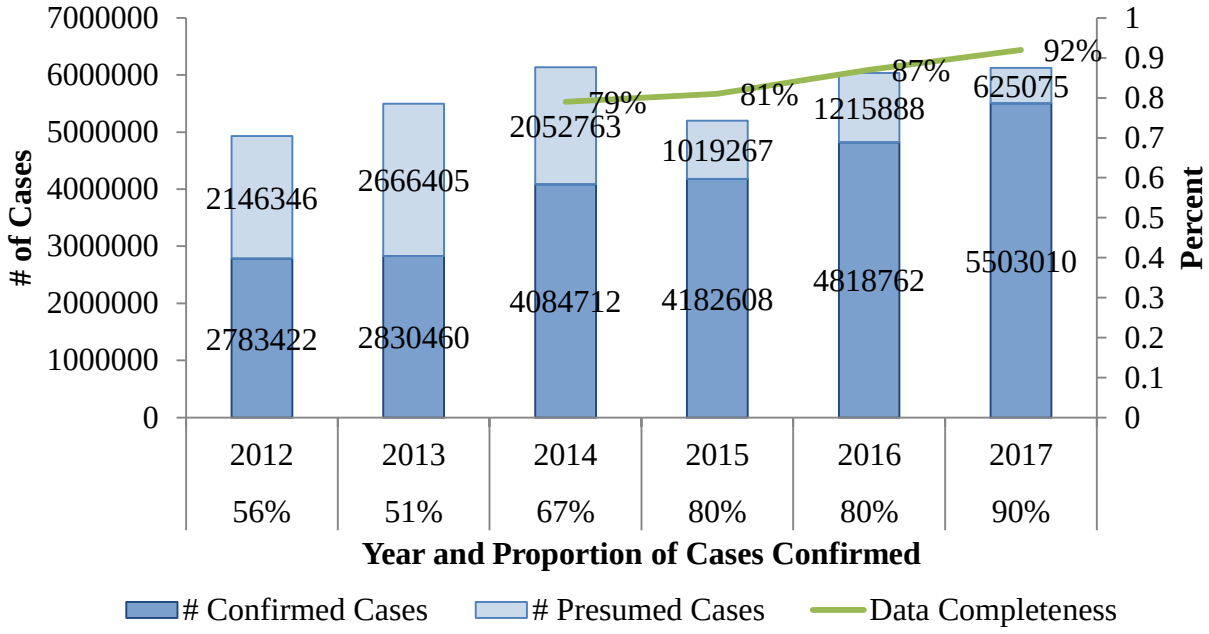
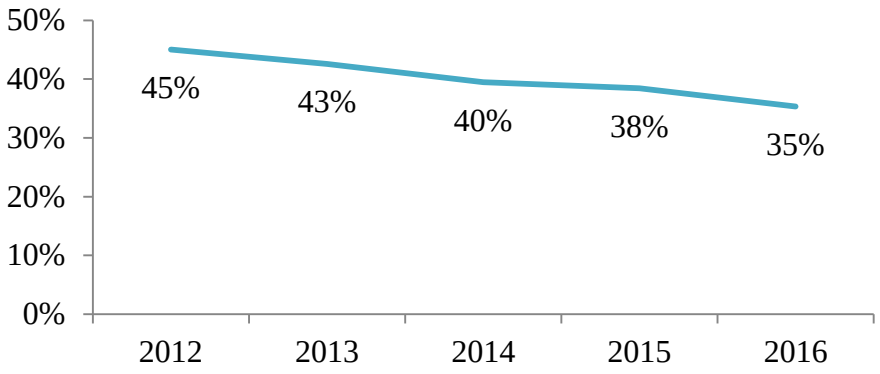


Figure 4: Percent of Malaria Cases <5 Years of Age



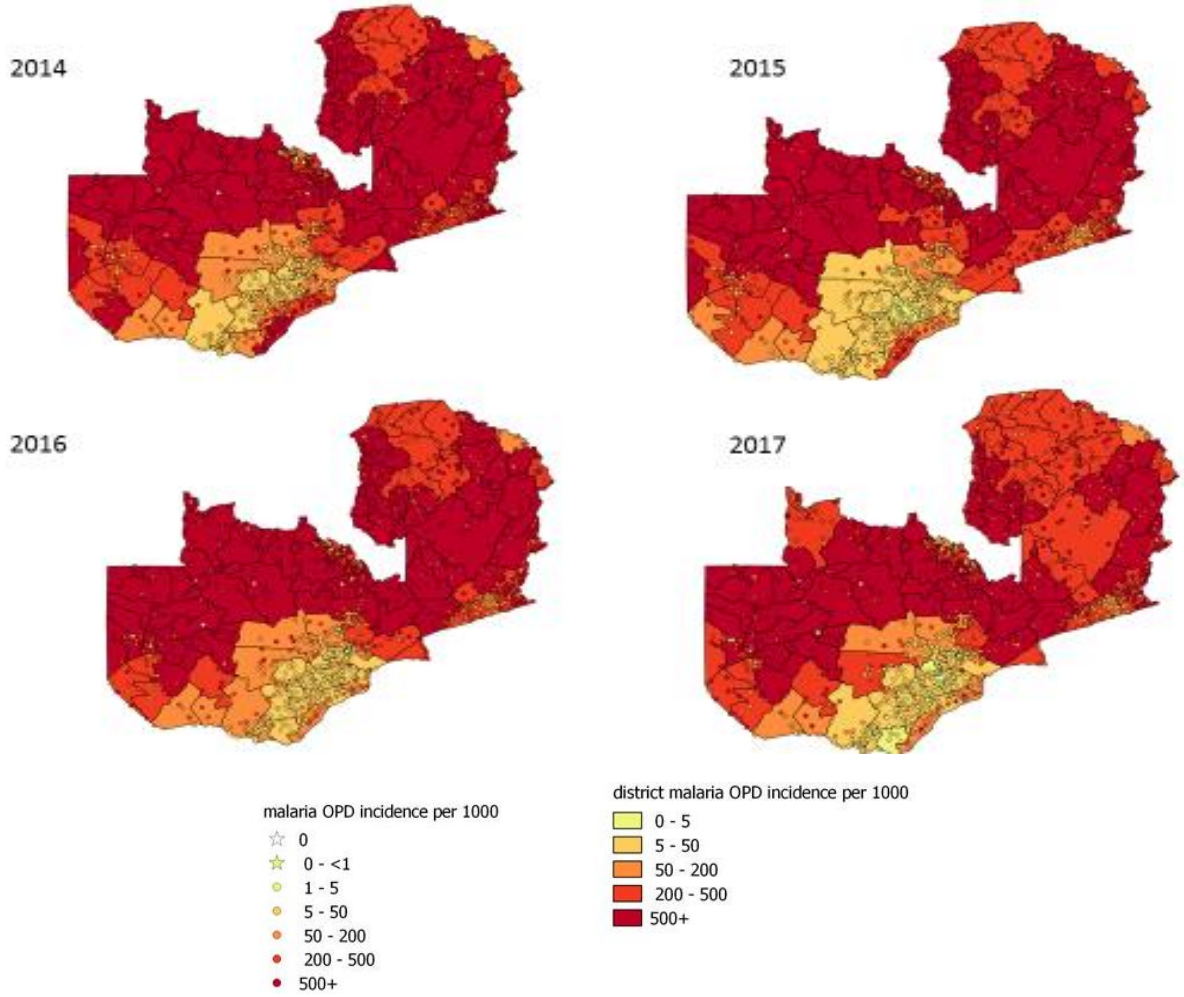
Trends in malaria outpatient cases

In spite of data quality challenges, such as incompleteness and inconsistent inclusion of cases treated by CHWs, Zambia's routine HMIS data is often analyzed for trends in malaria case burden over time. Overall, the number of malaria cases (clinical and confirmed) reported to the HMIS increased from 4,612,623 to 6,128,085 (2011-2017), with HMIS reporting rates reaching over 90 percent in 2017. Trends in total outpatient and inpatient cases from 2011 to 2017 are depicted in Table G.

A recent internal analysis of HMIS data on outpatient cases from PMI-focus provinces suggested recent progress. Although malaria incidence remains high (>150 per 1,000) in all districts, most

districts in PMI-focus provinces (24/36) showed a reduction in 2017 malaria incidence rates when compared to 2015 rates. Of note, this was in a setting where most districts in the country showed minimal or no improvement between 2015 and 2017. Additional analysis depicted geospatial trends in case incidence data at the HFCA level from 2014 to 2017 (Figure 5).

Figure 5: Map of 2014-2017 Malaria Outpatient Department Attendance Rates from HMIS Data by HFCA



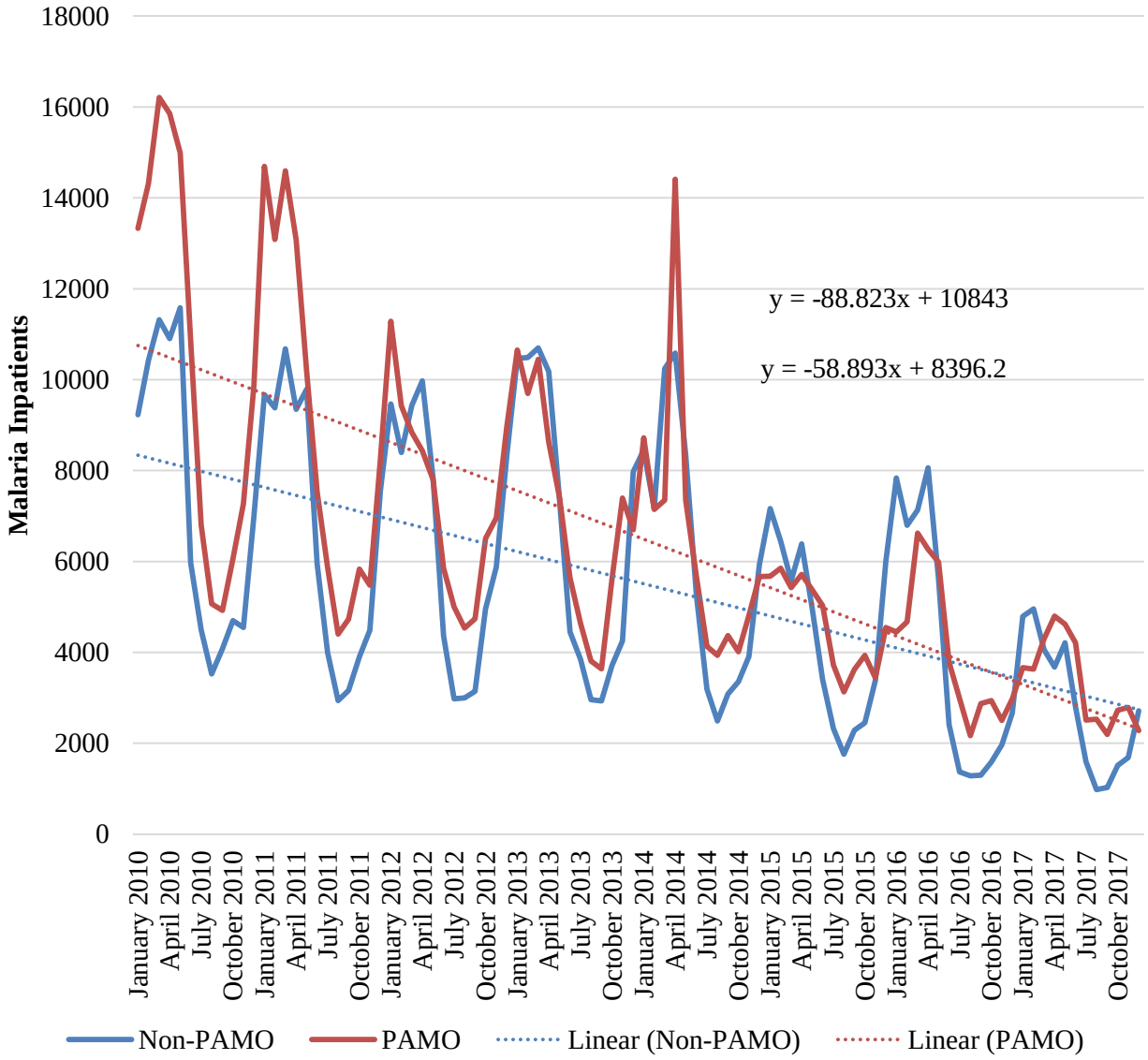
Source: NMEP/MACEPA

Trends in malaria inpatient cases and deaths

Trends in outpatient data can be difficult to interpret and may largely reflect expanded access, changes in case definition, and other confounders. However, trends in malaria inpatients (used as a proxy for severe malaria) and deaths provide a more clearly optimistic picture (Figures 6 and 7). Malaria inpatient numbers, including malaria inpatient deaths, show a steady decline since 2010. The NMEP reports that severe malaria declined significantly from 15.8 cases per 1,000 population in 2010 to 6.1 cases per 1,000 in 2016, a 61 percent reduction. Malaria deaths decreased by 61 percent, from 4597 in 2011 to 1827 in 2016. The annual case fatality rate reduced to approximately 2 percent. Declining rates of severe malaria and death may reflect reduced frequency and intensity of infections

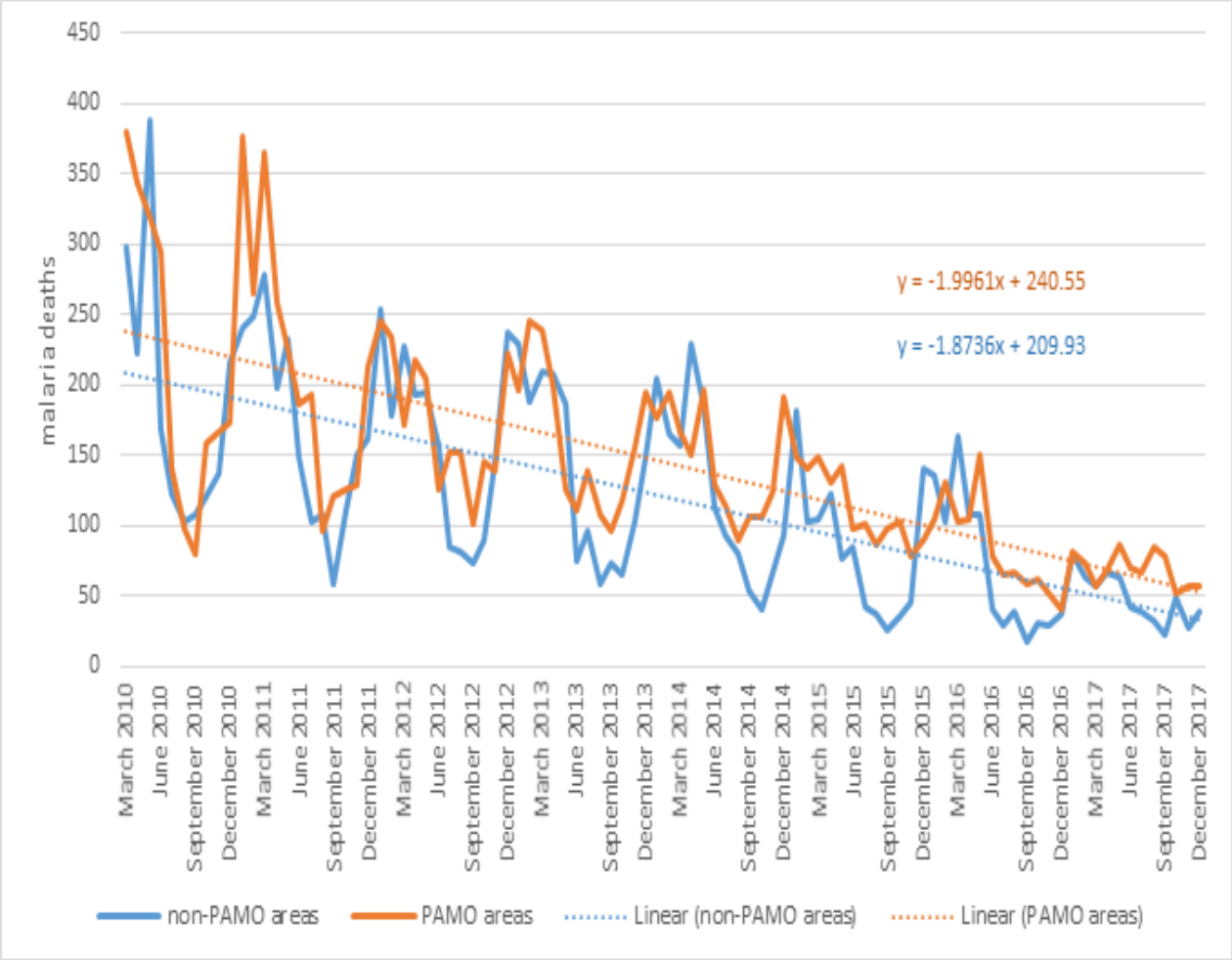
in the setting of improved preventive measures. It is also plausible that these favorable trends may be associated with greater emphasis on case confirmation and improved case management in the community, outpatient departments, and inpatient settings. PMI has supported the MoH to invest in malaria case management training, outreach training and supportive supervision (OTSS), and mentorship for health facility staff. The NMEP has rolled out injectable artesunate to all districts in the country, although uptake has been uneven. Additional efforts have included training of health providers in the management of severe malaria. 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.

Figure 6: Malaria Inpatient Discharges Total in PMI-Supported ("PAMO") Provinces Compared to Non-PMI-Support Provinces, 2010–2017



Source: Zambia HMIS, PATH

Figure 7: Malaria Deaths Total in PMI-Focus ("PAMO") Provinces Compared to Non-PMI Focus Provinces, 2010–2017



Source: Zambia HMIS, PATH

9. Other relevant evidence on progress

N/A

III. OPERATIONAL PLAN

1. Vector control

NMEP/PMI objectives

In theory, Zambia's NMESP 2017–2021 prioritizes high coverage with IRS, as opposed to ITNs, as the country's primary vector control strategy. The stated goal for the elimination strategy is to attain operational coverage of over 90 percent of eligible structures prior to peak transmission season, which would benefit up to 80 percent of the population of Zambia, including, in principle, the population of Lusaka and other large cities. This policy is influenced by renewed interest in IRS, including revived promotion of DDT among the Southern African Development Community. The national strategy proposes ITNs to cover communities not reached or ineligible for IRS, predominantly in hard to reach rural areas (i.e., in theory covering 20 percent of the population). Mass campaigns covering the whole country are to be replaced with more targeted campaigns. Continuous distribution of ITNs, including routine distribution to pregnant women and children under-5 through ANC and Expanded Program on Immunization (EPI) clinics will continue throughout the country. The NMEP also plans to continue rolling out community-based and school-based distribution to enhance routine distribution efforts.

In practice, sufficient funding has yet to materialize to achieve the intended level of IRS coverage, while a well-funded mass ITN campaign in 2017-18 resulted in near universal coverage in most parts of the country. The NMEP want IRS programs to rotate pesticides and decrease reliance on organophosphates for several reasons, including among others: (1) pesticide resistance management policy, (2) concern for the persistently high burden in many sprayed areas, and (3) the documented duration of action of pirimiphos-methyl and unconfirmed reports from non-PMI sites of as short as three months' duration (although PMI sites in northeastern Zambia have shown typical duration of five months). As of mid-2018, the NMEP has developed ambitious plans to implement IRS in virtually all districts in the country, using a mosaic of insecticides. The NMEP had provisionally designated more urban areas for IRS with DDT, some rural areas for the introduction of clothianidin-deltamethrin or clothianidin, and continuation with pirimiphos-methyl in certain PMI- and MACEPA-supported areas (see Figure 12 in IRS section).

The country's way forward on DDT remains unclear due to unresolved obstacles associated with reintroducing DDT at scale. Those obstacles include: (1) the absence of a reliable, WHO-prequalified manufacturer and associated policy constraints which limit or prevent PMI and other international partners from supporting DDT procurement; (2) the expense and long lead time to prepare environmental mitigation measures; and (3) threats posed to international exports by commercial agriculture. A secondary concern is vector resistance to DDT, as reviewed in the next section.

Although larval source management is part of Zambia's integrated vector management strategy, implementation has been funded on a very limited basis, typically at city council level in large urban centers.

PMI's technical strategy in vector control does not align fully with the national approach in all respects. Notably, PMI supports universal access to ITNs and does not fund larval source management. While PMI did support the use of DDT in Zambia until 2010, and elsewhere up to 2012, PMI would be unable to support DDT-based operations in Zambia for the foreseeable future due to the current absence of a WHO-prequalified supplier and the stringent requirements for environmental mitigation, which mandate significant investments in infrastructure and a monitoring regimen. However, PMI Zambia remains committed to supporting the country in its efforts to provide access to evidence-based, high-quality vector control to 100 percent of households.

a) Entomologic monitoring and insecticide resistance management

In Zambia, PMI prioritizes funding entomologic monitoring in area where it supports IRS campaigns, but also provides technical assistance to strengthen entomologic monitoring in the country as a whole. IRS is recognized as the only intervention available to manage insecticide resistance through rotation among different classes of WHO-prequalified insecticides, making entomological monitoring an indispensable component of an evidence-based resistance management program. Ongoing entomologic surveillance will continue to be used to monitor vector habits, densities, and sensitivities to the insecticides being deployed.

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. To mitigate vector resistance to insecticides, the plan calls for rotation and resistance monitoring of WHO-prequalified insecticides. In a setting of documented pyrethroid resistance, especially in *Anopheles gambiae*, Zambia's policy is to use non-pyrethroid pesticides in IRS. As mentioned, the NMEP is guiding all IRS programs to rotate away from long-used products (notably pirimiphos-methyl) and to implement a mosaic approach that incorporates clothianidin, DDT, clothianidin-deltamethrin, and others insecticides at the provincial level and, in some cases, district level when available and feasible. Specifically, the NMEP's intention for the 2019-2020 and 2020-2021 spray seasons is to spray with DDT in several provinces using GRZ and Global Fund resources. Geographic targeting will be based on insecticide resistance patterns and avoidance of DDT in districts where export agriculture is prominent. Consistent with the insecticide resistance management policy, the NMEP aims to include other pesticide classes, including continued spraying with clothianidin and piloting of clothianidin plus deltamethrin.

Progress since PMI was launched

PMI-supported IRS projects have been conducting entomological surveillance in six districts on a monthly basis since 2014. Data on local malaria vectors is provided to the NMEP for decision-making. Two community sites have been established in each district, one in an area of year-on-year IRS implementation, and the other in a historically unsprayed area (Table H). The program covers the four provinces where PMI has been supporting IRS implementation (Luapula, Muchinga, Northern, and Eastern), in addition to maintaining sites in Serenje District, Central Province, where PMI has not funded IRS since 2015. In late 2018, PMI began entomologic monitoring in one additional district in Eastern Province (i.e. two additional community sites), with the objective of collecting data from a representative high burden district in light of the reduced burden and reduced mosquito catches in Katete District.

The package of entomological indicators each year has included malaria vector species composition, density, biting behavior, feeding time and resting behavior, and parity rate. Beginning with the onset of spraying, the quality assurance of IRS and the decay of insecticide is assessed. The susceptibility of vectors to various insecticides is tested annually. Laboratory analyses, performed in-country in recent years at the Macha Malaria Research Institute, are used to determine the mechanism of resistance, the mosquito species, the sporozoite rate, and the blood meal sources.

Table H: PMI-Supported Zambia Entomological Monitoring Sites

Province	District	Sentinel Sites	Spray Status
Northern	Kasama	Kalonga	Sprayed
		Simeo Mwaba	Non-Sprayed *(control)*
Eastern	Katete	Mbalani	Sprayed
		Robert	Non-Sprayed *(control)*
	High Burden District TBD	Community Site TBD	Sprayed
		Community Site TBD	Unsprayed
Muchinga	Isoka	Nsalamba	Sprayed
		Nyamala	Non-Sprayed *(control)*
Luapula	Milenge	Lunga	Sprayed
		Miyambo	Non-Sprayed *(control)*
	Mwense	Shibesa	Sprayed
		Chebele	Non-Sprayed *(control)*
Central	Serenje	Chibobo	Sprayed *(intermittent, non-PMI)*
		Chishi	Non-Sprayed (control)

Beyond these seven monitoring districts, technical assistance has been provided to support sentinel sites in up to nine additional districts around the country in order to monitor non-PMI supported IRS activities. PMI has supported the national insectary through procurement of insectary equipment and supplies, as well as through salary support for insectary staff. Over the years, PMI has also supported the Insecticide Resistance Monitoring Technical Working Group in collating and interpreting entomological data through an annual meeting. PMI-funded IRS project staff have provided mentorship to NMEP staff at the central level to supervise entomological monitoring, analyze the data, and use the results for strategic decision-making.

A pre-fabricated insectary, procured with PMI funds, is operational at the NMEC campus. This facility has strengthened both IRS and ITN assessment capability. Currently, the NMEC still lacks a staff entomologist. Once one is identified, they will likely benefit from additional training and support.

Progress during the last 12-18 months

In 2017 and 2018, entomologic monitoring continued at the 14 sentinel sites mentioned above. Selected key findings are illustrated in Figures 9-11. The most abundant *Anopheles* (*An.*) species collected was *An. funestus* (43 percent), while *An. gambiae s.l.* was less common (6.7 percent). Findings suggest that IRS implementation with pirimiphos-methyl reduced the indoor resting density, biting rate, and longevity of the major malaria vector, and also suppressed the entomologic inoculation rate (from EIR of 0.2 infective bites per person per night pre-IRS to EIR of <0.1 post-IRS, and compared favorably with the post-IRS EIR of 0.6 in non-sprayed control sites).

The most recent susceptibility tests conducted in 2017 and 2018 showed both vectors are still mostly resistant to pyrethroids throughout the Northern and Eastern regions of Zambia, areas where PMI-supported resistance monitoring is being conducted. Resistance to bendiocarb (a carbamate) was found for *An. funestus*, particularly in areas of Luapula Province. *An. funestus* and *An. gambiae* were susceptible to pirimiphos-methyl, clothianidin, and chlorfenapyr at all sites where tested. DDT resistance in *An gambiae* has been documented consistently, including in a 2013 national survey. However, the predominant vector in most of the country, *An. funestus*, has shown adequate susceptibility in most instances (e.g. >90 percent mortality in 10 of 14 PMI monitoring sites tested in 2015-17).

Potentially worrisome findings included elevated rates of blood-fed *An. funestus* at sprayed sites three and four months post-IRS, associated with a limited period residual efficacy of pirimiphos-methyl of four to five months at most sites. This was in spite of findings of high quality initial IRS application.

Figure 8: Average Indoor Resting Density of *Anopheles funestus s.l.* Collected in PMI-Supported Entomologic Surveillance Sites, August 2017 to March 2018

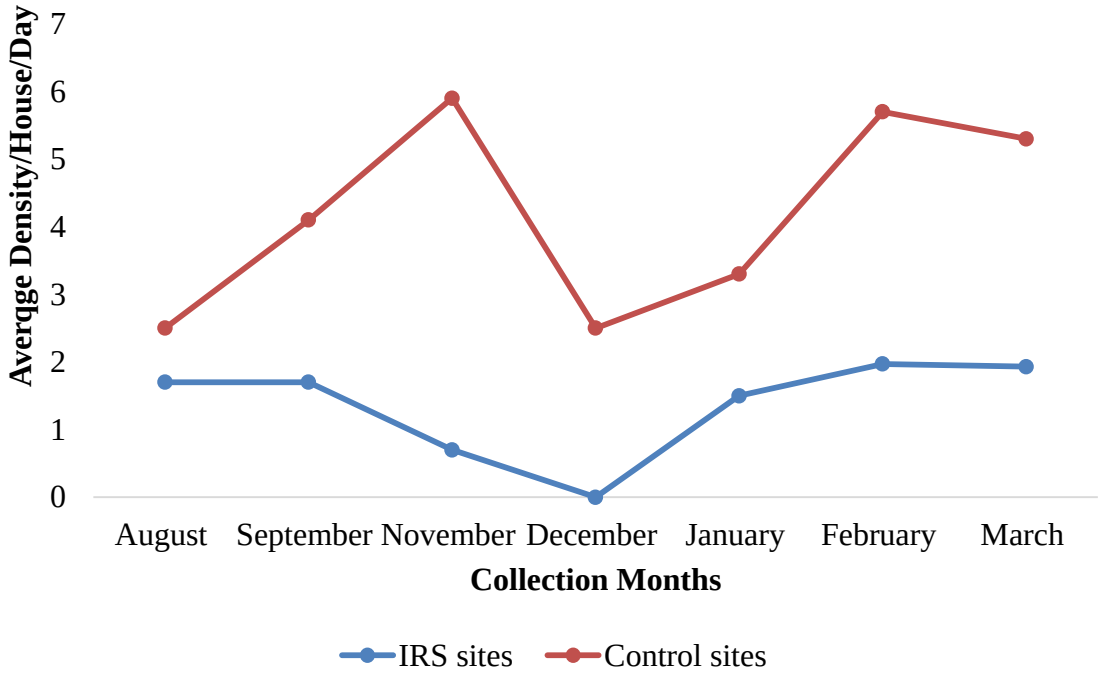


Figure 9A: Insecticide Susceptibility Status of *An. funestus s.l.*, 2017

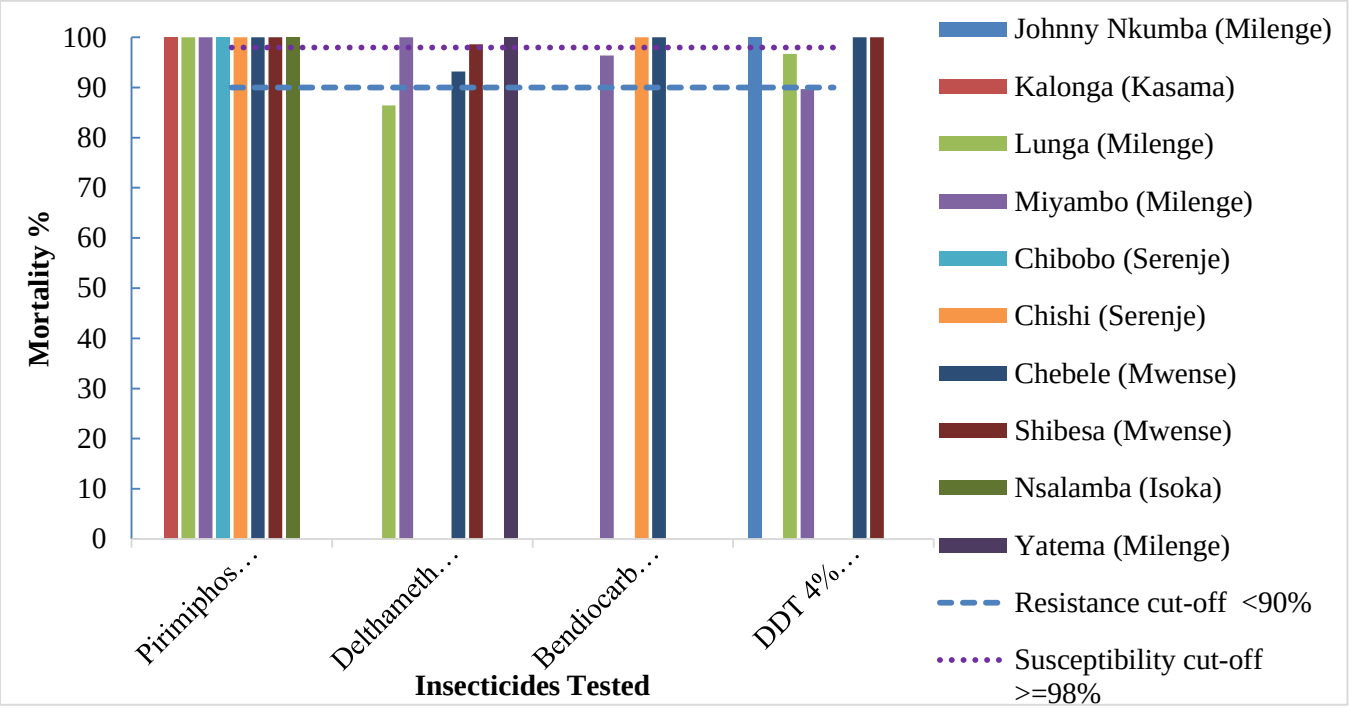


Figure 9B: Insecticide Susceptibility Status of *An. Gambiae s.l.*, 2017

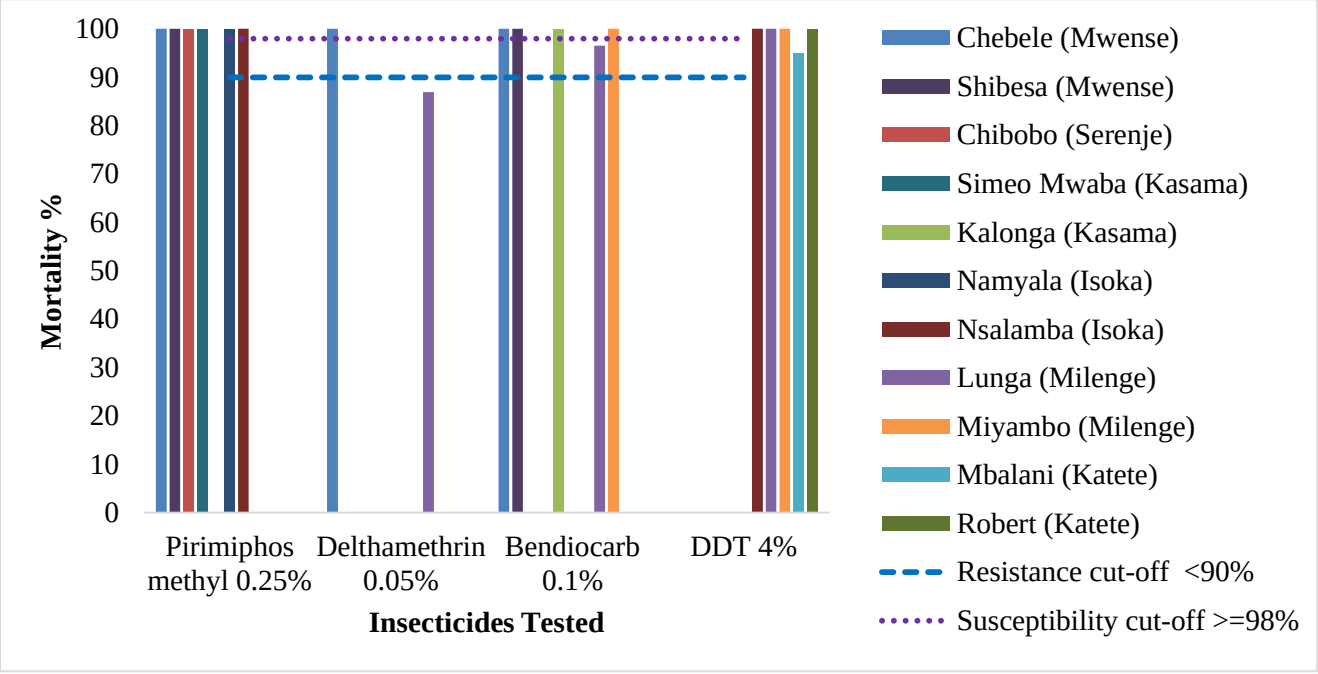
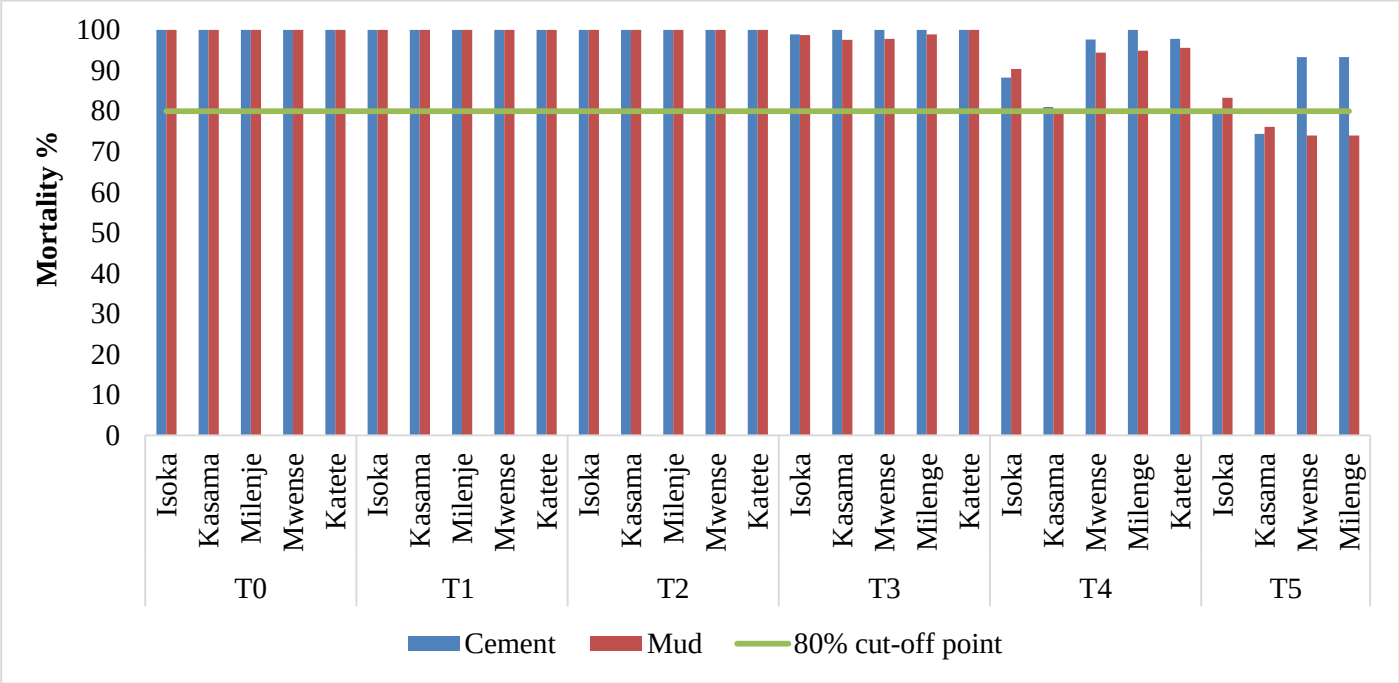


Figure 10: Mortality of Kisumu Susceptible Strain of *An. Gambiae* After Exposure to Pirimiphos-Methyl at Five Sentinel Surveillance Sites in Zambia, October 2017 – March 2018



Plans and justification for proposed activities with FY 2019 funding

The six PM- supported sentinel sites will be retained for 2020-2021 entomological surveillance activities (Table H). One additional site in Eastern Province is also proposed (see Pre-Elimination section for details), for a total of seven sites. The NMEP plans to scale up national entomologic surveillance to a total of 22 sentinel sites (inclusive of the PMI-supported sites); the additional sites will be supported by the Global Fund and MACEPA. PMI plans to support needed training of entomology personnel to build entomologic capacity at the NMEC. Assistance of Macha Research Trust in species determinations will also continue, although measures to improve timeliness of the work will be necessary. PMI will take every opportunity to learn from 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.

Please see Table 2 for a detailed list of proposed activities with FY 2019 funding.

b) Insecticide-treated nets

Progress since PMI was launched

Scale up of ITN distributions began prior to the launch of PMI in 2008, largely enabled by early Global Fund grants. Through 2011, intermittent provincial-level ITN distributions had become a regular event, including the successful pioneering of mass door-to-door distribution in Luapula, which

was funded PMI. With the support of the Global Fund, PMI, World Bank, and other partners, continuous distribution through ANC and EPI clinics was institutionalized.

By 2012, the MIS showed that 68 percent of homes had at least one ITN. However, coverage varied across provinces, ranging from 52 percent in Western to 90 percent in Luapula. To address falling coverage levels in some provinces, the NMEP conducted a national mass ITN campaign in 2013-2014. The GRZ received financial and technical support for the mass campaign from a number of stakeholders, including PMI, the Global Fund, DFID, UNICEF, WHO, MACEPA, and others. As a result of various distribution efforts, the percentage of homes with at least one ITN increased from 38 percent in 2006 to 77 percent in 2015.[2] The percentage of household members that slept under an ITN increased from 19 percent in 2006 to 55 percent in 2015.[3]

Following the mass ITN campaign in 2013-2014, ITN use in children under-5 increased from 24 percent in 2006 to 58 percent in 2015. Eastern Province reported the highest under-5 use at 78 percent and Lusaka and Northern had the lowest at 42 percent. The under-5 utilization was 77 percent nationally in households with at least one ITN. Fifty-eight percent of pregnant women reported sleeping under an ITN in 2015, ranging from 37 percent in Lusaka to 84 percent in Eastern.[4]

Progress during the last 12-18 months

In 2017-2018, the NMEP, with support from partners including PMI, the Global Fund and AMF, conducted a country-wide mass ITN distribution campaign. More than 9,000,000 ITNs were distributed during the campaign against a total need of 10,025,418 ITNs (1 ITN per 1.8 persons and a 10 percent buffer; based on the projected 2017 national population of 16,405,229). The estimated ITN need included urban Lusaka. However, urban Lusaka was excluded from the mass campaign due to low malaria burden. PMI contributed approximately 1,200,000 ITNs, while Global Fund and AMF contributed 6,263,217 and 3,000,000, respectively. According to post-campaign surveys, household ITN ownership topped 70 percent in all provinces except Copperbelt, and usage in children under-5 exceeded 70 percent in all provinces except Copperbelt and Lusaka. The mass campaign had initially been planned to be completed in all provinces by end of 2017, but concluded in first quarter of 2018 in four provinces due to logistical challenges.

In 2016, PMI supported a pilot school-based distribution of 55,229 ITNs to first and fourth grade students at 395 schools in four districts. Lessons learnt from the pilot informed the revision of the ITN distribution guidelines that will be used for the roll out this channel to the rest of country. In 2019, PMI will support the continued rollout of school-based distribution and 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 can maintain ITN ownership levels at 90 percent. Delays in completing the mass ITN distribution in 2018 necessitated further postponement of the community-based ITN pilot distribution, which had been planned for 2018 after the mass ITN distribution. The pilot will be based on a voucher system. Districts will be supplied with six months stock of ITNs required for community distribution, while health centers will be supplied with three

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

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 then be provided with a coupon that they can turn in for a new ITN at their respective health center.

The NMEP prioritized the mass campaign over other ITN distribution channels in 2017/2018. It has been the NMEP's longstanding practice that no ITNs for ANC and EPI channels should be procured or distributed in a year when mass distribution is undertaken. This policy runs against WHO guidance, but is justified on grounds of resource management and operational efficiency. PMI has taken the approach of striving to maximize universal coverage through all nationally approved channels in any given year. In 2018, ITN distribution through ANC and EPI channels resumed nationwide.

PMI is supporting ITN durability monitoring, which commenced in June 2018 following the mass ITN distribution campaign, to examine the physical integrity of ITNs distributed in selected provinces.

Commodity gap analysis

Table I: ITN Gap Analysis

Calendar Year	2018	2019	2020
Total Targeted Population	16,405,229	16,887,702	17,885,422
Continuous Distribution Needs			
Channel #1: ANC	885,882	911,936	965,813
Channel #2: EPI	754,641	776,834	822,729
Channel #3: School	*289,326*	*1,564,305*	*0*
Channel #4: Community	*50,000*	*200,000*	*300,000*
Estimated Total Need for Continuous Channels	1,979,849	3,453,075	2,088,542
Mass Campaign Distribution Needs			
2020 Mass Distribution Campaign in Luapula	0	0	1,236,000
Estimated Total Need for Campaigns	0	0	1,236,000
Total ITN Need: Routine and Campaign	**1,979,849**	**3,453,075**	**3,324,542**
Partner Contributions			
ITNs Carried Over from Previous Year	*0*	*255,607*	*0*
ITNs from MoH	*0*	*0*	*0*
ITNs from Global Fund	1,435,456	1,410,664	0
ITNs from Other Donors	0	0	0
ITNs Planned with PMI Funding	800,000	694,000	1,988,000
Total ITNs Available	2,235,456	2,360,271	1,988,000
Total ITN Surplus (Gap)	255,607	-1,092,804	-1,336,542

Notes: Total ITN need for the mass campaign is based on 1 net per 1.8 population and a 10 percent buffer. ITN quantities to be distributed through ANC and EPI are based on a combined proportion of 10 percent of the national population. Deterioration rates = 8 percent first year, 20 percent second year, and 50 percent third year. ITN quantities to be procured by the GRZ and Global Fund in 2019 and 2020 are yet to be finalized. It is anticipated that Luapula province will conduct mass ITN campaign in calendar year 2020. The rest of the country will conduct mass ITN campaign in calendar year 2021.

Plans and justification for proposed activities with FY 2019 funding

With FY 2019 funding, PMI will procure and distribute ITNs to support the mass ITN campaign in Luapula Province in 2020. Support will include distribution of ITNs, including transportation and other logistics, to districts and health facilities for a mass campaign in Luapula. As noted in Table I, GRZ and Global Fund contributions for 2020 are yet to be finalized. At the time of MOP writing, there is concern that resources may be inadequate to cover the full population in need. PMI will work with the NMEP and partners to ensure that universal coverage needs are filled, possibly in the more feasible format of a two-year campaign during 2020 and 2021. Further, PMI will continue to procure and distribute ITNs to maintain a supply of nets for continuous/routine distribution through ANC/EPI, school-based, and community channels. As per national policy, the assumption is that at the provincial level, routine channels will be put on hold during a mass campaign year.

Additional districts in Eastern Province will be covered by the pre-elimination funding stream (as described in the Pre-Elimination section).

PMI will conduct the final year of durability monitoring for ITNs distributed during the 2018 mass campaign. In order to maximize ITN usage, PMI will continue to support SBCC activities at both local and national level.

Please see Table 2 for a detailed list of proposed activities with FY 2019 funding.

c) Indoor residual spraying

Zambia's approach to IRS warrants some elaboration, as it differs from that in countries where IRS campaigns aim to spray every inhabited dwelling in districts which PMI "covers." The country applies the rationale that scattered or difficult-to-reach populations are too expensive to reach with IRS, and that as many districts as possible should receive at least some IRS. In a Zambian district, even if IRS campaigns are well run and reach 90 percent coverage in targeted communities in terms of sprayed/found structures, typically just 50 percent or less of the total structures in that district will have been sprayed, and 50 percent or less of the population will have been covered. This is not a paradox or a sign of poor quality, but is intentional. Zambian IRS operations—whether funded by the GRZ or by partners such as PMI, the Global Fund, or MACEPA—have historically applied a well-established but seemingly inconsistently applied set of criteria for defining "eligible structures." The approach may be best understood as first defining eligible areas (e.g., areas not considered too remote or 'cut off,' dwellings not too 'scattered,' malaria burden not too low, etc.) within which teams then determine eligible structures (e.g., a structure to be sprayed is a dwelling place, not a store room, not a kitchen, etc.). This de facto approach is illustrated in Figure 11 and Table J.

In practice, available resources for IRS are allocated to each district, where public health leaders apply the NMEP's eligibility criteria to ration out IRS. They prioritize the areas and structures they will include in their annual campaign and, in effect, to justify which they will exclude. As an example, in Petauke District in Eastern Province, the high-burden, low-lying HFCA of Sandwe is habitually excluded from the IRS campaign based on logistical criteria (poor roads, remoteness). However, that HFCA is prioritized in ITN campaigns. For Eastern Province as a whole, an estimated 56.3 percent of the total population was protected by PMI-supported IRS in 2017 (1.07 million out of 1.91 million population).

Figure 11: Schematic Depiction of *de facto* IRS Planning Approach in Zambia Through 2017

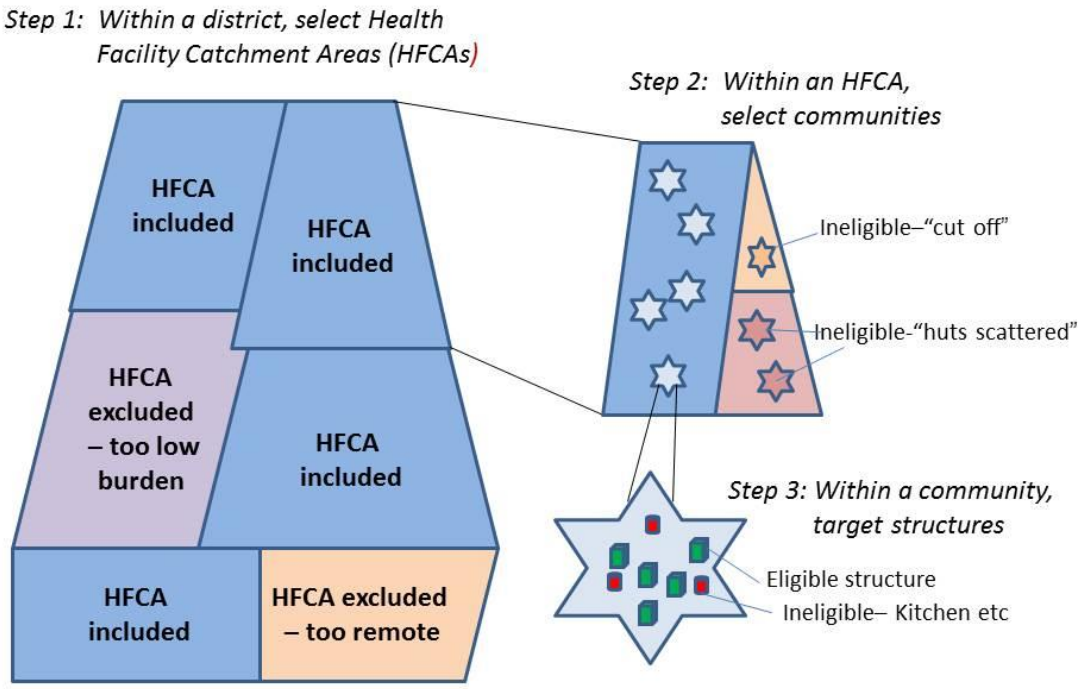


Table J: **Eligible Structures Identified and Targeted for IRS in 2017 in the Four PMI-Supported Provinces—Illustrating the Selective Approach to IRS Coverage in Zambia**

Province	Total Eligible Structures Identified	Total Structures Targeted for IRS by PMI	Percent Targeted
Northern	229,996	131,037	57%
Muchinga	134,679	76,499	57%
Eastern	371,543	223,361	60%
Luapula	217,402	217,903	100%
Total	**953,620**	**648,800**	**68%**

Benefits of the Zambian approach include the ability to offer IRS to a high number of districts for a given resource envelope. For example, in recent years 35 districts in Zambia have been targeted with a roughly $6 million per year PMI investment, compared to 7 districts in Ghana. In a setting of near-universal ITN coverage (80.7 percent rural household ownership in the 2015 MIS), it is arguably cost ineffective to send spray teams to every remote hamlet.

Progress since PMI was launched

Reflecting the priority Zambia places on IRS, the country has the remarkable distinction of conducting IRS campaigns in every province and in virtually every district in the country in recent years. According to the 2015 MIS, 28.9 percent of households nationwide reported receiving IRS, an increase from 14.9 percent in 2008. The 2015 reported household coverage ranged from a low of 17.4 percent in Lusaka Province to a high of 56 percent in Eastern Province, with no significant difference between urban and rural areas.

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. In recent years, private sector funding for IRS has dwindled. The GRZ has been increasing resource allocation to malaria control in general and IRS in particular in recent years. In 2017, the reported GRZ investment in IRS was $7.4 million, and the official gap analysis for the NEMSP work plan projects a steady increase in annual spending to $16.1 million by 2020. Additional resources and technical support have been mobilized through a number of external partners, including DFID, the Roll Back Malaria Partnership, the Global Fund, the World Bank's Malaria Booster Project, MACEPA, and WHO. Global Fund support for IRS expanded geographically in 2014-2016 to encompass large areas of North-Western, Central, Lusaka, Copperbelt, Western, and Southern Provinces. The current Global Fund grant commits roughly $3.9 million per year from 2018-2020 to support spraying of 350,000 structures per year in North-Western, Copperbelt, Central and Western Provinces. The E8 Initiative may become involved in facilitating procurement of DDT. The Global Fund has provided consistent funding for IRS, complementing GRZ and PMI resources.

PMI has supported IRS since 2009 (Table K), and was preceded by three years of USAID-funded IRS. By 2015, PMI was supporting IRS operations in 25 PMI-focus districts (9 in Eastern Province, 7 in Muchinga Province, and 9 in Northern Province). The number of districts and structures targeted by PMI has fluctuated over the years based on the availability of funds. For example, in 2015, funding from DFID permitted a short-term expansion of IRS into an additional 14 districts in Luapula and Central. Since 2016, Zambia has benefitted from the UNITAID-funded NgenIRS project and subsidy. This market intervention project includes a short-term co-payment to accelerate the reduction of price for long-lasting IRS insecticides, which in turn has permitted re-expansion of the PMI program.

The entomologic monitoring which has informed IRS planning decisions was covered in a previous section. In terms of environmental compliance, the PMI-supported IRS program is conducted in compliance with the U.S. Government's USAID Regulation 216, Zambia Environmental Management Act Chapter 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 Supplemental Environmental Assessment to cover IRS activities in Zambia from 2015 to 2020 was approved prior to the commencement of the 2015 spray operations. PMI provides technical support to the NMEP for environmental compliance, including waste disposal, recycling of insecticide bottles, entomology, and planning for IRS activities in the non-PMI supported provinces.

Table K: PMI-Supported IRS Activities in High-Burden Districts, 2009 – 2020

Calendar Year	Number of Districts Supported[1]	Insecticide Used	Number of Structures Sprayed	Coverage Rate	Population Protected
2009	36	DDT and pyrethroids	1,191,517	90%	(uncertain)
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 organophosphate	460,358	86%	1,710,833
2013	20	Organophosphate	432,398	81%	1,842,821
2014	40	Organophosphate	409,544	93%	2,000,824
2015	39	Organophosphate	519,598	95%	2,544,290
2016	35	Organophosphate	559,550	91%	2,626,718
2017	36	Organophosphate	634,371	93%	3,005,676
2018[2]	27	Organophosphate	540,000	TBD	2,559,000
	3	Neonicotinoid	90,000	TBD	426,000
2019[2]	24	TBD	560,000	TBD	2,630,000
2020[2]	21	TBD	500,000	TBD	2,350,000

[1] Districts are listed here as "supported," not "covered." Consistent with Zambia's approach to targeting IRS, only a portion of each district was covered, benefitting typically 50-60 percent of the population.

[2] Represents targets based on the 2018 IRS workplan. Projected targets for 2019 and 2020 are based on discussions with the NMEP.

IRS is inherently challenging and has brought its share of problems each year. In PMI areas, extra social and behavior change investments have been needed to combat "IRS fatigue" in certain communities, especially towns and areas with transient populations such as fishermen along Lake Tanganyika. PMI IRS operations have been suspended in Mpulungu District in Northern Province due to an ongoing USAID Office of the Inspector General investigation of data fraud associated with pilfering of pesticide during the 2017 season, prompting increase investments in supervisory staff going forward. In non-PMI supported districts, a persistent concern has been the late start of IRS campaigns due to delayed release of funds, pesticide procurement delays, and other bottlenecks. A PMI-supported capacity assessment in 2016 demonstrated management deficiencies and quality concerns in these districts.

A perennial challenge for IRS managers is determining the true number of sprayable structures on the ground and the true coverage rates achieved by the spray teams. To improve enumeration during planning and facilitate mop-up during campaigns, the mSpray system was developed in 2012 and deployed in 2014-2017 operations with PMI Zambia support. Notably, the system helped PMI to greatly increase coverage in Luapula in 2016. Although certain cost and operational issues remain to be resolved, mSpray has shown potential. First of all, mSpray allowed for detailed and low-cost mapping of structures on the ground during IRS planning. Secondly, it allowed for guiding mop-up efforts of unsprayed structures during IRS implementation.

Progress in the past 12 to 18 months

Implementation of Zambia's IRS program in 2017 was built upon lessons learned as the country entered its tenth year of PMI support for IRS. The program continued to implement IRS in the same four provinces that had been sprayed in 2016: Eastern (nine districts), Luapula (ten districts), Muchinga (seven districts) and Northern (ten districts). The 2017 spray season was started later than in previous years in response to the 2016 entomological recommendations to spray as close to the rainy season as possible. The program trained a total of 2,438 people, of which 35 percent were women, to deliver IRS in 2017. These included 1,797 spray operators, 352 team leaders, 247 supervisors, and 42 clinicians from 36 districts. Since there had been challenges with supervision in 2016, the program identified districts that needed an extra layer of supervision and, as a result, seven seasonal district coordinators were trained and hired to support full-time staff in supervision of the IRS campaign.

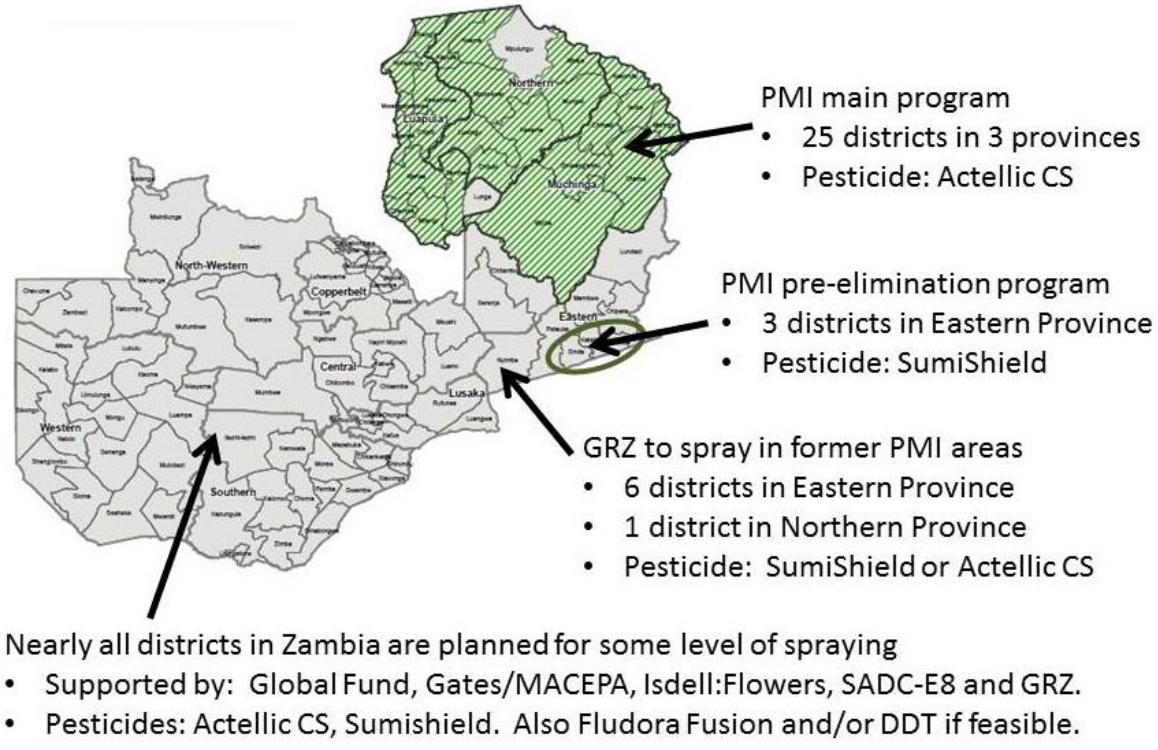
In 2017, the PMI-supported campaign targeted 648,800 structures in the same four high burden provinces and aimed to protect a population of 2,626,718. By the end of 66 days of IRS operations, the campaign reported finding 684,635 structures and spraying a total of 634,371 structures, yielding a spray coverage of 93 percent. A total of 3,005,676 people were protected by IRS, including 77,206 (2.6 percent) pregnant women and 443,140 (14.7 percent) children under-5 years old.

Planning for the 2018 spray season is far advanced. A total of 540,000 structures will be targeted for IRS in three provinces (Luapula, Northern, and Muchinga). Based on good susceptibility data and the absence of a suitable longer-acting pesticide, the decision has been made, in close consultation with the NMEP, to continue with pirimiphos-methyl in these provinces for one more year. In line with NMEP expectations for higher coverage of populations going forward, in 2018, PMI-supported IRS will take the approach of supporting the spraying of the greatest number of structures it can afford, distributed in a reduced area but at higher percent population covered than in previous years. Specifically, PMI is aiming for 80 percent coverage of structures and population in all districts of Luapula and Muchinga Provinces. Remaining structures will be allocated to as many districts in Northern Province as possible, at a population coverage of 80 percent in any single district PMI serves. To define the 20 percent of population which would not be protected by IRS, PMI, in collaboration with district health planners, will use the NMEP targeting criteria, which includes the following: malaria burden, population density, clusters, accessibility, and structure eligibility.

In addition, three districts in Eastern Province will be supported for IRS in 2018 as part of a PMI-funded pre-elimination package with a target of 90,000 structures (covered in a later section). PMI will thus effectively withdraw its IRS program from 6 districts in Eastern Province and approximately 3-4 districts of Northern Province. These are to be covered by the GRZ program, with the pesticide likely to be clothianidin. All of these districts benefitted from the ITN mass distribution campaign, targeting universal coverage, which concluded in late 2017/early 2018.

PMI's support for IRS in 2018 constitutes one component in a complex nationwide plan for spraying in virtually all districts under the coordination of the NMEP (Figure 12).

Figure 12: Map of PMI-Supported IRS Districts in the Planned 2018 National Campaign



Note: District boundaries are as of 2015

Plans and justification for proposed activities with FY 2019 funding

For the FY 2019 spray season (calendar year 2020), PMI will cover the cost of targeted IRS in all districts of Luapula and Muchinga Provinces, and selected districts in Northern Province. Approximately 500,000 structures will be targeted, protecting more than 2 million people. The actual number of household/structures sprayed will depend on the cost of insecticides selected and implementation.

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/NMEP to conduct training of trainers for spray operators; preparing a "Letter Report" for environmental compliance; launching spray operations in up to 22 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; and procurement of insecticide, spray pumps, personal protective equipment, and other IRS commodities.

The PMI-supported IRS program will continue to adopt the approach of benefitting at least 80 percent of the population in each district it covers, as per NMEP preferences. PMI will fund the spraying of

500,000 structures in the 2020 season. Choice of pesticide(s) for the campaign and target areas are not yet determined, and will be informed by NEMP and PMI policies and priorities at the time, as well as entomologic data including resistance and duration of efficacy. As in previous years, PMI will support a comprehensive IRS program, including: procurement of insecticides and other IRS supplies/equipment; training of spray operators, supervisors, and storekeepers; monitoring and evaluation; SBCC for IRS; pesticide storage; waste disposal; and pay for spray operations. For the GRZ implemented IRS program, PMI will provide support for training of trainers; supervision; training materials development; technical working group support; microplanning; post-IRS support; and waste disposal.

An FY 2019 budget decrease for this program from FY 2017 and FY 2018 levels (i.e. from $7.8 million to $6.8 million) was felt to be justified in light of the need to shift vector control resources into the underfunded 2020 ITN campaign . In light of the prolonged transmission season in the target provinces, the program should use the longest-acting, otherwise suitable pesticide available.

An additional 90,000 structures in three districts in Eastern Province will be covered by the Pre-Elimination funding stream, as described in a later section of this MOP.

Please see Table 2 for a detailed list of proposed activities with FY 2019 funding.

2. Malaria in pregnancy

NMEP/PMI objectives

The NMESP includes three strategies to reduce the malaria burden in pregnant women: (1) the provision of free IPTp with at least four doses of sulfadoxine-pyrimethamine (SP) during pregnancy, (2) the provision of free ITNs, and (3) 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 artemether-lumefantrine (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 current national policy calls for pregnant women to receive IPTp at every ANC visit at least one month apart up until the time of delivery, with the first dose starting after 16 weeks of gestation. Iron and low-dose folic acid are also provided to pregnant women through ANC. The FANC guidelines were updated to include low-dose folic acid instead of five milligrams in 2017. Procurement policies have now also been updated to reflect this change.

IPTp is supported through the FANC platform. ITNs are procured and distributed directly to pregnant women through ANC clinics and are also accessible to them through additional distribution channels (i.e., 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 and ITNs, and educating pregnant women on the importance of seeking care immediately for fever. ITN use by pregnant women was at 41 percent in the 2014 DHS and IPTp for one dose, two doses, and three doses stands at 90 percent, 79 percent, and 61 percent, respectively.[5]

Over the past 10 years, PMI has invested more than $3 million in FANC and MIP in Zambia. Funding from PMI has been critical to: (1) development of a national FANC curriculum and district-level trainers throughout the country; (2) national rollout of in-service trainings in FANC; (3) updates to pre-service curriculum in nursing schools in Zambia; (4) strengthening of supervision and quality improvement of ANC services; and (5) creating demand for quality ANC services and advocacy around safe motherhood issues. PMI funds were complemented with maternal and child health co-funding in line with the program's budget.

A PMI-funded study[6] analyzed the efficacy of SP for IPTp in Mansa, Zambia in 2013. This study found a 26 percent parasitological failure rate for IPTp-SP relative to the moderate 61 percent prevalence of the quintuple mutant among pregnant women with asymptomatic malaria parasitemia. IPTp-SP still retained efficacy and the sextuple mutant, which is known to compromise protective efficacy, was present at low levels, but periodic monitoring will be important to determine whether this mutation continues to increase in prevalence.

Progress during the last 12-18 months

In 2014, the NMEP aligned the national policy on IPTp with the updated WHO policy on IPTp. ANC registers and HMIS/DHIS2 were updated to capture three doses of IPTp. However, national policy did not yet align with the recommendation for low dose folic acid. PMI Zambia worked with the Safe Motherhood Technical Working Group to advocate for a policy change in order 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. Over the past year, the policy was disseminated to all levels of the health system, procurement policies were updated, and low-dose folic acid is now being provided at ANC visits.

Focused antenatal care training and supervision is provided to healthcare workers via Clinical Care Teams, which are present, in principle, in all districts and provinces nationwide. These teams consist of staff who are already a part of the health system, namely a clinical care supervisor and a CHW coordinator. Provincial-level Clinical Care Teams supervise and train Clinical Care Teams and health workers at district-level facilities. District-level Clinical Care Teams 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. Of the 668 ANC healthcare providers targeted by PMI for training, 497 were trained last year in MIP (including IPTp), counseling on the use of ITNs, and case management.

[5] 2015 Zambia Malaria Indicator Survey
[6] Tan et al. Malaria Journal 2014, 13:227 http://www.malariajournal.com/content/13/1/227

The MoH recently announced adoption of the 2016 WHO ANC guidelines. Review of the Zambia ANC guidelines is currently underway to incorporate the new guidelines.

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 the 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 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).

Table L: Status of IPTp Policy in Zambia

Status of Training on Updated IPTp Policy		Number and Proportion of Health Workers Trained on New Policy in Last Year	Updated IPTp Guidelines Available at Facility Level?	ANC Register Updated to Capture Three Doses of IPTp-SP?	HMIS/ DHIS2 Updated to Capture Three Doses of IPTp-SP?
Completed/ Not Completed	Date				
Completed	2014	497/668 (plus 114 the previous year)	Yes	Yes	Yes

Table M: Status of ANC Guidelines in Zambia

Status of 2016 WHO ANC Guidelines Adoption		Number and Proportion of HCWs Trained in New ANC Guidelines in Last Year	Are Updated Adopted ANC Guidelines Available at Facility Level?	Additional IPTp Contact Added to ANC Schedule at 13 Weeks?	ANC Register Updated to Capture 8-9 ANC Contacts?	HMIS/DHIS2 Updated to Capture 8-9 ANC Contacts
Started/ Completed/ Not Completed	Date Completed *(or Expected to be Completed)*					
Started	Guidelines currently being reviewed (June 2018)	0	No	No	No	No

Commodity gap analysis

Table N. SP Gap Analysis for Malaria in Pregnancy

Calendar Year	2018	2019	2020
Total Population	16,887,720	17,381,168	17,885,422
SP Needs			
Total Number of Pregnant Women Attending ANC [1]	854,519	879,669	905,003
Total SP Need (in Treatments) [2]	**2,249,093**	**2,314,810**	**2,383,303**
Partner Contributions			
SP Carried Over From Previous Years	*17,267*	*768,174*	*453,364*
SP from Government	*3,000,000*	*2,000,000*	*2,000,000*
SP from Global Fund	0	0	0
SP from Other Donors	0	0	0
SP Planned with PMI Funding	0	0	0
Total SP Available	**3,017,267**	**2,768,174**	**2,453,364**
Total SP Surplus (Gap)	**768,174**	**453,364**	**70,061**

Twenty-three percent of the national population are women of reproductive age. Pregnant women account for approximately 22 percent of women of reproductive age. Total ANC attendance is estimated at 97 percent. One-hundred percent of pregnant mothers attending antenatal clinics will receive first IPTp dose, 80 percent will receive second IPTp dose, and 65 percent will receive the third IPTp dose (MIS 2015). It is estimated that 20 percent of the total antenatal attendances are likely to receive the fourth IPTp dose. It is further estimated that 100 percent of those who will receive the fourth dosed are likely to receive the fifth and sixth dose. SP quantities to be procured by GRZ in 2019 and 2020 are yet to be finalized (Malaria Forecasting and Quantification 2019-2019 Report).

Plans and justification for proposed activities with FY 2019 funding

The strategy to increase IPTp coverage in Zambia focuses on the continued training 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). Support will be split across two partners as this is a transition year between projects. In addition, support for routine distribution of ITNs through ANC/EPI will continue (see ITN section for full description).

GRZ will continue to procure SP, but, as noted in the Gap Analysis, quantities are yet to be finalized. PMI will work with NMEP to ensure that the SP need for 2020 is filled.

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 (see SBCC section for full description).

Please see Table 2 for a detailed list of proposed activities with FY 2019 funding.

3. Case management

NMCP/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 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 integrated community case management (iCCM).

Table O. Status of Case Management Policy and Implementation in Zambia

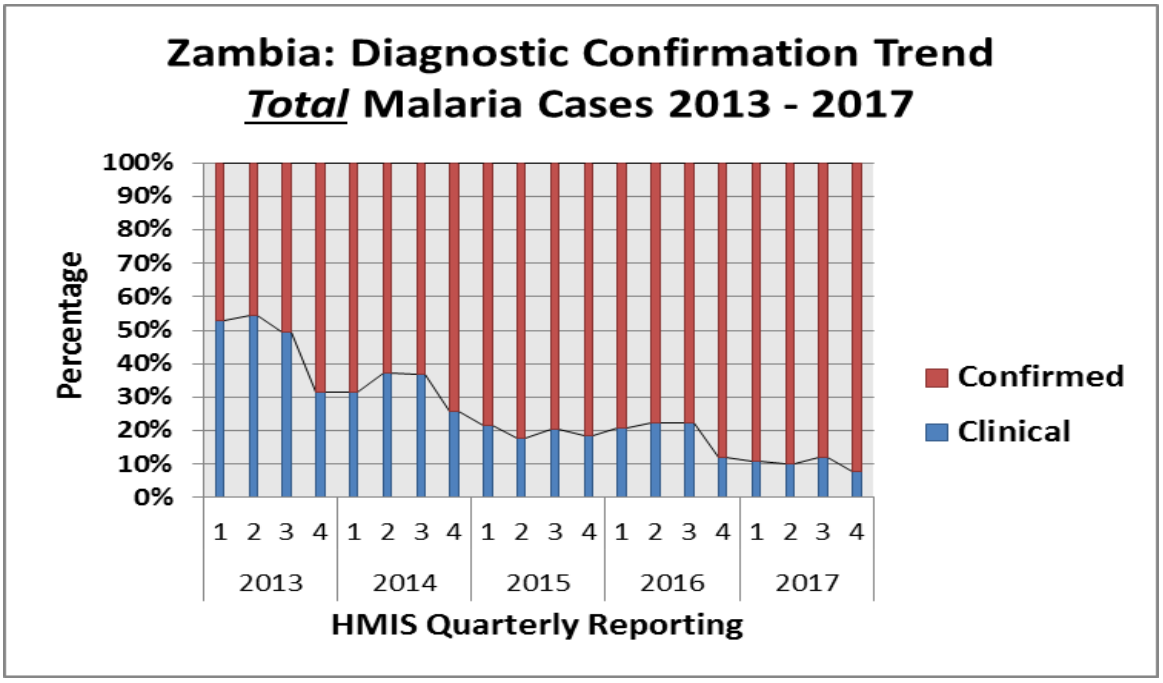
Status of Case Management Policy in Zambia According to National Malaria Diagnostic and Treatment Guidelines 2014 (Revised 2015)	
What is the first-line treatment for uncomplicated *P. falciparum* malaria?	Artemether-lumefantrine Dihydroartemisinin-piperaquine (alternate)[1]
What is the second-line treatment for uncomplicated *P. falciparum* malaria?	None
What is the first-line treatment for severe malaria?	Injectable artesunate[2]
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 and 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[3] Injectable artesunate[3]
Is pre-referral treatment of severe disease recommended for community health workers? If so, with what drug(s)?	Rectal artesunate
If pre-referral rectal artesunate is recommended, for what age group? *(Note: current international guidelines do not recommend administering to those ≥ 6 years.)*	For children less than 6 years old[4]

[1] To be used only in non-mass drug administration areas.
[2] If injectable (intravenous-IV or intramuscular-IM) artesunate is unavailable, artemether (IM) or quinine (IV or IM) are suggested alternatives.
[3] If these two options are not available, quinine (IM) is recommended.
[4] Per the 2017 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 the provision of OTSS for quality assurance of malaria diagnostics. Progress has been made as a result of this investment. The percentage of children with fever that reported having a heel or finger stick increased from 17 percent (MIS 2010) to 36 percent (MIS 2015). The HMIS confirms progress in diagnostics (Figure 13). Ninety percent of reported malaria cases were confirmed in 2017, compared with 31 percent in 2010 (HMIS).

Figure 13. Diagnostic Confirmation Trend Total Malaria Cases in Zambia, 2013 - 2017



While the RDT supply has improved, stock availability, including at the central level, has remained a challenge, falling below minimum levels during periods of the year. Additionally, at the facility level, stockouts remain a challenge. The PMI-supported end-use verification survey conducted in the first quarter of calendar year 2018 reported RDT stockouts in 26 percent of facilities visited.

To strengthen malaria diagnostic capacity at all levels, PMI has invested in training laboratory technicians, clinicians, and CHWs in malaria diagnosis. PMI has supported health workers in approximately 18 facilities in each of the ten provinces in the country and has supported training for more than 2,600 CHWs and over 3,200 clinicians in iCCM.

Although iCCM training is supported by various partners, the provision of non-malaria commodities (oral rehydration solution, zinc, and 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.

Retention of CHWs has also remained a challenge. MACEPA has been successful in deploying and retaining a large cadre of CHWs in Southern Province through the provision of an "enabler's package," which includes non-monetary incentives such as a bicycle, t-shirt, supply box, and, in some cases, a cell phone credit for transmitting data. PMI is drawing from these experiences to inform support for CHWs in focus provinces and pre-elimination districts.

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, as well as WHO accreditation of three laboratory technicians at the national level and diagnostics refresher training for district laboratory supervisors in order to build microscopy expertise and training capacity.

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 in order 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 2017, there were no reported central level stockouts of either RDTs or ACTs in the country. However, a number of health facilities reported stockouts and that central level stocks for RDTs and some pack sizes of artemether-lumefantrine (AL) fell below the minimum stock level required. A total of 25,731,550 RDTs arrived in Zambia in 2017 from procurements by the Global Fund (6,068,300), PMI (7,210,875) and GRZ (12,452,375). The difference between the need and the quantities procured in 2017 was filled by RDTs carried over from 2016. In 2018, more than 24 million RDTs are expected to arrive, with PMI providing the bulk of the supply (13,244,400). Additional RDTs will be provided by the Global Fund (11,482,830).

PMI procured 3 million ACTs in 2017 for the treatment of malaria at the health facility and community level. In addition, 2,298,000 ACTs were procured by the Global Fund and 5,741,230 by GRZ. In 2018, approximately 14 million ACTs are expected, with PMI providing more than 4.2 million, the Global Fund providing 7 million, and GRZ providing approximately 2.8 million.

PMI currently supports two main types of case management supervision activities: (1) formal MoH Performance Assessment exercises conducted in the first and third quarter in selected districts (typically the worst and highest performing districts), and (2) OTSS visits, ideally planned as quarterly rounds at initial implementation, but in practice occurring two to three times per year. In each province, all facilities with microscopes are selected for OTSS visits. Due to resource constraints, only a subset of other facilities are included in OTSS in a given year, prioritized by highest burden and poorest performance.

PMI supports OTSS in eight out of the ten provinces in the country. In 2017, 55 provincial supervisors and 237 district supervisors from four provinces were trained on OTSS and electronic data systems. The introduction of electronic data systems has resulted in improved data quality. When the PMI-supported case management partner project ended in September 2017, OTSS and electronic data systems in four of the eight supported provinces were transitioned to the NMEP. The remaining four provinces continue to receive OTSS support through PMI's bilateral partner. PMI also supported the establishment of a national malaria slide bank in order to enhance long-term national microscopy training and capacity building efforts. Furthermore, PMI conducted quality assurance visits to the sites to confirm species identity and parasite quantification for samples.

In 2017, PMI supported the training of 405 health facility staff in malaria case management. Additionally, 149 supervisors and 1,239 CHWs in four focus provinces (Muchinga, Luapula, Northern, and Eastern) were trained in iCCM.

HMIS data has shown progressive improvement in malaria diagnosis confirmation. Confirmed malaria cases accounted for 90 percent of total malaria cases in 2017, up from 80 percent in 2016. Furthermore, the MIS 2015 indicated that 80 percent of children under-5 with fever that received an antimalarial drug reported receiving the recommended antimalarial. This was up from 18 percent in 2006.

In 2017, the NMEP and partners made revisions to the Guidelines for the Diagnosis and Treatment of Malaria in Zambia that included rectal artesunate for pre-referral treatment of severe malaria in children less than 6 years, including at the community level. 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.

Training of health workers in the use of injectable artesunate has continued, and all level one and two hospitals in all districts are now trained. There is renewed MoH interest in scaling up the use of rectal artesunate for management of children with severe malaria at the time of referral from community settings and health posts. An ongoing pilot study (2017-2018) in Serenje District has shown promising preliminary findings in terms of feasibility and improved care.

Table P. PMI-Funded Therapeutic Efficacy Studies (TESs)

Completed TESs			
Year	**Site Name**	**Treatment Arm(s)**	**Plans for k13 Genotyping**
2016	Katete, Mansa, Gwembe	AL 100percent PCR-corrected ACPR; ASAQ 100percent PCR-corrected ACPR; DHA-PQ 100percent PCR-corrected ACPR	An NMEP trainee conducted genotyping at CDC laboratory in 2017.
Ongoing TESs			
Year	**Site Name**	**Treatment Arm(s)**	**Plans for k13 Genotyping**
N/A			
Planned TESs (Funded with Previous or Current MOP)			
Year	**Site Name**	**Treatment Arm(s)**	**Plans for k13 Genotyping**
2018-2019	Katete (Eastern Province), Mansa (Luapula Province), Gwembe (Southern Province), Isoka (Muchinga Province), Mpongwe (Copperbelt Province) and Serenje (Central Province)*	AL, ASAQ, DHA-PQ	Planned genotyping at NMEP laboratory with support from CDC, including monitoring visit, if necessary,

*Three sites will be supported by PMI with FY 2017 funds, and three sites will be supported by the Global Fund.
ACPR: Adequate clinical and parasitological response

Commodity gap analysis

Table Q: RDT Gap Analysis

Calendar Year	2018	2019	2020
RDT Needs			
Total Country Population	16,887,720	17,381,168	17,885,422
Population At Risk for Malaria[1]	16,887,720	17,381,168	17,885,422
PMI-Targeted At-Risk Population	16,887,720	17,381,168	17,885,422
Estimated Community Cases	2,533,158	3,476,234	3,573,569
Estimated Outpatient (OPD Attendances)	40,023,288	41,143,941	42,295,971
Total Number of Projected Fever Cases	25,533,868	26,772,104	27,521,723
Percent of Fever Cases Tested with an RDT	90%	90%	90%
Total RDT Needs	**34,470,722**	**23,054,729**	**23,700,261**
Partner Contributions *(To PMI Target Population if Not Entire Area at Risk)******			
RDTs Carried over from previous year	9,048,225	0	0
RDTs from Government	6,000,000	15,000,000	15,000,000
RDTs from Global Fund	4,500,000	4,500,000	0
RDTs from Other Donors	0	0	0
RDTs Planned with PMI Funding	13,244,400	2,000,000	3,065,000
Total RDTs Available	**32,792,625**	**21,500,000**	**18,065,000**
Total RDT Surplus (Gap)	**-1,678,097**	**-1,554,729**	**-5,635,261**

OPD attendance was 37,872,723 in 2017. Applying a 2.8 percent population increment, it was assumed that OPD attendance will increase to 40,023,288 in 2018, 41,143,941 in 2019, and 42,295,971 in 2020. Based on end-use verification survey data, it is assumed that 60 percent of outpatient department attendance will present with fever as a clinical symptom. RDT need for 2018 is inclusive of six months of pipeline to ensure adequate supply at the beginning of the next year. RDT quantities to be procured by GRZ and the Global Fund in 2019 and 2020 are yet to be finalized. The analysis reflects the best information available at time of writing, and will be reviewed prior to finalizing procurement decisions.

RDT quantities to be procured by GRZ and Global Fund in 2019 and 2020 are yet to be finalized. The analysis presented in Table Q reflects the best information available at time of writing, and procurements will be reviewed prior to finalizing procurement decisions.

Table R: ACT Gap Analysis

Calendar Year	2018	2019	2020
ACT Needs			
Total Country Population	16,887,720	17,381,168	17,885,422
Population At Risk for Malaria	16,887,720	17,381,168	17,885,422
PMI-Targeted At-Risk Population [1]	16,887,720	17,381,168	17,885,422
Total Projected Number of Malaria Cases	6,264,842	6,076,897	5,894,590
Total ACT Needs	**16,288,589**	**15,474,160**	**14,700,452**
Partner Contributions *(To PMI Target Population If Not Entire Area At Risk)*[1]			
ACTs Carried Over from Previous Year	*5,338,566*	*3,279,171*	*0*
ACTs from Government	*2,755,380*	*7,000,000*	*7,000,000*
ACTs from Global Fund	7,187,968	3,000,000	3,000,000
ACTs from Other Donors	0	0	0
ACTs Planned with PMI Funding	4,285,846	2,300,000	3,517,000
Total ACTs Available	19,567,760	15,579,171	13,517,000
Total ACT Surplus (Gap)	3,279,171	105,011	-1,183,452

ACT need is calculated based on "consumption data" as reported by health facilities through the electronic Logistics Management Information System (eLMIS). Note that true ACT need tend to run higher than total number of malaria cases indicated by a factor of approximately 2.6, as assessed in national quantification exercises. Among other reasons, this is due to (a) case data is derived from HMIS, which has a report completion rate of approximately 70%; (b) ACT need for each year includes a 6-month buffer to ensure an adequate supply at the beginning of the next year. Also note that ACT quantities to be procured by GRZ and Global Fund in 2019 and 2020 are yet to be finalized.

Estimating ACT needs is a challenging process, not just in Zambia, but worldwide. The footnotes to Table R highlight several factors which help to explain the discrepancy between estimated cases and the projected need for treatment course. Of note, there is currently a study going on in Zambia to address these questions. The study is being led by MoH with support from the Global Fund. Procurement plans will be updated when the final results come out.

Plans and justification for proposed activities with FY 2019 funding

Government health facilities are the main providers of health services in Zambia, including for malaria. The private healthcare sector is small, accounting for just 14 percent 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 the community level will also be enhanced through iCCM, particularly for rural remote communities. With FY 2019 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 using CHWs. PMI will procure RDTs and ACTs to contribute to filling the national need. As noted in

the gap analysis tables, GRZ and Global Fund contributions in 2020 have not been finalized and are anticipated to help fill the needs. PMI and partners will continue to work with GRZ to better understand the calculations that are being used for official forecasting and to improve their accuracy.

To provide healthcare workers, laboratory technicians, and CHWs with 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. Reagents for microscopy will also be provided for use by trained laboratory technicians at targeted facilities.

PMI will continue to support OTSS at targeted facilities, as well as case management training and refresher training for HCWs and CHWs. PMI will support management of uncomplicated and severe malaria according to national guidelines, including scaled-up use of rectal artesunate in referral setting should the MoH continue to show renewed interest in that approach. The GRZ has plans to procure rectal artesunate in 2019. No PMI procurement of rectal artesunate is planned at this time, but will monitor the scope of implementation and consider support to fill gaps if warranted.

Health facility 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 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.

In the four high burden PMI focus provinces, support will be split across two partners as this is a transition year between projects. Support will also be provided for strengthening malaria case management, including iCCM, in provinces that are not covered by the Global Fund or other partners (specific provinces TBD).

Additional case management activities in the pre-elimination districts in Eastern Province are described in the Pre-Elimination section.

Please see Table 2 for a detailed list of proposed activities with FY 2019 funding.

4. Cross-cutting and other health systems strengthening

In order to successfully implement the aforementioned activities, PMI Zambia supports a suite of activities that cut across and benefit insecticide- and drug-based prevention and case management activities. For example, availability of high-quality commodities is necessary to ensure high ITN coverage and effective case management, while health-seeking behavior of individuals and communities is necessary to improve coverage of all interventions. In addition, the gains achieved in malaria control in Zambia can only be sustained if there are strong health systems and local capacity. Hence, systems strengthening and capacity building are intrinsic in

all PMI intervention-specific activities previously mentioned (e.g., training and supervision of health workers, technical assistance for planning and monitoring interventions, etc.). Non-intervention specific or cross-cutting health systems strengthening activities are described below.

a) Pharmaceutical management

PMI and other partners continued to provide support to the MoH, Medical Stores Limited (MSL), and other stakeholders to improve the collection, management, and use of logistics data through support of an electronic logistics management information system (eLMIS). eLMIS training has been a focus of recent pharmaceutical management investments, leading to increased visibility of stock management and improved commodity availability at the facility level. PMI will continue to support strengthening GRZ's commodities supply and logistics systems at the central, provincial, district, and health center levels. FY 2019 funding will support the roll out of the eLMIS facility version to an additional 200 health facilities. This will bring the total number of trained health facilities to 650.

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:

- 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 percent to 90 percent.
- 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 resource for health in supply chain
- Public-private partnerships

In 2012, the MoH announced the mandate of the MSL would be significantly increased. In the past, MSL was responsible for central-level storage of commodities and distribution of those commodities to districts. Districts were then responsible for further distribution to health centers. The new policy has expanded MSL's mandate to include distribution to health centers. In order to expand its capacity for last-mile distribution, MSL has created seven 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. With support from USAID, MSL conducted a technical organization capacity assessment to determine the organization's staffing needs. In 2016, senior staff at MSL were trained in management and leaderships skills. Furthermore, in late 2016, the MoH announced a partial transfer of the procurement function to MSL. Currently, MSL is the procurement agent for emergency preparedness commodities.

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 logistics data for making informed supply chain decisions through both the eLMIS and EMLIP;
3) Training at the national, provincial, and district level in the use of an end-use verification tool to monitor availability of malaria commodities at the facility level, as well as training in malaria case management practices, and adherence to treatment guidelines; and
4) Support for the storage space expansion program at the central level.

PMI has provided capacity building and technical assistance to the MoH and NMEP in forecasting and quantification activities to ensure a robust procurement process with long-term national forecasts for malaria pharmaceuticals and commodities. The goal of this support was to facilitate a transition to the MoH and institutionalize coordinated, transparent forecasting and quantification activities.

In addition, PMI provided support to the MoH, MSL, and other stakeholders to improve the collection, management, and use of logistics data through eLMIS, which was approved for national implementation in 2014. Developers designed eLMIS as an innovative tool that electronically gathers malaria logistics data (e.g., stock on hand, consumption, losses and adjustments, etc.) 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 percent 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 EMLIP to track and monitor consumption of essential medicines including malaria commodities. EMLIP was initially rolled out as a pilot to 16 districts in 2009, but has since been rolled out to all districts and health facilities in Zambia.

In order to strengthen MSL's capacity for last-mile distribution, USAID, with funding from PEPFAR and in collaboration with the Global Fund, supported the construction and racking of seven regional warehouses. This activity focused on procurement of racking material and kitting of regional warehouses in Choma (Southern), Luanshya (Copperbelt), Mansa (Luapula), Mpika (Muchinga), and Mongu (Western). In addition, USAID, with funding from PEPFAR and in collaboration with the Global Fund, supported the kitting of the Central Medical Stores (Lusaka). Construction and racking of the hubs is expected to be completed by end of FY 2018. The completion of the hubs will increase storage capacity for medical supplies including malaria commodities in targeted provinces. Currently, MSL hubs are operational in four regions: Chipata, Choma, Mongu, and Ndola. Where hubs exist, MSL delivers commodities down to the facilities. In other areas, they deliver to DHOs, who then fund and execute the distribution of commodities to the health facilities.

Progress during the last 12-18 months

In 2017, MoH, with support from partners, rolled out the eLMIS facility and central versions so that 450 health facilities and all DHOs, respectively, have now been reached. This innovation has enabled staff to enter logistics data and facility orders directly, as opposed to submitting paper forms to MSL. Where the facility version has not yet been rolled out, staff submit paper forms to DHOs, who then enter logistics data into the eLMIS central version and submit facility orders electronically to MSL. In addition, this has increased central-level visibility of stock management at facility level. Each year, the plan is to add 200 additional facilities, so that 1,050 facilities will be reached by the end of FY 2020. The use of the eLMIS has improved central level visibility and increased stock availability at both the central and health facility levels. Health facility reporting rates have continued to range between 98 percent-100 percent for the 2017-2018 period. Furthermore, the Commodity Security Center at the MoH recorded a 98 percent reporting rate and improved commodity facility level stock availability (100 percent) for malaria commodities in EMLIP districts for the period from January to April 2018. In addition, according to monthly reports sent to the Commodity Security Center from health facilities, no health facility reported a stockout of all presentations of ACT from January 2017 to April 2018.

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, artesunate injections, artesunate suppositories, ITNs, RDTs, and SP. The national core group successfully conducted a transparent forecast and quantification exercise for 2017 through 2019. The entire process was facilitated by MoH/NMEP staff.

PMI and USAID Zambia also participated in a national supply chain assessment. Among the overall supply chain findings, it was encouraging to note that not a single facility from those sampled across the country was found to be stocked out of all weight bands of AL. A preliminary report is currently available with the final report anticipated to be ready shortly.

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 a transport optimization network assessment for MSL in light of its new mandate to operate as a commercial entity and efficiently manage its distribution system.

Plans and justification for proposed activities with FY 2019 funding:

In collaboration with the MoH, PMI will continue strengthening the GRZ's commodities supply and logistics systems at the central, provincial, district, and health center level. PMI will provide support for continued supply chain system strengthening and roll-out of the eLMIS in collaboration with the MoH in order to ensure malaria commodity security at all levels of the health system. PMI will also leverage 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 storage in box units to support districts, and vehicles to transport commodities from the central level to the 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 the central, district, and health center levels. PMI will also work with the NMEP to institutionalize the exchange of procurement and shipping information on a monthly basis among major stakeholders, including Global Fund principal recipients (MoH and CHAZ), PMI, GRZ procurement centers, and MSL.

Additional activities in the pre-elimination districts in Eastern Province are described in the Pre-Elimination section.

Please see Table 2 for a detailed list of proposed activities with FY 2019 funding.

b) Social and behavior change communication

NMEP/PMI objectives

The NMEP launched the new National Communication Strategy for Malaria Elimination on World Malaria Day in April, 2018. This strategy is in support and alignment with the NMESP 2017-2021 and the National Health Strategic Plan. Target audiences are also identified and measurable communication objectives are clearly stipulated. All institutions working on malaria, including public and private organizations, NGOs, and PMI are required to follow the national strategy. Table S summarizes key objectives and indicators developed for the National Communications Strategy for Malaria Elimination.

The NMEP believes that both national-level and community-level SBCC activities are needed to change and maintain behaviors related to 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. Part of the monitoring and evaluation strategy for SBCC will be to analyze information collected through the 2018 MIS regarding knowledge and practices, as well as coverage estimates (i.e., final results of SBCC efforts). Implementation of the plan will be informed by the findings of a PMI-supported formative research study, which is planned for late 2018.

The following table is a list of objectives developed for the National Communications Strategy for Malaria Elimination. Currently, not all objectives apply to PMI-supported provinces and districts due to the burden of disease and focus on control activities. In the future, specific SBCC indicators will be ascribed to each objective. The baseline and targets for these indicators will be informed by a PMI-supported formative research study that is planned for late 2018.

Table S: Behavioral and Communication Objectives for Key Malaria-Related Behaviors

Behavioral Objective
• All pregnant women have ITNs and use them every night, all year-round. • All household members, including adolescents, have access to ITNs and use them appropriately/allow their households to be sprayed/clear stagnant water in surroundings. • Migrant populations carry ITNs wherever they go/have a responsibility to allow their homes to be sprayed.
Communication Objectives
• To increase knowledge of malaria/the mosquito. • To increase understanding of ITNs/IRS/larval source management activities and increase the awareness of the benefits of vector control. • To communicate the community benefit of vector control.
Behavioral Objective
• To increase the number of women taking at least four doses of IPTp during pregnancy. • To increase the number of men/husbands supporting their spouses during ANC. • To increase the number of symptomatic people who seek care within 24 hours. • To improve the quality of care and prevent misdiagnosis.
Communication Objectives
• To increase the number of pregnant women and women of childbearing age with knowledge of the importance of IPTp and early ANC. • To increase the number of men/husbands who understand the importance of ANC. • To increase the number of people with knowledge of the common symptoms of malaria. • To increase the number of people that know how to seek malaria testing and treatment. • To stress the importance of conducting a malaria diagnostic test before prescribing medication.

Behavioral Objective
• Record every case into the register, aim for zero clinical diagnosis. • Submit case management and community details into the reporting system on time each week. • Based on data, order enough supplies to provide quality healthcare. • Insist on blood test before receiving and malaria treatment. • If you test positive, adhere to the complete treatment course.
Communication Objectives
• To increase the number of districts adopting Component B strategies. • To increase trust in health service delivery by clinicians. • To increase understanding of the importance and use of data. • To increase understanding of malaria services available. • Increase understanding on malaria treatment.
Behavioral Objective
• To increase the percentage of people participating in mass drug administration, in particular those who move for fishing and farming (seasonal migration) and adolescents. • To increase the percentage of people-adhering to the three-day regimen. • To increase the number of religious leaders actively promoting mass drug administration from their pulpits. • To increase the number of community leaders publicly testifying on the benefits of mass drug administration
Communication Objectives
• To increase thee understanding of symptomatic vs. asymptomatic malaria. • To increase the understanding of mass administration drugs (currently dihydroartemisinin-piperaquine (DHAP)). • To increase awareness of the community benefits of mass drug administration participation, and demonstrate safety by having CHWs and leaders take their first dose during a village meeting. • To inspire community leaders to become “malaria champions.”
Behavioral Objective
• Increase the number of community members seeking medical services from their resident CHW. • Increase the number of household members who accept malaria testing, even when they do not feel sick. • Increase the number of communities providing incentives to their CHWs. • Timely and accurate data reported by CHWs. • Quality care being administered by CHWs. • Follow-up on all index cases.
Communication Objectives
• Increase trust in CHWs. • Increase understanding of asymptomatic malaria and the disease transmission. • Increase appreciation for the community-wide impact of a single malaria case. • To be armed with durable and appropriate materials for engaging homes. • To communicate how CHW work is part of a larger effort to end malaria.

Behavioral Objective
• Strengthen malaria surveillance systems. • Expand training to the delivery of other healthcare services (while continuing to test and treat every suspected case of malaria). • Increase/maintain treatment seeking behavior. • Increase number of community advocates for malaria elimination. • Increase the number of businesses supporting malaria elimination. • Sponsor, celebrate, and recognize the attainment of malaria-free status. • Increase the number of malaria-free zones.
Communication Objectives
• Increase the understanding of malaria elimination – both the requirements and benefits. • Recognize community effort to achieve malaria-free status. • Increase awareness of malaria elimination campaigns in local areas.

Source: National Communications Strategy for Malaria Elimination April 2018

Progress since PMI was launched

To date, PMI progress on SBCC has included the development of communication and training materials used by SBCC implementing partners working in malaria prevention and treatment. For example, case management training for health workers, CHAs, 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 communication strategy, training materials, and tools are also 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 Peace Corps volunteers in their efforts to work with local NGOs on implementing malaria SBCC activities in various provinces.

PMI supports several vehicles for its communication activities in target provinces. Activities include community mobilization and community dialogues that focus on: (1) increasing use and reducing misuse of ITNs, (2) increasing ANC attendance with higher IPTp uptake, (3) strengthening healthcare-seeking behaviors, and (4) acceptance of IRS. PMI also supports the implementation of integrated community-based communications focusing on the promotion of malaria prevention, diagnosis, appropriate treatment, and nutrition for pregnant women and children under-5 years of age in select districts and communities across four higher malaria burden provinces.

From 2006 to 2015, SBCC efforts contributed to improved malaria knowledge among Zambians, including on nets as a malaria prevention method (from 78 percent to 91 percent), and on fever as a symptom of malaria (from 65 percent to 80 percent). The percentage of those who recognized that mosquito bites cause malaria increased from 80 percent in 2006 to 89 percent in 2012, but decreased to 85 percent in 2015. This could be attributed to placing an emphasis on using ITNs, without providing a clear explanation on the reason for their use.

Progress during the last 12-18 months

PMI has been providing technical assistance to the MoH to strengthen malaria SBCC by developing and implementing community-level SBCC activities, which focus on malaria care-seeking and 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 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 is also included in the curriculum for CHWs and SMAGs, and PMI provides support for CHWs and SMAGs to implement SBCC interventions in their communities.

In 2017, the NMEP developed SBCC materials for the universal ITN mass distribution campaign. These materials were developed directly with PMI to be used in Luapula Province, have been adapted for use in other areas throughout the country. This included radio messages that were aired before, during, and after mass campaign. In addition, there were talking points developed for use by traditional and religious leaders on community radio stations and public announcements. PMI also supported revisions to the ITN distribution guidelines, which identified key SBCC objectives, including promoting increased ITN use, stopping misuse, and promoting net care and repair. To promote community acceptance, the PMI-supported 2017 ITN campaign in Luapula Province relied heavily on village elders and other traditional leaders to assist in enumeration and distribution, as well as the promotion of messages focused on the value of ITNs in preventing malaria cases and deaths.

To maximize uptake of IRS at the community level, PMI worked with the NMEP to develop an IRS communications strategy for the 2017-18 spray campaign. This included radio messages for the four high-burden provinces that PMI supports and was complimented with active demand creation, as well as efforts to overcome misperceptions at the community level to decrease refusals. This effort was facilitated with data provided by the mSpray program, which provided a decision-management tool targeting structures that were not sprayed during the initial round. Face-to-face interaction with households demystified and corrected any misconceptions about IRS in addition to educating households on their roles and responsibilities before, during, and after spray activities. For assessment of impact on household behaviors and perceptions, PMI will rely on the 2018 MIS to examine changes related to IRS since the 2015 and 2012 surveys. To enhance the reliability of the MIS results, PMI funded oversampling will take place in the focus provinces of Luapula and Muchinga.

CHAs are MoH employees on the GRZ payroll. The intent is that CHAs spend 80 percent of their time in the community and 20 percent of their time at health facilities. However, as previously mentioned, currently CHA coverage is low, and in some instances CHAs spend a significant amount of time in health facilities. In communities where CHAs are present, PMI supports their SBCC activities. In a continued effort to support community level health workers, PMI support 19 community-based organizations and civil society organizations through a grant process that is underway in 2018. These activities will take place in 24 districts within PMI-supported provinces.

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. Furthermore, 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 project is planned to inform implementation of the National Communications Strategy for Malaria Elimination. This project will also be aligned with the NMESP and aimed at identifying evidence-based strategies for the country's changing malaria epidemiology. Emphasis will also be placed on targeting messages, mediums, and approaches according to different contexts and audiences. Below are the proposed objectives and methodological approach for the project.

Objectives of PMI-supported formative SBCC research

1. To understand and describe how communities respond to malaria prevention and treatment interventions;
2. To describe the facilitators and barriers influencing community responses to malaria prevention and treatment interventions;
3. To identify behavior change priorities for specific eco-epidemiological profiles and different audiences;
4. To describe the health information needs associated with behavior change priorities and audiences, for different levels of organization (central, provincial, district, community, and household);
5. To define evidence-informed malaria prevention and treatment message themes and how they may be effectively delivered to different audiences; and
6. To describe the status of communication resources and capital for effective implementation of the national malaria communication strategy

Methodological approach

The research will use mixed methods, specifically qualitative focus group discussions, a semi-structured health worker survey, and a quantitative cross-sectional focused communication survey. The rationale for use of these methods is the ability to obtain a large volume of data expeditiously and more cost- and time-effectively than with other methods such as individual interviews. The target population is males and females 18 years of age and older residing in the selected areas.

Plans and justification for proposed activities with FY 2019 funding

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.

At the national level, PMI will support 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. National SBCC efforts for malaria in pregnancy are part of a larger integrated campaign on maternal health and nutrition that disseminates messages through national radio and television spots. Lastly, activities will aim to increase early care-seeking behavior for fevers, demand for malaria diagnosis, and adherence to treatment.

In four target provinces (Luapula, Northern, Eastern, and Muchinga Provinces), PMI will support community-level SBCC by working through health facilities, community-based organizations, and CHWs. This will lead to increased acceptance of IRS, increased ANC attendance with higher IPTp uptake, improved healthcare-seeking behavior, and increased demand for and acceptance of malaria diagnostics. The approach will include funding NGOs/faith-based organizations to increase ITN ownership and correct and consistent use of ITNs. The primary focus will be to target late adopters, as they typically 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, which recommend 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, as well as adherence to treatment and use of treatment services at the community-level. Support will be split across two partners as FY 2019 will be a transition year between projects.

PMI investments to improve IRS acceptance will be channeled largely through the IRS implementing partner, because in IRS the critical SBC activity is door-to-door education and mobilization timed just prior to spray operations. In PMI focus districts for IRS, activities and messages during the lead-up to IRS campaigns will be tailored for the engagement of key stakeholders, including political and religious leaders, community leaders, and members of the mass media. In urban and periurban areas, which usually have lower acceptance of IRS, messages will need to be adapted, if coverage is to be expanded. (Budget captured under IRS implementation.)

Both SBCC implementing partners have a set of SBCC performance indicators as part of their approved workplans. As a cost-saving measure, they will rely on the 2018 MIS results to assess the status of knowledge, attitudes, and practices, in comparison to the 2015 and 2012 MIS. The indicators address perceptions of malaria risk, attitudes toward products/practices/services, and so on. PMI funded over-sampling in the focus provinces of Luapula and Muchinga will allow for more granular data that can be used for targeted planning and monitoring in these areas. PMI will work with the NMEC and implementing partners to identify formal and informal methods of data collection to evaluate progress toward the communication and behavioral objectives identified in the National Communications Strategy for Malaria Elimination.

All 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.

Additional SBCC activities in the pre-elimination districts in Eastern Province are described in the Pre-Elimination section.

Please see Table 2 for a detailed list of proposed activities with FY 2019 funding.

c) Surveillance, monitoring, and evaluation

The recently launched NMESP 2017–2021 strongly emphasizes the importance of a robust SM&E system 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 MoH/NMEP and partners to process, present, interpret, and disseminate malaria data from services delivery points for use in timely decision-making. Malaria surveillance data can be used to identify areas in need of interventions, measure the impact of interventions, and guide policy and decision-making. A revised National Malaria SM&E Plan has been developed to complement the NMESP 2017–2021 and address the challenges in Zambia as it moves toward eliminating malaria.

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; and
- 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 key objectives and strategies from the National Malaria SM&E Plan are as follows:

Objectives:

- To strengthen and enhance SM&E systems so that key indicators are reliable, can be accurately tracked, and data can be used strategically to inform malaria programming at the national, provincial, district, facility, and community levels.
- To assess the impact of the NMESP 2017-2021 and measure successes in reducing malaria burden.

Strategies:

- Strengthen capacities at the community, facility, district, provincial, and national level for malaria surveillance and monitoring to provide feedback to the NMEP, Roll Back Malaria partners, and other relevant authorities in order to improve malaria program planning, management, and accountability.

- Strengthen and enhance malaria data management systems at the 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 SM&E across the NMEP by working with each program area to enhance their capacity to manage and use data for programming.

PMI's support of SM&E in Zambia aligns with the NMESP, as well as the National Malaria SM&E Plan. PMI coordinates and collaborates with the NMEP and several partners, including MACEPA, the Global Fund, UNICEF, and WHO, in providing technical assistance and resources for SM&E activities. PMI also provides logistical and technical assistance to the SM&E and Operations Research Technical Working Group, which meets quarterly to provide national-level coordination and leadership in this area.

Table U: Surveillance, Monitoring, and Evaluation Data Sources

Survey Activities	Year								
	2012	2013	2014	2015	2016	2017	2018	2019	2020
Demographic Health Survey (DHS)			X				(X)*		
Malaria Indicator Survey (MIS)	X			X			X		
Health Facility Survey						X*			
Service Provision Assessment				X*					
End-Use Verification Survey	X	X	X	X	X	X	X	(X)	(X)
Knowledge, Attitudes, and Practices Survey							(X)*		
Malaria Surveillance System (MRRS) – Selected Provinces			X	X	X*	X	X*	(X)	(X)
HMIS/DHIS2		X	X	X	X	X	X	(X)	(X)
Electronic Logistics Management Information System (eLMIS)			X	X	X	X	X	(X)	(X)
In Vivo Efficacy Testing		X			X		(X)*	(X)	
Entomological Surveillance and Resistance Monitoring	X	X	X	X	X	X	X	(X)	(X)
Malaria Program Review		X			X			(X)	
Malaria Impact Evaluation			X*						
National Supply Chain Assessment						X*			

(X) Indicates an activity is planned

*Non-PMI funded

Progress since PMI was launched

Surveillance and monitoring:

Malaria data from the HMIS are used routinely to follow trends in incidence at the provincial, district, and HFCA levels. Consistent with the stratification of intervention packages by HFCA according to case incidence trends, public health authorities in Zambia routinely following trends in confirmed cases and diagnostics use, and may change approaches in areas where incidence has been increasing. For example, districts may target HFCAs for IRS in the upcoming spray season, and low endemicity area may direct mass drug administration or increased Step D activities to hot spots.

Since 2014, the national HMIS has been run on the DHIS 2.0 platform in all districts. 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. The HMIS collects data on malaria clinical and confirmed cases, outpatient department, and inpatient cases, and deaths, all by age under one year, one to five years, and over five years. Information flows from the health facility to the district and provincial levels, before being transmitted to the HMIS group within the MoH. The NMEP accesses malaria data from the MoH HMIS and also maintains its own web-based data management system using the DHIS2 platform. At the national level, DHIS2 provides significant improvements over the previous platforms (DHIS 1.4 and paper-based systems) in terms of timeliness of reporting, data visualization, and data systems management. However the system's strength remains data storage, not visualization. The NMEP, with support from MACEPA and other partners, has increasingly made use of Tableau software for data visualization.

With consistent support from PMI, the Global Fund, MACEPA and other partners, capacity building activities have been conducted at all levels of the health system in SM&E. A 2017 data quality assurance exercise supported by PMI in its four focus provinces suggests that great strides have been made in some HMIS quality measures, including completeness (100 percent of reports sampled) and timeliness (86 percent), but that data accuracy remains a challenge (average monthly score of 31 percent).

In Southern Province, where most HFCAs and districts have reached pre-elimination levels, enhanced malaria surveillance systems have been developed, which utilize the malaria rapid reporting system (MRRS) and incorporate mobile phones and geographic information system data. In select facilities, healthcare workers report malaria cases, laboratory testing, and drug availability by web-enabled cell phones or tablets. Although it may be considered a parallel system, the MRRS feeds into the HMIS, while meeting the pre-elimination setting's needs for timely, high-quality data capture. Community health workers, who in low-endemic HFCAs are engaged in both passive (CCM) and active (Step D) case detection, report monthly. Health facilities report weekly through the MRRS and monthly through HMIS, working from common paper-based registers. The NMEP is pleased with the functionality of this approach and is working to replicate it throughout the country, with priority on the pre-elimination HFCAs (stratification levels one and two). As of late 2018, the MRRS system was being scaled up to selected districts in Central and Western Province with MACEPA support, and to selected districts of Eastern Province with PMI support. Given the urgent ambitions to accelerate toward

elimination, the NMEP has decided not to wait for the development and deployment of a truly integrated system.

The MoH does plan to eventually deploy a long-planned-for Community Health Information System (CHMIS), but this remains in development under the MoH Program Management Unit. With MACEPA support, the MRRS is being scaled up in Western Province, and with PMI support is planned for scale-up in the pre-elimination districts of Eastern Province.

Evaluation:

The major tools for evaluating outcomes and impact of malaria prevention and control activities in Zambia are the periodic nationally representative surveys, namely the DHS and the MIS. Nationwide MISs were carried out at the end of the rainy seasons 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. Data collection in the 2018 MIS has been completed in May 2018, but data analysis was pending at the time of MOP writing.

The most recent Zambia DHSs were conducted in 2007, 2014, and 2018 (planned). Although the DHS does not include malaria biomarkers and has not been timed for malaria peak season in Zambia (unlike a MIS), its crucial contribution is determination of all-cause mortality in children under-5 years of age. Numerous other child and household health indicators are collected by the DHS and used in assessing malaria control impact. The 2007 DHS report provides a baseline estimate of mortality at the start of PMI in Zambia.

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 (such as ITNs and IRS), contributed to declines in under-5 mortality in Zambia during 1990–2010, but it was not statistically possible to quantify the individual impact of these interventions on under-5 mortality.[7] However, a follow-on study concluded that "increased ITN coverage is associated with decreased malaria morbidity and use of health services for malaria illness in Zambia during 2009– 2011."[8]

A number of other surveys and evaluations not funded by PMI have provided 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 healthworker performance and the quality of healthcare and the 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 healthcare. Table U shows household and facility surveys implemented and planned from 2010 to 2019.

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

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

Progress during the last 12-18 months

In 2017, all four PMI focus provinces, with technical and logistical support from PMI, managed to conduct data quality audits, covering 188 randomly selected health facilities in all the districts. The audits were coordinated by the Public Health Offices through their respective Senior Health Information Officers (SHIOs). The project also supported malaria data review meetings and health facility supervisory visits by DHOs. This was based on the understanding that the improvement of data quality and related practices cannot be attained without adequate supervisory follow-ups on findings and action plans decided. The 2017 audits demonstrated timeliness and completeness of 100 percent, while data accuracy measures were lagging at 31-48 percent. This will be reassessed later in calendar year 2018. Impact of the participatory data review process arises from: (a) providing immediate technical support in weak areas; (b) developing action plans with clear timelines on when such issues would be resolved; (c) creating awareness by staff of being audited and creating the expectation to record better results in subsequent visits; and (d) increasing understanding by supervisors of malaria case management and data quality issues. Regarding HMIS and DHIS2 training, there is no formal documentation of impact.

In 2018, PMI is continuing to provide technical and material support to the MoH to conduct data quality audits (DQAs) in health facilities and CHW programs, covering both the HMIS and MRRS. This support will be given through respective PHOs with technical oversight by central-level NMEP and employing a standard national DQA tool. PMI supports activities aimed at enhancing data quality in order to improve timeliness, accuracy, and completeness of malaria data.

In 2017, among many contributions to RMIS strengthening, PMI supported the training of 222 health facility staff toward ensuring that each facility in the focus provinces had at least one person trained in HMIS. The purpose was to strengthen HMIS reporting by having adequate capacity to compile and submit complete and reliable monthly reports to the district. PMI also supported DHIS2 training for 66 PHO and DHO staff, aimed at enhancing the capacity of DHO and PHO staff to analyze and utilize malaria data for decision-making. Dashboards for both community surveillance and facility routine HMIS reporting have been developed and are currently being tested with the HMIS and NMEP teams. These dashboards will continue to be refined through PMI-supported training and data review activities. The expected impact is improved reporting by facility staff and improved use of data for planning meetings at levels of the malaria task force, district, and province.

PMI is continuing to provide technical assistance to enhance standardization and reporting of facility- and community-level data, including community surveillance data. This technical assistance is aimed at ensuring that the data collected is analyzed and used for decision-making at various levels. For example, to ensure effective tracking of malaria incidences at health facilities and for well-informed community surveillance decisions, PMI is supporting the profiling of health facilities according to epidemiological zones, which will help in the packaging of interventions according to the malaria endemicity of specific locations.

At the national level, PMI is: (1) providing ongoing technical assistance for cleaning malaria data elements and indicators in HMIS; (2) supporting national-level SM&E coordination with

partners such as MACEPA, the Clinton Health Access Initiative, and others; (3) supporting SM&E technical working group meetings; and (4) providing technical assistance to enhance standardization and reporting of national, facility, and community-level data in HMIS. At all levels, PMI coordinates with other USAID-supported programs and non-USG partners working in SM&E in order to leverage resources and avoid overlap.

Finally, in 2018, PMI was a major partner, together with the Global Fund and MACEPA, in supporting the GRZ to conduct the 2018 Zambia MIS. In coordination with these partners, PMI has or will provide logistical, technical, and financial assistance in such areas as planning, training of field staff, field work, processing of laboratory samples, data analysis, writing, and dissemination of findings.

Plans and justification for proposed activities with FY 2019 funding

The monitoring and evaluation of malaria prevention and control activities will rely on a combination of routine malaria data through the HMIS and surveys. Although the DHIS platform has been in Zambia for quite some time, not all health posts and health facilities are using DHIS2 correctly and the accuracy of data is lower than expected, although completeness and timeliness have improved. Sustained effort and leadership is needed to ensure that all facilities generate accurate data, incorporate the DHIS community component, and that the GRZ provides leadership and strategic vision for utilizing the data at all levels.

With FY 2019 funds, PMI will provide support to strengthen routine malaria data collection at the community, health facility, district, provincial, and national levels through the HMIS. Zambia exhibits a stronger culture of data tracking and disease mapping at all levels than many comparable, high-burden malaria countries. Improving trends in data completeness and timeliness, case confirmation rates, and the routine use of data for planning and advocacy at the district level would suggest that past PMI and Global Fund investments have had impact. Going forward, the objective is to achieve 100 percent on-time reporting and accuracy of malaria cases by districts and 90 percent by health facilities in PMI-targeted provinces. PMI will ensure that SM&E activities at the national level and in the four PMI-supported provinces are complementary. PMI will continue to support DQAs as a proven tool for improving system performance. In Zambia, community-level case management through scale-up of 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. Support for routine surveillance strengthening in the four PMI focus provinces will be split across two partners as this is a transition year between projects.

PMI support at the national level will continue. The SM&E Technical Working Group meets quarterly and has been among the more effective technical working groups. Through this technical working group, PMI will support the NMEP and its partners in: (1) ensuring that existing policies and guidelines are in line with current technical standards, (2) collecting and reviewing evidence to inform program implementation, and (3) ensuring that program activities are well-coordinated and implemented. In addition to support for the technical working group, other national support included strengthening malaria policies and guidelines, which involved conducting the end-term review and development of the new elimination strategic plan.

The next national MIS is planned for 2021. Given the time-sensitivity of MIS preparation and implementation, one half of PMI-support for this activity is included in this MOP, with the second half planned for the FY 2020 MOP. The MIS data is expected to be publicly available. Per usual Zambian Central Statistical Office practice, data sets are made available on request, but not posted on a website.

Additional activities in the pre-elimination districts in Eastern Province are described in the Pre-Elimination section.

Please see Table 2 for a detailed list of proposed activities with FY 2019 funding.

d) Operational research

NMCP/PMI objectives

In 2017, PMI supported the NMEP to develop a list of priority malaria research topics by thematic area for the 2017-2021 timeframe. The NMEP is now considering how to prioritize and initiate activities on topics that are not currently being addressed. The thematic areas include vector control, case management, MIP, health systems/program management, SBCC, monitoring and evaluation, elimination, and epidemic response.

Progress since PMI was launched

PMI supported an operational research project on ITN durability that was completed in 2013 (see ITN section). The study, which examined the structural integrity of ITNs distributed in Northern and Luapula Provinces, was started in 2011 and 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 2-3.5 years. At 27-30 months, ITNs already had a large total hole surface area that was equivalent to the oldest nets observed. Nets were often tucked under reed mats which may explain the finding that the largest hole area was found in the lower half of the net.[9] These data fed into a PMI-wide pooled analysis that identified factors influencing ITN durability across countries.

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 NMEP are currently working to identify opportunities for regular molecular monitoring of SP resistance. (See the MIP section for more information.)

The first phase of a two-part IRS targeting study, titled "Modeling the impact and cost-effectiveness of focal IRS with pirimiphos-methyl in Nchelenge District: Identifying targeting strategies to maximize protection while minimizing cost," was completed in 2016. This study

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

modeled different IRS targeting strategies to identify promising methodologies, which were then tested in the second phase of the study (see below).

Finally, a study titled "Association between malaria control scale-up and micro-economic outcomes: evidence from a retrospective analysis in Zambia" was completed in 2016. 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 microeconomic 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 on the distribution of ITNs and IRS from 2006 to 2010, this study examined whether the scale-up of those activities in Zambia is associated with improved microeconomic outcomes at the household level. Results indicated that microeconomic outcomes increased (33 percent increase in food spending) concurrently with malaria control coverage (62 percent increase) from 2006 to 2010.[10] 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 microeconomic 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.

Progress during the last 12-18 months

The second phase of the IRS targeting study, "Comparison of different indoor residual spraying strategies to maximize finite resources in Zambia: A comparison-control trial, Eastern Province, Zambia," is currently underway. Despite implementing epidemiologically targeted IRS in Eastern Province, questions remain about how to best distribute finite IRS resources, as well as what targeting strategy is most appropriate. The study is examining 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) geographically concentrated spraying is applied to one district and the other receives no spray, (2) both districts receive HMIS data-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 primary outcome is parasite prevalence by PCR and secondary outcomes include parasite prevalence by RDT, anopheline mosquito density per household, insecticide resistance profiles, and cost effectiveness. By matching IRS impact to parasite prevalence and mosquito vector abundance, the cost-effectiveness of two focal IRS strategies in reducing parasite prevalence is being measured.

[10] 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

IRS took place from October to December 2017, and entomological collections began in December 2017. Preliminary results are expected in July 2018, with final results and manuscripts expected in September 2018.

Table V: PMI-Funded Operational Research Studies

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 Microeconomic 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	$503,875
Planned OR Studies FY 2019			
Title	**Start Date**	**End Date**	**Budget**
None			

* PMI core-funded OR studies.

Plans and justification for proposed activities with FY 2019 funding:

No operational research activities are planned in the FY 2019 MOP.

Please see Table 2 for a detailed list of proposed activities with FY 2019 funding.

e) Other health systems strengthening

NMEP/PMI objectives

The NMESP vision, goals, and objectives are focused on working towards a malaria-free Zambia. The NMSP is anchored to the broader National Health Strategic Plan (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, 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 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

PMI supports a broad array of health system strengthening activities which cut across intervention areas and support the six building blocks laid out in the NHSP. These activities include training of health workers, supply chain management and strengthening, and health information systems strengthening, which are all described in other sections of the MOP. In addition, PMI supports capacity building at the NMEC, whose staff are committed to malaria control and elimination but are currently understaffed to carry out their work to effectively supervise provincial, district, and community-level activities and effectively coordinate the many partners contributing to malaria efforts in Zambia.

PMI support for technical assistance and capacity building from the central level at the NMEP down to community level has, together with many other interventions for malaria and other diseases, have resulted in a 55 percent reduction in all-cause mortality rates for children under-5 years of age (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. The study also showed that hospital spending on malaria interventions decreased by a factor of ten.[11] In addition, despite some increases in the total number of reported malaria cases in recent years, the number of reported inpatient cases and deaths due to malaria has been reduced by 52 percent and 65 percent, respectively. This is likely due in part to better access to, and quality of, case management, including increased testing and treatment at the community level. The national HMIS has also been upgraded from the DHIS 1.4 to 2.0, offering significant improvements in timeliness of reporting, data visualization, and data systems management, and contributing to a growing data-driven culture within the Zambia public health system.

PMI has also supported capacity-building through the Field Epidemiology Training Program (FEPT) program and Peace Corps. The FETP program in Zambia began in 2014. Since then, one PMI-supported FETP resident and one intermediate-level (Level One) resident have successfully completed the training. One graduate is currently serving as a PHO in Western Province and is actively involved in malaria programming and surveillance activities.

Peace Corps Zambia is one of the world's largest program, with more than 300 volunteers posted in all provinces, and a large contingent of volunteers working in health. Since the Peace Corps Stomp Out Malaria Initiative began more than six years ago, Peace Corps has provided training on malaria social and behavior change to all volunteers and encourages each volunteer to consider malaria work as a side project if not their main activity. Collaboration with Peace Corps included support for a third-year position as Malaria Coordinator, a small grants program to promote social and behavior change in community-based interventions, and joint implementing and publishing of an ITN durability monitoring study. In 2016, Peace Corps volunteers helped

[11] 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.

train more than 1,000 community mobilizers in malaria behavior change communications and 62 teachers in malaria prevention.

Progress during the last 12-18 months

Currently, PMI is supporting capacity-building activities for the NMEC, including support for their training and professional development needs, as well as support to strengthen management capacity of provincial and district MoH personnel to improve oversight and coordination of malaria prevention and control interventions. PMI supports one FETP resident, placed at the NMEC. Currently, this advanced FETP candidate works on the SM&E team at the NMEC, where the quality of mentorship has developed a good reputation.

In FY 2016 and FY 2017, PMI developed a modest pipeline ($40,000) of funding intended for Peace Corps grants and other support. For this reason no additional funding is proposed in FY 2019. There are plans to reinvigorate the collaboration by the end of 2018. PMI did support a third-year Peace Corps Malaria Coordinator through the end of 2017. Additionally, the PMI Resident Advisors (RAs) provide subject matter expertise to the Peace Corps Malaria Coordinator who helps inspire and coordinate the 300 Peace Corps volunteers and trainees in Zambia who are all encouraged to conduct malaria-related activities. A volunteer malaria committee remains active even though the third-year position is vacant.

Plans and justification for proposed activities with FY 2019 funding:

With FY 2019 funding, PMI plans to focus on capacity-strengthening and malaria health system improvements at the 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. PMI will also continue to provide support to strengthen NMEP staff capacity through professional development activities and through participation in the FETP program either at the intermediate or advanced level for one Zambian national.

Please see Table 2 for a detailed list of proposed activities with FY 2019 funding.

f) Pre-elimination

Background

Beginning in FY 2017, PMI Zambia has received an additional $5 million per year in funding earmarked for investments in pre-elimination districts. Zambia was selected to receive this additional support for several reasons, including:

(1) A track record of progress in malaria control, especially in Southern Province, which witnessed a decline in under-5 prevalence from 13.6 percent in 2006 to 0.6 percent in 2016. As previously mention, this was associated with sustained high coverage of a package of interventions, namely universal ITNs, targeted IRS, community case management, SBCC with good community engagement, and intensive surveillance, which were supported largely by the Global Fund and Gates Foundation/MACEPA;

(2) Strong commitment to malaria elimination among the country's political and public health leadership, as embodied in the country's NMESP 2017-2021; and
(3) PMI's experience of effective collaboration with the GRZ and its partners in malaria control, particularly in the PMI-focus provinces of Luapula, Muchinga, Northern, and Eastern.

A set of reduced-burden districts on the plateau of Eastern Province were identified as potential pathfinders, who with enhanced malaria control investments might be able to achieve pre-elimination status in a relatively short period of time. According to a 2006 baseline prevalence model, these areas had malaria prevalence of less than 10 percent (Riedel et al., *Malaria Journal* 2010 9:37). The three districts with the lowest 2017 case incidences in Eastern Province were Katete (100 per 1000 population, NMESP level two), and its neighbors Sinda District (210 per 1000 population, lower level three) and Chadiza District (320 per 1000 population, level three). Their combined population in 2017 was estimated as 545,090. (Figure 14). The local epidemiology will be further characterized by a PMI-funded baseline assessment, which is being conducted in the fourth quarter of calendar year 2018 and will draw upon rich datasets, including biomarkers and intervention coverage levels from the 2018 MIS (which was over-sampled for Eastern Province); PMI-supported entomologic monitoring data from the Katete sites since 2014; the PMI-supported IRS operations research study of 2017-18; local HMIS data; and remote-sensed environmental data, among others.

Figure 14: District Map of Eastern Province, Zambia, Showing Proposed Focus Districts

(Source: Ministry of Lands, 2014)

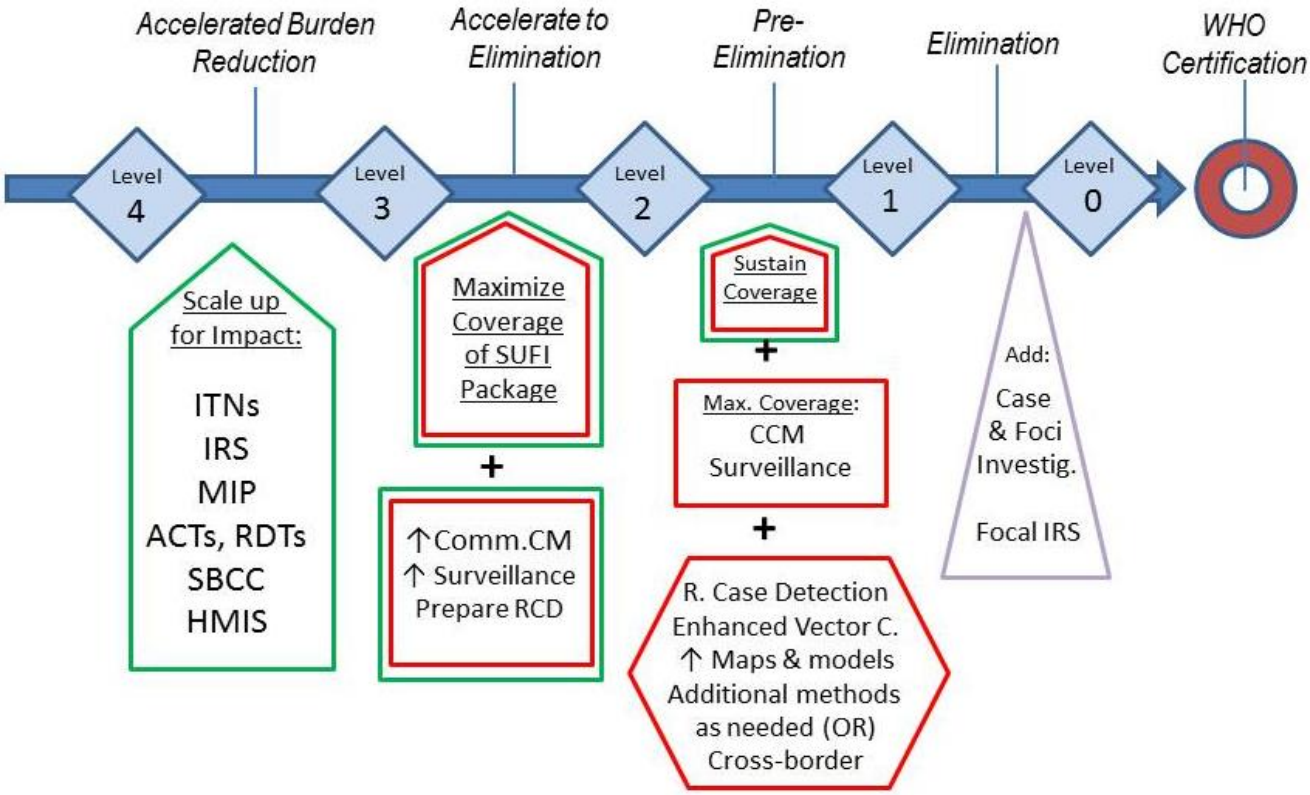
Taken together with the adjacent, lower-burden HFCAs of Petauke and rural Chipata District, this contiguous area constitutes the target "three to five pre-elimination districts" for PMI focus in FY2017, FY2018 and FY2019. There is an expectation for future geographic expansion of pre-elimination work as epidemiologically appropriate in the future, potentially linking with areas of Lusaka, Southern, and Western Provinces to create a zone of malaria pre-elimination/elimination along the southern borders of Zambia.

Strategic Approach to the Pre-Elimination Investments

The incorporation, since FY2017, of enhanced activities in pre-elimination districts represented a new strategic direction for PMI Zambia, where instead of investing all resources in the highest

burden areas in order to maximize reduction of morbidity and mortality, PMI would invest a portion in already low-burden areas. Therefore, PMI, in consultation with the NMEP and partners, developed an explicit strategy for investing this district funding stream in the pre-elimination districts. This is illustrated in the schema in Figure 15. The approach is consistent with *PMI Technical Guidance.* It facilitates the vigorous pursuit of elimination and learning about elimination as a valuable, albeit lesser objectives in their own right, while not distorting or distracting from the main thrust of PMI Zambia's program.

Figure 15: A Schema for PMI Zambia Investments in Elimination



Key: · Main MOP investments in Green in 40 districts in 4 provinces.
· Additional PMI Elimination investments in Red in 5 districts in Eastern Province.
· Potential future investments in Purple as local incidence approaches zero.

The strategy recognizes that districts are not yet ready for the full package of malaria elimination activities (sometimes referred to as the malaria "end-game"), but the near-term goal is to pilot the push from moderate-to-low transmission to pre-elimination, thereby serving as a pathfinder for other districts in Zambia as they strive toward the NMESP target. PMI's guiding principles for pre-elimination investments are consistent with WHO guidelines and are drawn from the Zambian NMESP, namely:

- The unit of elimination and of intervention implementation will be the HFCA.
- Malaria incidence thresholds will guide the intervention package toward the goal of malaria elimination.

- Epidemiologic and entomological information (clarified using data reviews and verification procedures) will be critical in directing action and tracking progress,

Key objectives for the PMI Zambia investments in the pre-elimination districts include:

- Developing the building blocks for elimination. This includes refining core package of interventions needed to achieve and sustain impact and preparing the ground for accelerating activities.
- Documenting and sharing lessons learned and achievements.

As in many countries, PMI Zambia's strategic approach does not align 100 percent with the national strategy. Table C depicts the national strategy and the PMI strategy is depicted in Figure 15. While PMI embraces the concepts of stratification by HFCA, it differs somewhat in which interventions are seen as most appropriate at each level. For example, as shown in Figure 15, case and foci investigation would be appropriate for the elimination phase, i.e. in HFCAs which are at level one (case incidence <50/1000). At present, most HFCAs in districts are not considered ready for reactive case detection, due to high health worker caseloads. Moreover, PMI takes a more skeptical approach to the cost-effectiveness of mass drug administration, especially in higher transmission settings, as the effect is often transient and attaining high population coverage rates is challenging. No funding for MDA has yet been programmed. However, PMI Zambia may consider a trial of MDA in pre-elimination districts in the future, in the context of operations research.

In spite of such minor differences in approach, PMI's pre-elimination investments have been welcomed enthusiastically by MOH leadership at national, provincial, and district levels as providing resources crucial for meeting their ambitious targets. The joint PMI-GRZ efforts were kicked off in July 2018 at a successful workplan harmonization exercise, hosted by the NMEP in Lusaka. While the pre-elimination investments may carry the potential for transformative change, it is recognized that the endeavor will be highly challenging and PMI and its partners will need to stay flexible, focused, and maintain a data-driven approach.

Progress in the Past 12-18 Months

Initiation of a phased approach to implementation:
A phased approach is being employed, whereby the first thrust is to achieve high levels of the standard package of malaria control investments in the target districts, following by reassessment, and introduction of additional or modified approaches as warranted. Evidence from the baseline assessment and from the first two years of implementation (FY 2017 and FY 2018) will inform investments for FY 2019 and beyond. Strengthened local systems for data collection, management, and analysis would be expected to permit close monitoring of intervention coverage and impact during year one and two.

This phased approach may be outlined as follows:

Expected Implementation During Year One and Two (FY 2017 and FY 2018 Funds):
Attain High Coverage of Main Interventions

- Implement full package (ITNs, IRS, iCCM, Step D, SBCC) in Katete, Sinda, and Chadiza.
- Phase in CHW training and deployment over two years, implementing iCCM and Step D at scale.

- Build capacity for iCCM and community-based surveillance, including Step D, in selected HFCAs where appropriate, in the neighboring Petauke District and rural parts of Chipata District.
- Use the mSpray mapping technology and the results of recent PMI-funded OR on IRS targeting approaches to maximize true coverage of IRS and possibly other population-based interventions (ITNs, SBC, etc.).

Proposed Implementation During Year Three (FY 2019 Funds) and Beyond: Reassess, Add New Interventions as Appropriate

- Consider further geographic expansion of full package to adjacent HFCAs in Petauke, Chipata, and possibly other areas of the plateau.
- Consider adding new malaria control tools, such as attractive targeted sugar baits (currently undergoing testing in Southern Province), mass drug administration, and/or other interventions, in an OR setting.
- Continue IRS initiated with FY 2017 funds to ensure coverage for a minimum of three years to the newly targeted populations.

Status of malaria control interventions in the pre-elimination districts:
By early 2018, the three target districts had benefitted from relatively high coverage of the main malaria control interventions. PMI, CHAZ, the Global Fund, and AMF resources had supplemented GRZ resources in malaria control. Preliminary site visits and desk review provided the following initial summary of the status of malaria control interventions. A PMI-supported formal baseline assessment, planned for the second half of 2018 to kick off year-one implementation, is expected to provide more details.

- Entomologic Monitoring: The local entomologic profile is well known, as PMI has supported an entomologic monitoring site in Katete since 2014. The major vector is *An. funestus*, which is present throughout the peak transmission season (December-May) while *An. gambiae* tends to be found only late in the season (April-May). Significant biting behavior is noted from January through May at sprayed sites, continuing until August at unsprayed sites. A worrisome finding during the pirimiphos-methyl years, which potentially undermined the impact of IRS in this area, was the 4-5 month duration of action of the pesticide. Rates of indoor blood-fed mosquitoes were found to spike in peak season (March-April) at the time of waning efficacy of pirimiphos-methyl residues. However, the effect of waning insecticide efficacy is difficult to determine as the overall numbers of mosquitoes collected were very low in both sprayed and non-sprayed areas.

- IRS: All three districts were included in the 2014-2017 PMI-funded IRS campaigns. IRS coverage of the targeted areas in the district (measured as structures sprayed out of structures found) was 90 percent or above. IRS effectiveness (measured as population protected out of full district population) was 50-60 percent. The approach of prioritizing geographically concentrated structures was employed, such that more remote and difficult-to-access parts of the districts were likely not to be sprayed. In recent years Katete District, in particular the urban "BOMA" was observed to have high rates of IRS refusal, requiring additional SBCC efforts and extra investments in "mop-up" spray operations. Katete and Chadiza Districts were included in a 2017-18 PMI-supported OR

study regarding targeting approaches, and therefore benefited from detailed satellite mapping using the mSpray technology. Results are pending.

- ITNs: The three districts were included in Eastern Province's January 2018 mass distribution campaign. The nets were procured by AMF. Due to discrepancies between the census figures used to project ITN needs and the district head counts used during the campaign, there was an 18 percent shortfall in ITNs distributed. Field reports suggest that nets were rationed at the household level (e.g. by providing just three nets to a household that had been calculated to need four nets). Dating to a GRZ-funded program that ended in 2012, some CHWs still function as "malaria agents," who provide education on ITNs and encourage environmental measures to reduce breeding sites (e.g. filling ditches).

- Case management: Confirmatory testing rates are reported to consistently exceed 90 percent in the area, and RDT stockouts are rare. Community case management of malaria has been promoted in the setting of iCCM in the three focus districts and the two neighboring districts. Only a fraction of local CHWs have been provided iCCM training and commodities and are reporting monthly to their supervisors at health facilities, typically the environmental health technicians. In Katete and Sinda, for example, PMI-funded projects in 2017 helped to train and deploy 78 of the needed 594 CHWs to attain population coverage of 1:750. CHAZ had supported the training of a comparable number. ACT stocks are periodically unavailable, according to interviews during site visits in rural Chipata and Katete in May 2018. St. Francis Mission Hospital in Katete functions as a referral center for much of Eastern Province, while doubling as the district hospital for Katete. A small subset of local health facility clinicians and laboratorians have participated in case management quality improvement activities in recent years, such as OTSS and mentorship.

- Mass test-and-treat: Since 2015 there have been sporadic, highly focal exercises in mass test-and-treat supported by CHAZ in Katete District, targeting known malaria hot spots in hard-to-reach rural areas. For example, in early 2018 in Katete, 800 people of all ages were tested in one high-burden village (population 3110) in one HFCA (population 6000), with an unknown number treated in the field. This was said to have resulted in a reduced local case incidence, which persisted for 1-2 months. In the past year, approximately ten small communities have participated in such targeted test-and-treat exercises in Katete District. (As mentioned, PMI will not prioritize this sort of mass treatment activity, given its transient effect among other concerns.)

- Cross-border malaria: Each of the target districts border Mozambique. Facilities with malaria cases in residents of Mozambique frequently treated in border towns such as Mlolo in Katete and Nyanje in Sinda District. For example, at the Lunga health post on the border of Katete District and Mozambique, in April 2018 more than 100 of the 300 weekly confirmed malaria cases were reported to have been in cross-border cases. The Institute of Medicine has recently facilitated "tripartite" discussions between Zambia, Mozambique, and Malawi, with a view to start exchanging detailed information on HIV, malaria, and other case data.

Plans and Justification for proposed activities with FY 2019 funding

Enhanced Vector Control in the Pre-Elimination Districts:
To support a pre-elimination strategy, the expanded entomologic monitoring program in Eastern Province should be maintained. With the continued reduction in local vector populations and transmission indices, Katete's two sites (established in 2014) have become progressively less representative of Eastern Province, and in particular of the riverine habitats. To guide malaria control efforts in the rest of Eastern, and to inform future expansion of the elimination focus area to neighboring districts, a second site was added in rural Chipata in FY 2017. This site will continue to be supported with FY 2019 funds under the overall entomological monitoring budget.

Entomologic monitoring will continue to provide valuable data on local vectors, biting rates, resting densities, pesticide susceptibility, and pesticide residual activity, among other parameters, to inform year-by-year program design. As demonstrated in Southern Province, high coverage of both ITNs and IRS are central components in the package of interventions that can bring an area to pre-elimination status.

To maximize coverage of vector control, PMI will continue to invest in state-of-the-art tools, such as mSpray, to map the area and guide campaign workers at a finer scale. Based on the geospatial databases and operational lessons learned during years one and two, campaigns may be able to explore use of the mapping for multiple purposes, including SBCC, ITNs, CHW, geospatial analysis, and quality assurance.

ITNs: Universal ITN coverage, defined as one net per sleeping space, will be a fundamental component of malaria elimination efforts in the focus districts. It is expected that the districts will benefit from the planned national mass distribution campaign in 2020. Given the uncertainty generated by the NMEP's current plans to cover just 50 percent of the population in the national campaign, dedicated PMI resources will be needed to assure universal coverage targets in the districts are met. PMI will provide technical assistance and cover the distribution costs of ITNs distributed during the 2020 mass campaign in the three core elimination districts beyond the health facility level to the community level distribution points.

IRS: IRS can make meaningful additional contribution in a setting of high ITN coverage if high IRS effectiveness can be assured (i.e., high proportion of local population targeted and protected). In light of documented resistance to pyrethroids in northeastern Zambia, there is justification for IRS with non-pyrethroids to slow the development of pyrethroid resistance in the target area, thus protecting ITNs. This principle has been applied locally through the delivery of IRS with pirimiphos-methyl until 2017, and with clothianidin from 2018. Residual efficacy will continue to be a key parameter of interest. For good reason, the NMEP is acutely interested in seeing IRS campaigns across the country switch to longer-acting pesticides as soon as feasible, if such were to become available in the coming years.

To assure timely and high quality IRS application, PMI will continue to support the implementation of an IRS program in the three core pre-elimination districts. This will include: activities to train spray operators, supervisors, and storekeepers; monitoring and evaluation;

pesticide storage; waste disposal; and pay for spray operations. The mSpray system or a similar tool will be employed to optimize enumeration and implementation during IRS SBCC, spray operations, and post-spray monitoring. Based upon 80 percent coverage this will amount to 90,000 structures. If and when case incidences drop to pre-elimination level, certain locations may become appropriate for a shift to focal rather than blanket IRS.

Please see Table 2 for a detailed list of proposed vector control activities with FY 2019 funding in the pre-elimination districts (Katete, Sinda, Chadiza, and potentially other adjacent districts TBD).

Malaria in Pregnancy in the Pre-Elimination Districts
While pregnant women are not considered to be major drivers of malaria transmission, they are an especially vulnerable population in terms of malaria morbidity and mortality. In the pre-elimination setting, it will continue to be important to optimize prevention of uncomplicated and severe malaria in pregnancy. Investments are captured in the main MOP and under case management below.

Expanded Access to Case Management in the Pre-Elimination Districts
The expansion of community-level case management of malaria is well-recognized to reduce morbidity and mortality and to contribute to reduced case incidence, as occurred in Southern Province with MACEPA support. Zambia's national strategy has long emphasized the scale-up of community case management using ACTs and RDTs. In the past year, as part of the roll-out of the NMESP 2017–2021, the NMEP has redesigned the iCCM package to include community-level malaria surveillance. Against a background of optimizing coverage of the usual interventions, the aim will be to implement iCCM at scale, with robust systems to ensure that commodities flow from health facilities to CHWs and malaria case data flows reliably from CHWs to health facilities and districts.

Zambia's stratified implementation strategy recognizes that in high burden, resource-limited areas, most malaria diagnosis and treatment will occur through passive case detection, where symptomatic patients present to a health facility or to a CHW. As malaria burden falls and the ratios of health workers to population increases, community case management will be expanded in selected HFCAs by incorporating reactive case detection (screening household members and neighbors of index cases found in passive case detection, aka "Step D" activities).

The approach calls for high coverage of CHWs, supported through pre-service and refresher trainings, as well as supportive supervision. Beginning in FY 2017, PMI's financial and technical assistance has been providing a standard package of enhanced support to CHWs in pre-elimination districts including enablers kit, rigorous monthly, then weekly reporting, and close supervision and monitoring. Experience in Southern and Western Provinces has demonstrated the effectiveness of 1 CHW per 850 population in lower transmission areas and 1 CHW per 750 population in higher transmission areas. (For planning purposes, this document uses the 1:750 ratio.) In FY 2019, it is anticipated that funds will be needed to fill gaps which remain after FY 2017 and FY 2018 investments in the three pre-elimination districts, and to ramp up CHW training deployment into adjacent HFCAs in Petauke and rural Chipata.
In order to ensure that newly deployed CHWs have the necessary commodities to work with, PMI should support the procurement of RDTs and ACTs to avoid stockouts, especially in the

early scale-up, where experience in Southern Province showed this is common. In addition, technical assistance will be provided to the medical stores, the DHOs and health facilities.

According to the NMESP, consideration may be given to other forms of active case detection as well, such as screening populations for cases during mass drug administration. Currently, PMI has no definitive plans to support mass drug administration in FY 2019, but this could potentially be considered under an OR protocol.

With FY 2019 funding, PMI will support the MoH to scale-up and strengthen community level diagnosis and treatment services to include malaria case management for all ages in five targeted districts, based on the iCCM platform and incorporating Step D (reactive case detection) approaches, where appropriate . Building on previous years' investments, PMI will help to train and deploy CHWs to fill gaps in Katete, Sinda and Chadiza Districts, and also scale-up in Petauke and Chipata Districts. FY 2019 support will be split across two partners as this is a transition year.

To ensure sustained, effective deployment of CHWs in the five districts, PMI will provide technical assistance and commodities as need to fill gaps. This package will include: (1) strengthening supervisory capacity at health facility and district levels; (2) procuring RDTs and ACTs to fill temporary gaps anticipated as community-level services expand; and (3) providing technical assistance to strengthen pharmaceutical and supply chain management systems in five districts to support rapid expansion of malaria case detection and management at the community level. The focus here will be on establishing reliable systems for distributing ACTs, RDTs, and other iCCM supplies to community workers and for collecting and responding to consumption reports.

Please see Table 2 for a detailed list of proposed case management activities with FY 2019 funding in the pre-elimination districts

SBCC in the Pre-Elimination Districts

Since FY 2017, PMI investments have been based on the notion that SBCC is, if anything, even more important in pre-elimination settings than in high burden settings, given the need to optimize intervention coverage and add new tools. A PMI-supported 2017 study, titled "Social behavior change considerations for areas transitioning from high and moderate to low, very low and zero malaria transmission," highlighted the following roles of SBCC in this setting:

1. Establish appropriate levels of perceived severity as malaria cases decline and perceived risk declines.
2. Introduce new case management interventions and establish trust and understanding among both communities and service providers.
3. Ensure service providers are equipped with counseling skills to address concerns about fevers that increasingly test negative for malaria to avoid patient dissatisfaction and erosion of trust between patients and providers.
4. Maintain prompt care-seeking.
5. Maintain high levels of ITN use.
6. Test new sampling methods and behavior change approaches where/when appropriate.

In FY 2019, PMI will continue to help strengthen community-level SBCC through multiple channels, with the aim of providing targeted messaging that takes into account the local context and changing malaria epidemiology. This will include additional support in five districts for district, health facility, and community-based SBCC for proper and consistent net usage, increased ANC attendance and demand for IPTp, increased early care-seeking behavior ,and demand for proper malaria diagnosis and adherence to treatment for malaria at health facility and community levels. SBCC will use multiple channels such as local radio, print materials, and community-based SBCC through NGOs and faith-based organizations.

Please see Table 2 for a detailed list of proposed SBCC activities with FY 2019 funding in the pre-elimination districts.

Enhanced Surveillance in the Pre-Elimination Districts

In the context of malaria elimination, as malaria cases become rarer, data quality becomes increasingly important for making decisions that will help accelerate the reduction of malaria cases. Strengthening data collection and analysis capacity is fundamental for higher-burden HFCAs, while in lower-burden HFCAs confirming every suspected case becomes top priority. Timely acquisition of data to efficiently deploy supplies, plan the right type of interventions, and focus attention on specific locations becomes critical. In general, frequency of data reporting should increase from monthly to weekly, and geolocation of cases should be incorporated over time.

In Southern Province and parts of Western Province where community surveillance including Step D has been scaled up, the NMEP has adopted a DHIS2-based MRRS to meet these data needs and feed into timely decision-making. The MRRS currently captures weekly reports from health facilities, monthly reports from the CHWs, with a dashboard for visualization that supervisors, district offices, and the NMEP can readily view. The intention is to implement MRRS in other areas where Step D is being scaled up. The community component of the MRRS will eventually be adapted into the MoH's community HMIS system which is currently under development.

As case burden falls, the relative importance of cross-border imported cases from Malawi and Mozambique may be expected to increase. No FY 2019 PMI funds are dedicated to cross-border investments per se, although PMI will take an active interest in E8 and the MoH's initiatives in this area. Indirectly, by strengthening routine surveillance systems, PMI's support will enable the districts to begin to track imported versus endogenous cases, leading to improved understanding of the local malaria burden.

With FY 2019 funding, PMI will support the establishment of community surveillance in an increasing number of contiguous HFCAs in five districts, and strengthen community and facility reporting through HMIS/DHIS2, complemented by MRRS (and presumably CHMIS when it is ready). Methods will include the adaptation and rollout of Step D community reporting tool, strengthening supervision, supporting data review meetings and DQAs. PMI will help to build capacity for case and foci investigations in future.

Please see Table 2 for a detailed list of proposed SM&E activities with FY 2019 funding in the pre-elimination districts.

5. Staffing and administration

Three health professionals oversee PMI in Zambia. A USAID Infectious Diseases Advisor is responsible for the overall PMI portfolio. Two others serve as Resident Advisors (RAs), one representing CDC and one representing USAID. All PMI staff members are part of a single interagency team led by the USAID Mission Director or his/her designee in country. The PMI team shares responsibility for development and implementation of PMI strategies and work plans, coordination with national authorities, managing collaborating agencies and supervising day-to-day activities. Candidates for RA positions (whether initial hires or replacements) will be evaluated and/or interviewed jointly by USAID and CDC, and both agencies will be involved in hiring decisions, with the final decision made by the individual agency.

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

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

The two PMI RAs are physically based within the USAID Health Office but are expected to spend approximately half of their time with and providing technical assistance to the NMCP 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.

Please see Table 2 for a detailed list of proposed activities with FY 2019 funding.