U.S. PRESIDENT'S MALARIA INITIATIVE

Zambia

Malaria Operational Plan FY 2022

This FY 2022 Malaria Operational Plan has been approved by the U.S. Global Malaria Coordinator and reflects collaborative discussions with national malaria elimination programs and other partners. Funding available to support outlined plans relies on the final FY 2022 appropriation from the U.S. Congress. Any updates will be reflected in revised postings.

This document was prepared in the early months of 2021 as the COVID-19 pandemic continued to evolve worldwide, including in PMI-focus countries. The effects of the pandemic on malaria control and elimination work in 2022 are difficult to predict. However, because U.S. Congressional appropriations for PMI are specific to work against malaria and any appropriations for work against the COVID-19 are specific for that purpose and planned through separate future U.S. Government planning processes, this FY 2022 MOP will not specifically address the malaria-COVID-19 interface and will reassess any complementary work through timely reprogramming in countries.

CONTENTS

ABBREVIATIONS

ACT	Artemisinin-based combination therapy
AIDS	Acquired Immune Deficiency Syndrome
AL	Artemether-lumefantrine
ANC	Antenatal care
BMGF	Bill & Melinda Gates Foundation
CCA	Community change agents
CCI	Champion Communities Initiative
CDC	U.S. Centers for Disease Control and Prevention
CHA	Community health assistant
CHAZ	Churches Health Association of Zambia
CHW	Community health worker
CS	Capsule suspension
CSO	Civil society organization
CY	Calendar year
DDT	Dichlorodiphenyltrichloroethane
DHAPQ	Dihydroartemisinin + Piperaquine
DHIS2	District Health Information System 2
DHO	District Health Office
DHS	Demographic and Health Survey
DQA	Data quality audit
EIR	Entomological inoculation rate
eLMIS	Electronic Logistics Management Information System
EMC	End Malaria Council
EMF	End Malaria Fund
EPI	Expanded Program on Immunization
EUV	End Use Verification
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
HF	Health facility
HFCA	Health facility catchment area
HIV	Human Immunodeficiency Virus
HMIS	Health Management Information System
HSS	Health systems strengthening
HSSCS	Health Sector Supply Chain Strategy

iCCM	Integrated community case management
ICEMR	International Center of Excellence in Malaria Research
IPTp	Intermittent preventive treatment for pregnant women
IRS	Indoor residual spraying
ITN	Insecticide-treated mosquito net
IVM	Integrated vector management
LLIN	Long-lasting insecticide-treated mosquito net
LSM	Larval source management
M&E	Monitoring and evaluation
MACEPA	Malaria Control and Elimination Partnership in Africa
MDA	Mass drug administration
MIP	Malaria in pregnancy
MIS	Malaria indicator survey
MOH	Ministry of Health
MOP	Malaria Operational Plan
MRR	Malaria rapid reporting
NGO	Non-governmental organization
NIH	National Institutes of Health
NMEC	National Malaria Elimination Centre
NMEP	National Malaria Elimination Program
NMESP	National Malaria Elimination Strategic Plan 2017–2021
OP	Organophosphate
OPD	Outpatient department
OR	Operational research
OTSS	Outreach training and supportive supervision
PBO	Piperonyl butoxide
PCR	Polymerase chain reaction
PE	Program evaluation
PEPFAR	President's Emergency Plan for AIDS Relief
PHO	Provincial Health Office
PMI	U.S. President's Malaria Initiative
PPE	Personal protective equipment
RAS	Rectal artesunate
RCD	Reactive case detection
RDT	Rapid diagnostic test
s.l.	sensu lato
s.s.	sensu stricto
SADC	South African Development Community

SBC	Social and behavior change
SM&E	Surveillance, monitoring, and evaluation
SMAG	Safe Motherhood Action Groups
SMC	Seasonal malaria chemoprevention
SMEO	Surveillance, monitoring, evaluation, and operations research
SP	Sulfadoxine-pyrimethamine
TAC	Technical Advisory Committee
TES	Therapeutic efficacy study
TWG	Technical working group
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization

EXECUTIVE SUMMARY

The U.S. President's Malaria Initiative (PMI)—led by the U.S. Agency for International Development (USAID) and implemented together with the U.S. Centers for Disease Control and Prevention (CDC)—delivers cost-effective, lifesaving malaria interventions alongside catalytic technical and operational assistance to support Zambia to end malaria. PMI has been a proud partner of Zambia since 2006, helping to decrease child death rates by 49 percent (PMI 14th Annual Report) and increasing access to insecticide-treated nets by 197 percent since 2007 through investments totaling almost $309 million.

The proposed PMI fiscal year (FY) 2022 budget for Zambia is $28 million. This Malaria Operational Plan (MOP) outlines planned PMI activities in Zambia using FY 2022 funds. Developed in consultation with the national malaria elimination program (NMEP) and key malaria stakeholders, proposed activities reflect national and PMI strategies, draw on best-available data, and align with the country context and health system. Proposed PMI investments support and build on those made by the Government of the Republic of Zambia (GRZ) as well as other donors and partners.

PMI will support investments in the following intervention areas with FY 2022 funds:

Vector Control

PMI helps to guide the NMEP's programmatic choice of insecticide by supporting annual insecticide susceptibility testing, and monthly cone wall bioassays to assess the decay rate of sprayed insecticides on different wall surfaces. Enhancements have been made to the capacity of the National Malaria Elimination Centre (NMEC) laboratory to perform molecular analysis on mosquito samples by providing equipment, reagents, and supplies and to develop a District Health Information System 2 (DHIS2) database for data visualization.

Over 1.2 million insecticide-treated mosquito nets (ITNs) were provided by PMI during the 2020–2021 ITN campaign, 600,000 ITNs were provided to antenatal care (ANC) and Expanded Program on Immunization (EPI) channels and over 98,000 ITNs were distributed for school-based channels. Other ancillary activities to support ITN distribution include technical assistance (TA) to ensure efficient deployment and accountability of the distribution, durability monitoring to evaluate the longevity of ITNs, and assessment of continuous distribution channels to improve delivery of ITNs to vulnerable populations.

In 2020 the PMI-supported campaign sprayed 648,952 structures out of 672,620 structures found by spray operators, resulting in 97 percent spray coverage while adopting rigorous adherence to the mitigation measures and modifying IRS procedure without compromising the integrity of indoor residual spraying (IRS) best practices. The campaign protected over 2.7 million people, including 391,460 children under five years of age and 73,965 pregnant women. PMI discontinued direct operational support from the seven urban districts in the Copperbelt Province but provided training, support, and TA to IRS programs of the Ministry of Health (MOH) and local mining companies. In two districts in northern Luapula, the Global Fund/GRZ program supplied insecticide while PMI covered the other costs.

Zambia is shifting its vector control strategy toward having next-generation ITNs as the primary vector control approach and IRS serving as a complementary measure to be used in targeted or focal areas based on to-be-

determined criteria. Therefore, more investment will go into greater procurement of next-generation ITNs, improvement of mass campaign distribution through TA, assessment and bolstering of continuous distribution channels, and enhancement of social behavior change (SBC) for ITNs use with an emphasis of changing behaviors by identifying barriers to ITN use.

Entomological monitoring remains a critical component of vector control and will be important as sites with IRS shift to ITNs. Vector rebounds will need to be monitored in the event of malaria transmission increases. Entomological monitoring will also be essential to monitor next-generation ITN deployments.

Supply Chain (with malaria focus)

PMI is currently supporting the strengthening of the logistics information systems to avail critical data for informed supply chain decision-making; monitoring and evaluation (M&E) to include data visibility and analytics initiatives; increased ownership by GRZ to lead quantification and procurement planning processes; reliable procurement services provided to GRZ; improved effectiveness and efficiency in warehousing and distribution; and increased innovation for strategic management and planning for improved commodity security.

With FY 2022 funding, PMI will continue to provide supply chain TA focused on commodity security and partner engagement to the MOH, monitor stock status and consumption trends and report availability of malaria commodities to stakeholders, support End Use Verification (EUV) activities as feasible, and will continue to implement the PMI stockout reduction activity.

Social and Behavior Change (SBC)

In FY 2020, PMI has continued to provide TA to the NMEP at the central level and has worked through implementing partners to conduct quality SBC interventions at the health facility and community levels. Community-level engagement has included support for the Champion Communities Initiative (CCI), which was adopted into the national malaria strategy in 2020 as a sustainable model for successfully mobilizing communities against malaria, as well as community dialogues to help address malaria knowledge gaps as identified in the 2018 MIS. These activities strive to increase awareness and uptake of malaria interventions and services. Through mass media, PMI engaged a wider audience than could be reached through the targeted community approaches with messaging focused on increasing knowledge and awareness on proven malaria interventions including correct and consistent ITN use, promoting early treatment-seeking behavior, and early commencement of intermittent preventive treatment in pregnancy (IPTp).

With FY 2022 funds, PMI will support the MOH and local communities to implement evidenced-based, targeted SBC interventions in all four provinces. Evidence to date on SBC program effectiveness supports the use of high-impact approaches including reinforcing specific health behaviors, using multiple communication channels, and using community change agents to facilitate and support individual and community actions. PMI will integrate SBC in other public health programming and platforms such as EPI and ANC.

I. INTRODUCTION

The U.S. President's Malaria Initiative (PMI)—led by the U.S. Agency for International Development (USAID) and implemented together with the U.S. Centers for Disease Control and Prevention (CDC)—delivers cost-effective, lifesaving malaria interventions alongside catalytic technical and operational assistance to support the Republic of Zambia to end malaria. PMI has been a proud partner of Zambia since 2006, helping to decrease child death rates by 49 percent according to the 2018 Demographic and Health Survey (DHS) and increasing access to insecticide-treated nets by 197 percent since 2007 through investments totaling almost $309 million.

The proposed PMI fiscal year (FY) 2022 budget for Zambia is $28 million. This Malaria Operational Plan (MOP) outlines planned PMI activities in Zambia using FY 2022 funds. Developed in consultation with the National Malaria Elimination Program (NMEP) and key malaria stakeholders, proposed activities reflect national and PMI strategies, draw on best-available data, and align with the country context and health system. Proposed PMI investments support and build on those made by the Government of the Republic of Zambia (GRZ) as well as other donors and partners.


Zambia at a Glance

- **Geography:** Landlocked country located on the central plateau of the Southern African region with a land area of over 752,000 square kilometers

- **Climate and Malaria Transmission Seasonality:** The country is classified as humid subtropical or tropical wet and dry, with patches of semi-arid steppe climate in the southwest. In the north of the country rainfall is 1,250 mm or more a year, decreasing southwestward to Livingstone where it is about 690 mm annually. Rainy seasons generally lasts from October/November through April/May, depending on latitude.

- **Population in 2021:** 17.9 million persons (Zambia Statistics Agency/Central Statistics Office)

- **Population at Risk of Malaria:** 100% (WHO World Malaria Report 2020)

- **Principal Malaria Parasites:** *P. falciparum* (WHO World Malaria Report 2020)

- **Principal Malaria Vectors:** *A. gambiae*, *funestus*, and *arabiensis* (WHO World Malaria Report 2018)

- **Malaria Case Incidence per 1000 Population:** 413 (Zambia Health Management Information System [HMIS] via Malaria Data Integration and Visualization [M-DIVE], 12/2020 Update)

- **Under-Five Mortality Rate:** 61/1,000 (2018 DHS)

- **World Bank Income Classification and Gross Domestic Product (GDP):** Lower middle-income, 1,305 USD GDP per capita (World Bank Group 2019)

- **Government Health Budget:** 9.3% representing ZMK 8.07B or USD 365M (United Nations Children's Fund [UNICEF] 2019 Zambia Health Budget Brief)

- **Trafficking in Persons Designations, 2018–2020:** Tier 2 Watch List (Department of State 2020 Trafficking in Persons Report)

- **Malaria Funding and Program Support Partners Include:**
    - U.S. President's Malaria Initiative (PMI)

- ○ Global Fund to Fight AIDS, Tuberculosis, and Malaria (Global Fund)

- ○ World Health Organization (WHO)

- ○ Bill & Melinda Gates Foundation (BMGF via the Malaria Control and Elimination Partnership in Africa [MACEPA] Program)

- ○ Against Malaria Foundation (AMF)

- ○ Isdell Flowers Cross-Border Malaria Initiative

- ○ Rotary Club

- ○ Zambia End Malaria Council

- ○ South African Development Community (SADC) – Elimination 8

- ○ Mining companies and plantations

- **PMI Support of National Malaria Elimination Strategy:** As a major partner of the Zambian National Malaria Elimination Program (NMEP within the Ministry of Health [MOH], PMI aims to help the country accelerate toward its goal of malaria elimination as aggressively as resources, epidemiologic realities, and local constraints allow. PMI prioritizes reducing disease burden in high-burden areas in northern Zambia while beginning to invest a portion of its budget (approximately 16% in FY 2019) in pre-elimination settings. (See III. Overview of PMI's support of Zambia's Malaria Control Strategy for additional details.)

- **PMI Investments:** Zambia began implementation as a PMI-focus country in FY 2007. The proposed FY 2022 PMI budget for Zambia is $28 million; this will bring the total PMI investment to nearly $378 million.

PMI organizes its investments around the activities below, in line with the Zambia national malaria strategy. The current strategy is for 2017–2021, with a new five-year strategy (2022–2026) expected to be developed during the second half of 2021.

Figure 1. PMI's approach to end malaria[1]
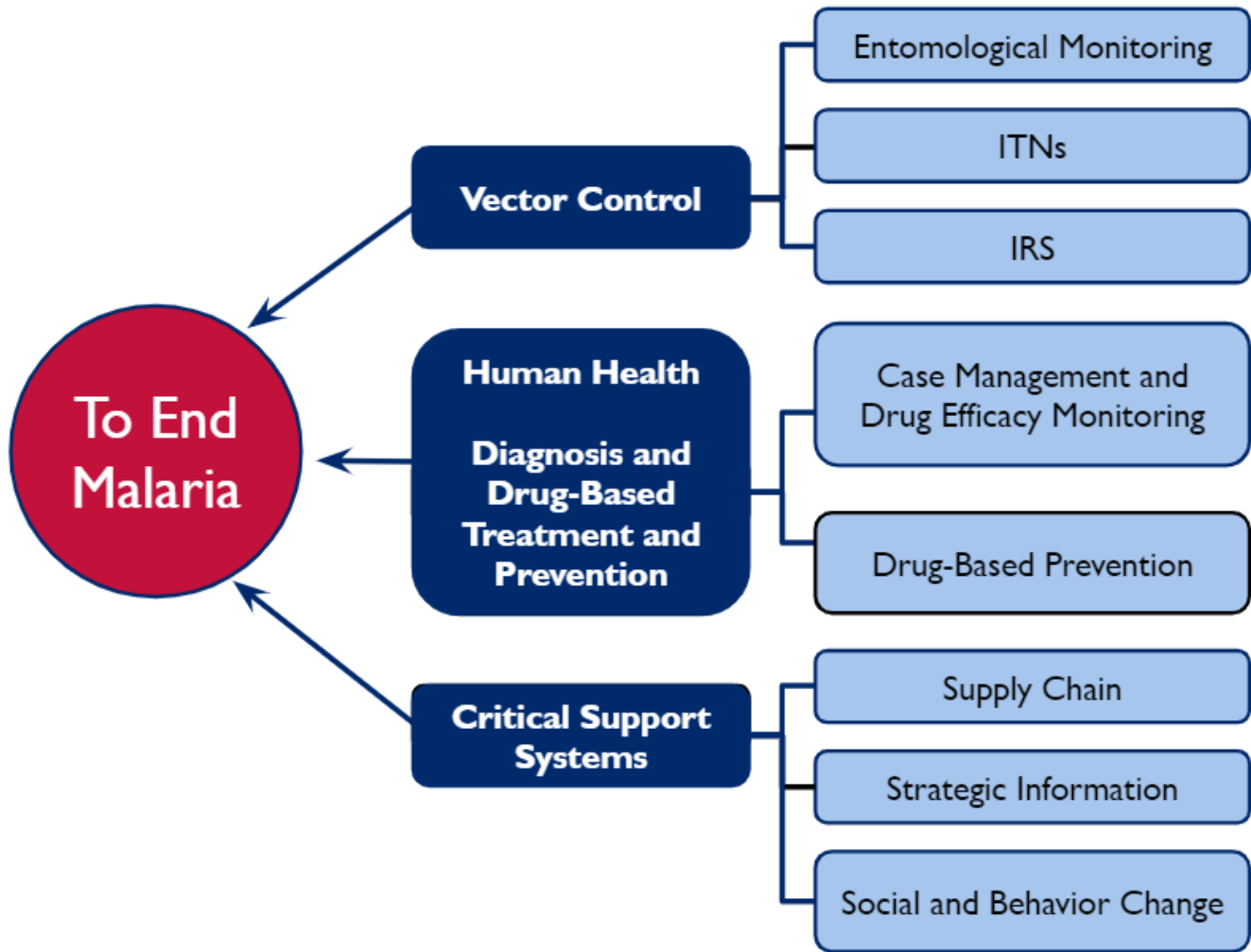
Building and strengthening the capacity of Zambia's people and institutions—from the central level to communities—to effectively lead and implement evidence-based malaria control and elimination activities is paramount to PMI. The majority of PMI's planned support for FY 2022, across the areas of vector control, human health, and critical support systems such as supply chain, contains elements of capacity-building and system strengthening. PMI/Zambia will continue to rely on and engage with local partners such as the Churches Health Association of Zambia (CHAZ) and is deepening its collaboration with the End Malaria Council. Finally, PMI/Zambia will continue to rely on private sector partnerships such as the Zambian mining industry.

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[1] A number of actions are cross-cutting in nature. For example, social and behavioral change (SBC) is embedded in all vector control and human health work; program evaluation (PE) and operational research (OR) are relevant in all of the fieldwork; finance and management support and the introduction of new tools/interventions are critical for all programs; and elimination requires work across the full spectrum of transmission.

While recognized internationally for its ambitious goal of malaria elimination and for having attained pre-elimination levels in Southern Province, Zambia, as a whole remains a highly endemic malaria country, with the entire population considered to be at risk of contracting malaria. Zambians suffered over 6.9 million confirmed cases of malaria in 2020 (Health Management Information System [HMIS]). Risk is highest in the wetter, rural, impoverished provinces of Luapula, Northern, Muchinga, and North-Western (11 percent to 30 percent prevalence in 2018), and lowest in Lusaka Province (0.1 percent) and Southern Province (<0.1 percent). Rural districts on the Copperbelt and low-lying districts in Eastern Province have similarly high burden. As captured in the national stratification scheme (Figure 3), at the health facility catchment area (HFCA) level, malaria incidence varies widely, from less than 50 cases to over 500 cases per 1,000 population per year.

Through 2019, the GRZ made significant progress in malaria control in partnership with PMI, the Global Fund, the Bill & Melinda Gates Foundation (BMGF), nongovernmental organizations (NGOs) such as PATH, CHAZ, research institutions, and others. This was reflected in encouraging trends in several indicators in the most recent Malaria Indicator Survey (2018 Zambia MIS) (Table 2):

- The national infection rate in children under five years of age had decreased from 22 percent in 2006 to 9 percent in 2018.
- 80 percent of households in 2018 owned at least one insecticide-treated mosquito net (ITN), an increase from 38 percent in 2006.
- 77 percent of children in rural areas, where risk is greatest, slept under bed nets in 2018, an increase from 42 percent in 2008.
- 81 percent of pregnant women in 2018 received medications to prevent malaria, an increase from 59 percent in 2006.

However, worrisome trends characterized 2020, despite strong partnerships, including a 30 percent to 40 percent worsening of burden indicators in 2020 from 2018–2019 levels, including incidence, deaths, and positivity rates. Similar trends were noted across southern Africa. The trend began in Q1, prior to most in-country COVID-19 effects. In the absence of a formal study, this may be attributed to more conducive rainfall pattern in the 2019–2020 rainy season in setting of inadequate vector control coverage; spotty saturation of community case management of malaria; under-investment in artemisinin-based combination therapies (ACTs) and rapid diagnostic tests (RDTs), and other factors. COVID-19 impact was felt mainly in disruption of supply chains from March 2020 onward, compounding global RDT shortages. There is mixed data on whether health seeking was stable in rural areas. All 10 provinces have seen worsening malaria indicator trends, including the four PMI-focus provinces, but with relative sparing of districts with high intervention coverages. Preliminary HMIS health facility data from the first quarter 2021 suggested an improving trend, with for example health facility cases (2.11 million) falling midway between 2019 cases (1.71 million) and 2020 cases (2.53 million). Updated prevalence data is awaited from the 2021 Malaria Indicator Survey.

II. MALARIA SITUATION AND PROGRESS

Figure 2. Trends in malaria prevalence, 2006–2018

Proportion of children 6 to 59 months of age who tested positive for malaria by RDT [2018] in household surveys.
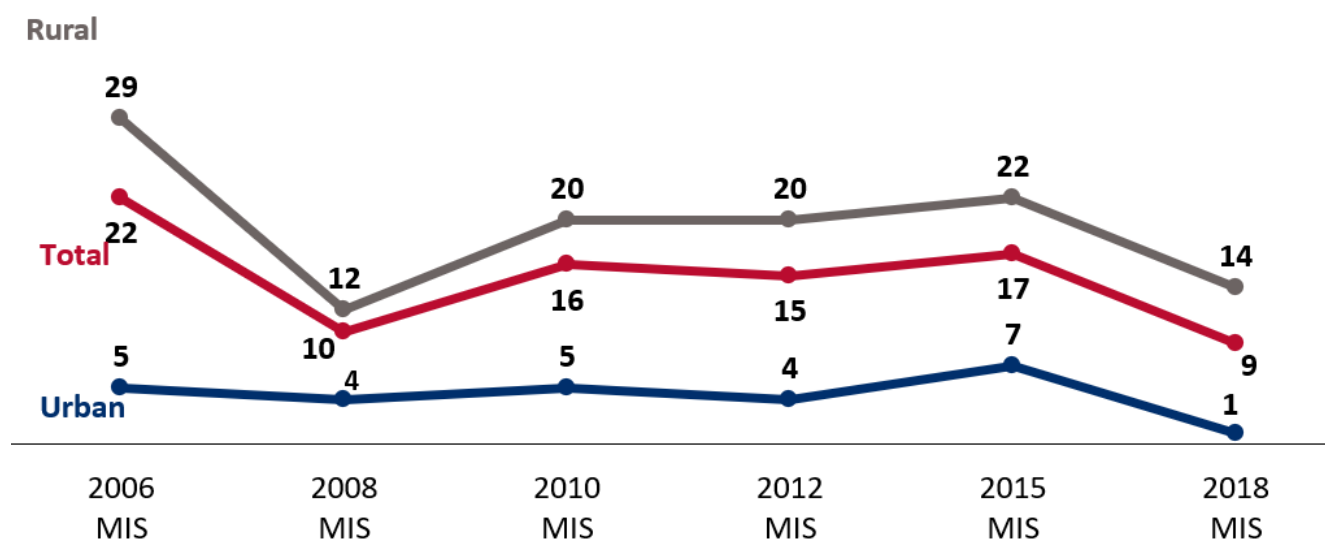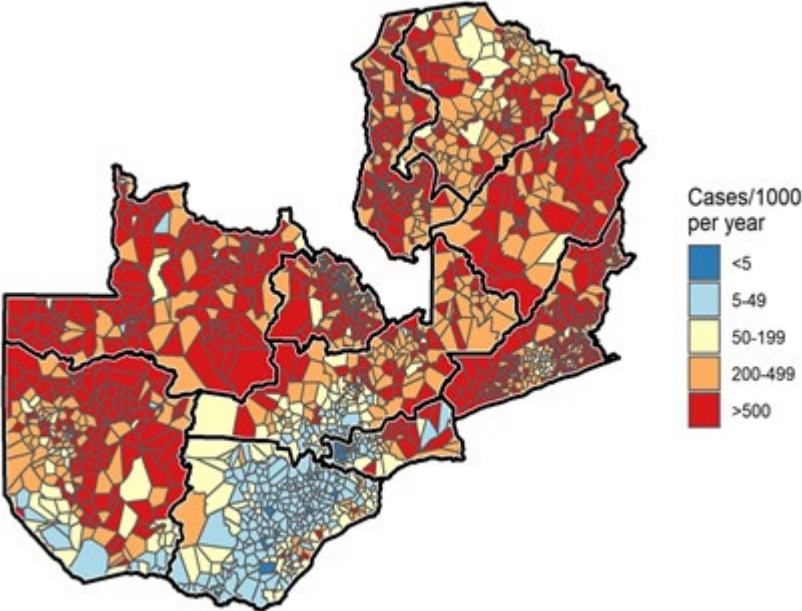
Figure 3. Malaria incidence by health facility catchment area, including both facility (HMIS) and community passively reported cases, from October 2019 to September 2020

Source: PATH, NMEC.

Figure 4. Malaria cases passively reported from health facility outpatient department (HF OPD) and community levels, by month (January 2017–December 2020). Provinces are grouped as the four PMI-supported provinces (labeled as "PAMO Plus") and the six other provinces
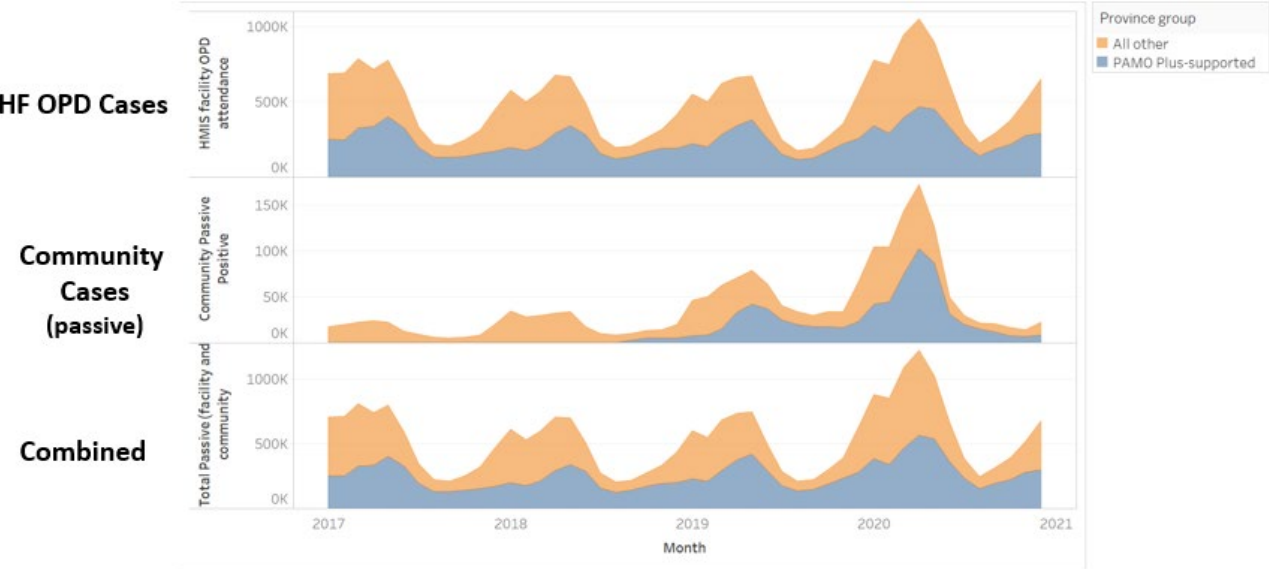
Source: NMEC instance of DHIS2, PATH.

Figure 5. Reported malaria inpatients and deaths by province group, January 2017 to December 2020

(The four PMI provinces are labeled here as End Malaria Program – EMP)
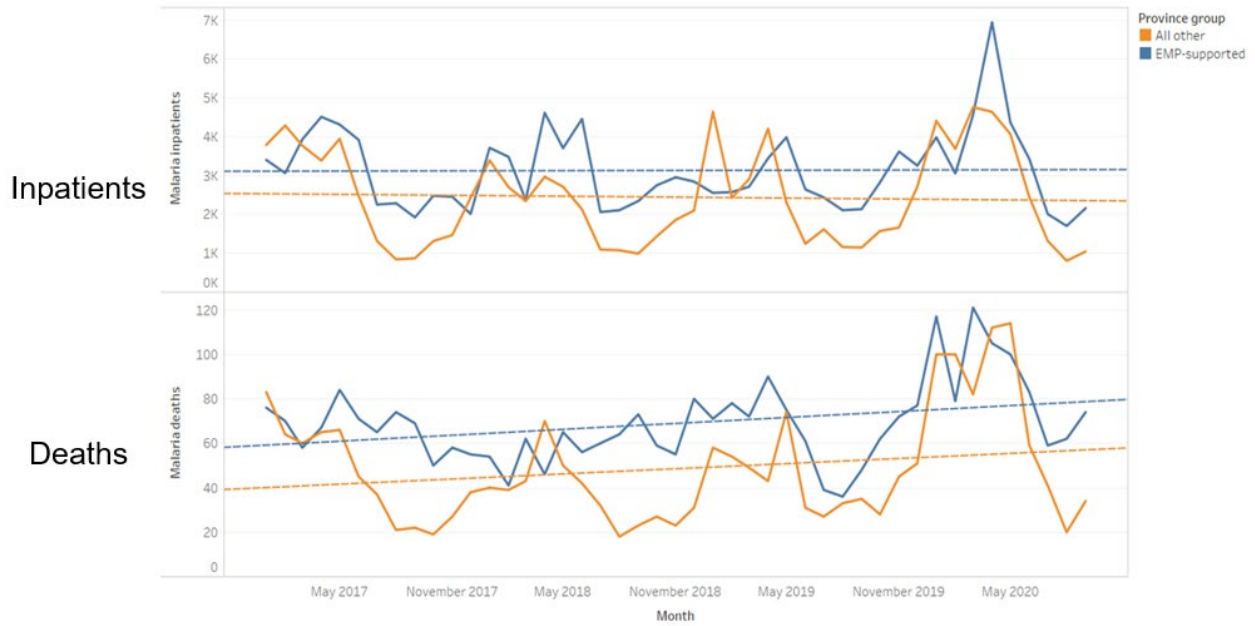
PATH, Source: HMIS.

Figure 6. Reported confirmed malaria cases by province, 2018–2020, with the four PMI-focus provinces circled
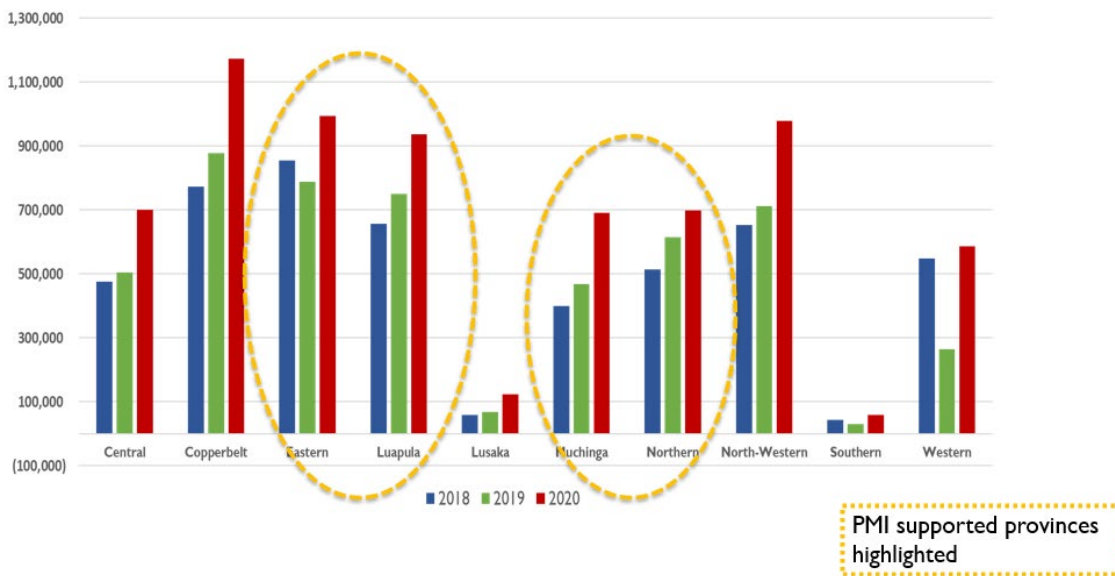
MIS, Source: HMIS.

Figure 7. Reported malaria deaths by province, 2018–2020, highlighting the four PMI-focus provinces
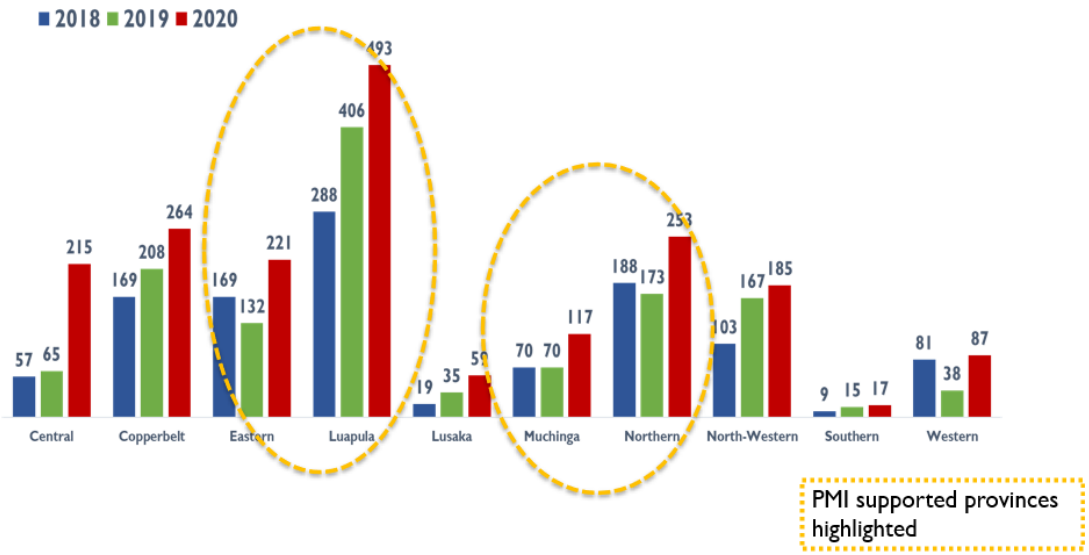
MIS, Source: HMIS.

Figure 8. Comparison of the direction of malaria case changes (increased or decreased) by district, January–June 2019 vs. January–June 2020
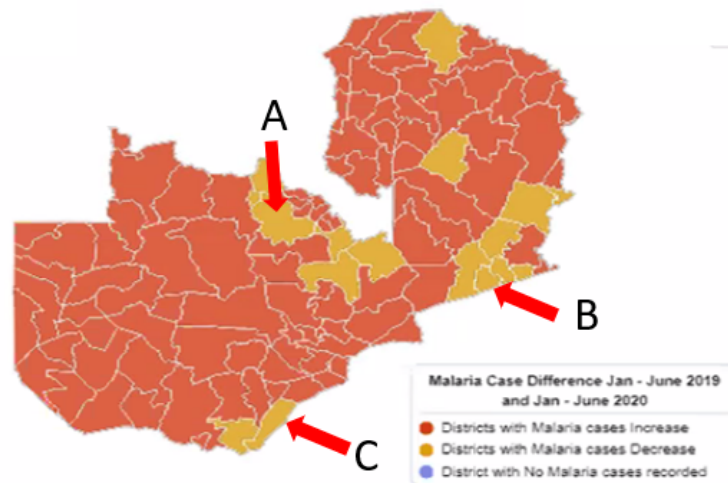
A = Saturation of IRS with PMI support.   B = Saturation of IRS, ITNs, CCM with PMI and GF/CHAZ support
C = Saturation of IRS, ITNs, CCM with GF and Gates/MACEPA support

NMEC, Source: HMIS.

Figure 9. Map showing percentage malaria parasite prevalence by RDT among children under five years of age, by province

Source: Zambia 2018 MIS.

Table 1. Key indicators for malaria prevention and treatment coverage and impact indicators from Demographic Health Surveys (DHS) and Malaria Indicator Surveys (MIS) from 2006 to 2018

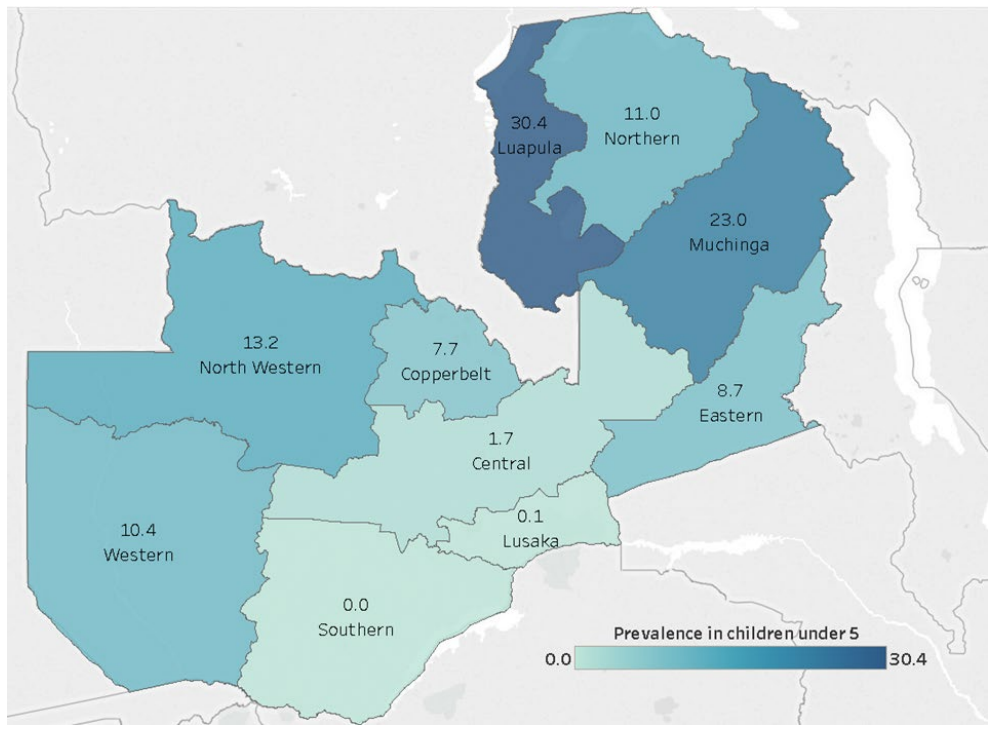| Indicator	2006 MIS	2007 DHS	2008 MIS	2010 MIS	2012 MIS	2013–2014 DHS	2015 MIS	2018 MIS
% Households with at least one ITN	38	53	62	64	68	68	74	80*
% Households with at least one ITN for every two people		18				27		44*
% Population with access to an ITN		34				47	65	67
% Population that slept under an ITN the previous night**		23				35		64
% Children under five years of age who slept under an ITN the previous night**	24	29	41	50	57	41	58	69
% Pregnant women who slept under an ITN the previous night**	24	33	43	46	58	41		71
% Children under five years of age with fever in the last two weeks for whom advice or treatment was sought[1]		70				75		61
% Children under five years of age with fever in the last two weeks who had a finger or heel stick	n/a	n/a	11	17		49	36	55*
% Children receiving an ACT among children under five years of age with fever in the last two weeks who received any antimalarial drugs		29	30	76	85	90	92	97

Indicator	2006 MIS	2007 DHS	2008 MIS	2010 MIS	2012 MIS	2013–2014 DHS	2015 MIS	2018 MIS
% Women who received two or more doses of IPTp during their last pregnancy in the last two years, at least one of which was administered during an ANC visit	57	63	60	69	70	73	79	81
% Women who received three or more doses of IPTp during their last pregnancy in the last two years, at least one of which was administered during an ANC visit					51	50	61	67
Under-five mortality rate per 1,000 live births		119				75		61*
% Children under five years of age with parasitemia (by **microscopy,** if done)**	22		10	16	15		17	9
% Children under five years of age with parasitemia (by **RDT**, if done)**								16
% Children under five years of age with severe anemia (Hb<8gm/dl)	14		4	9	7		6	5

*Indicator source is the 2018 DHS report rather than 2018 MIS.
**DHS/MICS surveys are generally fielded during the dry season, as opposed to MIS surveys, which are deliberately fielded during the high-transmission season, which should be taken into consideration when interpreting these indicators.
[1]Note that this indicator has been recalculated according to the newest definition, care or treatment from any source excluding traditional practitioners wherever possible.

Table 2. Evolution of key malaria indicators reported through routine surveillance systems

Indicator	2016	2017	2018	2019	2020
# Suspect malaria cases[1]	N/A	N/A	N/A	N/A	N/A
# Patients receiving diagnostic test for malaria[2]	N/A	N/A	N/A	N/A	N/A
Total # malaria cases[3]	6,034,650	6,128,085	5,248,366	5,064,227	7,649,316
# Confirmed cases[4]	*4,818,762*	*5,503,010*	*5,022,912*	*4,927,573*	*7,069,325*
# Presumed cases[5]	*1,215,888*	*625,075*	*225,454*	*136,654*	*579,991*
% Malaria cases confirmed[6]	80%	90%	96%	97%	92%
Test positivity rate (TPR)[7]	N/A	N/A	N/A	N/A	N/A
Total # <5 malaria cases[8]	2,132,139	2,022,175	1,643,137	1,663,570	2,225,536
% Cases in children under five years of age[9]	35%	33%	31%	33%	29%
Total # severe cases[10]	96,565	74,264	68,112	59,760	82,715
Total # malaria deaths[11]	1,783	1,410	1,214	1,356	1,972
# Facilities reporting[12]	N/A	N/A	N/A	N/A	N/A
% Data completeness[13]	87%	92%	92.3%	98.5%	97.8%

1. Number of patients presenting with signs or symptoms possibly due to malaria (e.g., fever). 2. RDT or microscopy, all ages, outpatient and inpatient. 3 Total reported malaria cases; all ages, outpatient and inpatient, confirmed and unconfirmed cases. 4. Diagnostically confirmed; all ages, outpatient and inpatient. 5. Clinical/presumed/unconfirmed; all ages, outpatient and inpatient. 6. # confirmed cases divided by total # cases. 7. Confirmed cases divided by # patients receiving a diagnostic test for malaria (RDT or microscopy). 8. Outpatient and inpatient, confirmed and unconfirmed. 9. Total # <5 cases divided by total # of cases. 10. The number of malaria admissions is used as a proxy for severe malaria in Zambia. 11. All ages, outpatient, inpatient, confirmed, and unconfirmed. 12. Total # of health facilities reporting data into the HMIS/DHIS2 system that year. 13. # monthly reports from health facilities divided by # health facility reports expected.
Source: HMIS, health facility data only; does not include data from integrated community case management [iCCM].

III.   OVERVIEW OF PMI'S SUPPORT OF ZAMBIA'S MALARIA STRATEGY

Updated Policy and Strategic Context

Zambia is in its 13th year as a PMI-focus country and has averaged $30 million per year in PMI support since FY 2017. PMI supports a comprehensive package of malaria control interventions in support of the *National Malaria Elimination Strategic Plan 2017–2021 (NMESP)*, including large-scale purchases of commodities and TA. PMI/Zambia works in close consultation with the MOH to design and implement the annual *Malaria Operational Plan* (www.pmi.gov), which allocates PMI funding by intervention area and geographic focus.

The NMESP continues to provide the overall strategic framework. The strategy will undergo its routine End-Term Review in 2021, which is expected to be supported by WHO, PMI, MACEPA, and other partners. Findings

from the review will feed into development of the next strategy. The country strategy is generally consistent with WHO and PMI technical guidelines.

The NMESP promotes a stratified approach to implementation at the level of the health facility catchment area (HFCA), whereby malaria incidence thresholds will guide the intervention package toward the goal of malaria elimination. Since 2014, PMI has focused most of its TA on the high-burden provinces of Luapula, Northern, Muchinga, and Eastern. Since 2018, additional, modest support in case management TA for Central and Copperbelt, and beginning in 2019 the PMI-funded IRS program has incorporated support for rural and peri-urban areas of Copperbelt.

Consistent with the global *PMI Technical Guidance*, PMI/Zambia's investment strategy focuses on the promotion of high coverage of a set of high-quality, evidence-based malaria control interventions:

1. Indoor residual spraying, complemented by entomologic monitoring
2. ITNs, distributed both continuously through clinics and schools as well as periodically through mass campaigns
3. Malaria in pregnancy interventions, including IPTp
4. Case management of malaria, including prompt diagnosis and treatment and pharmaceutical supply chain strengthening
5. Data for decision-making, gleaned from surveillance, monitoring and evaluation, and operations research activities
6. SBC, to promote consistent and correct use of interventions by high proportions of target populations and service providers.
7. Elimination activities, as described at the end of Section III

Figure 10. PMI-supported activities in Zambia
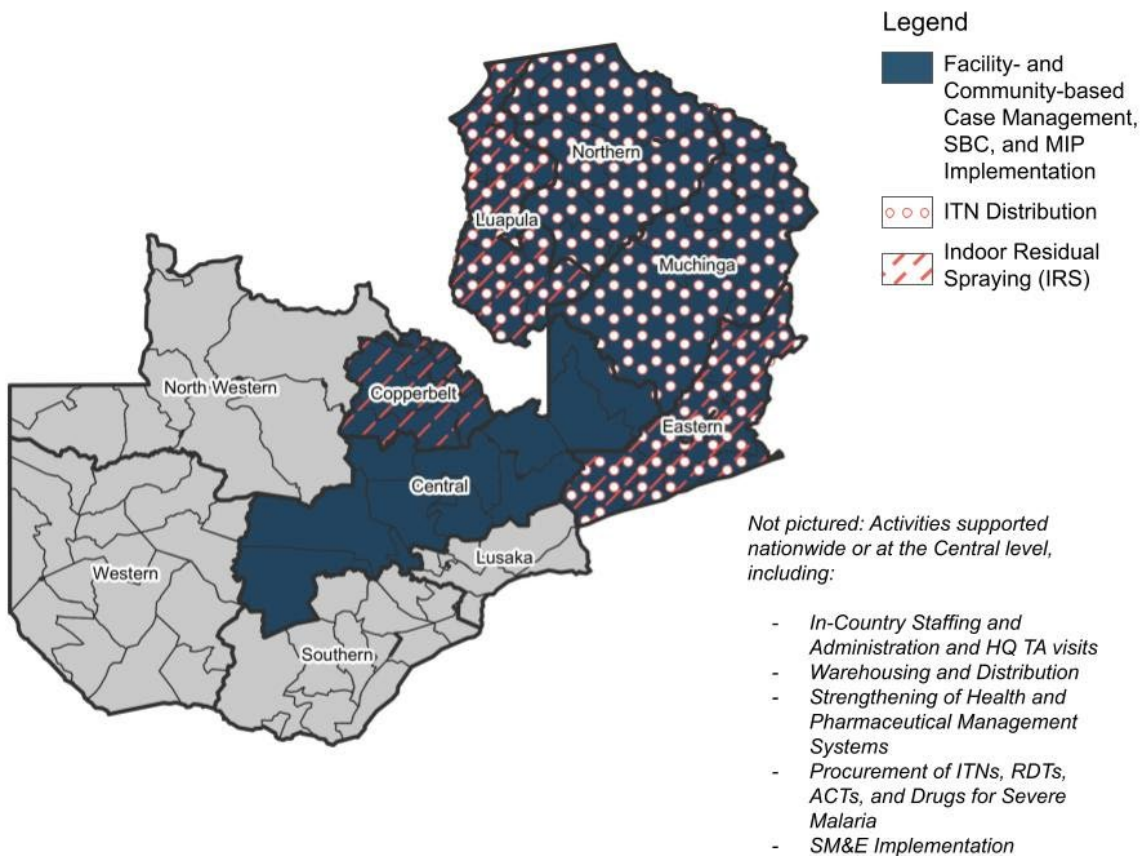
Source: Zambia MOP Funding Table 2, Fiscal Year 2021 Malaria Data Integration and Visualization (M-DIVE).

Figure 11. PMI-supported service delivery and social and behavior change activities in Zambia
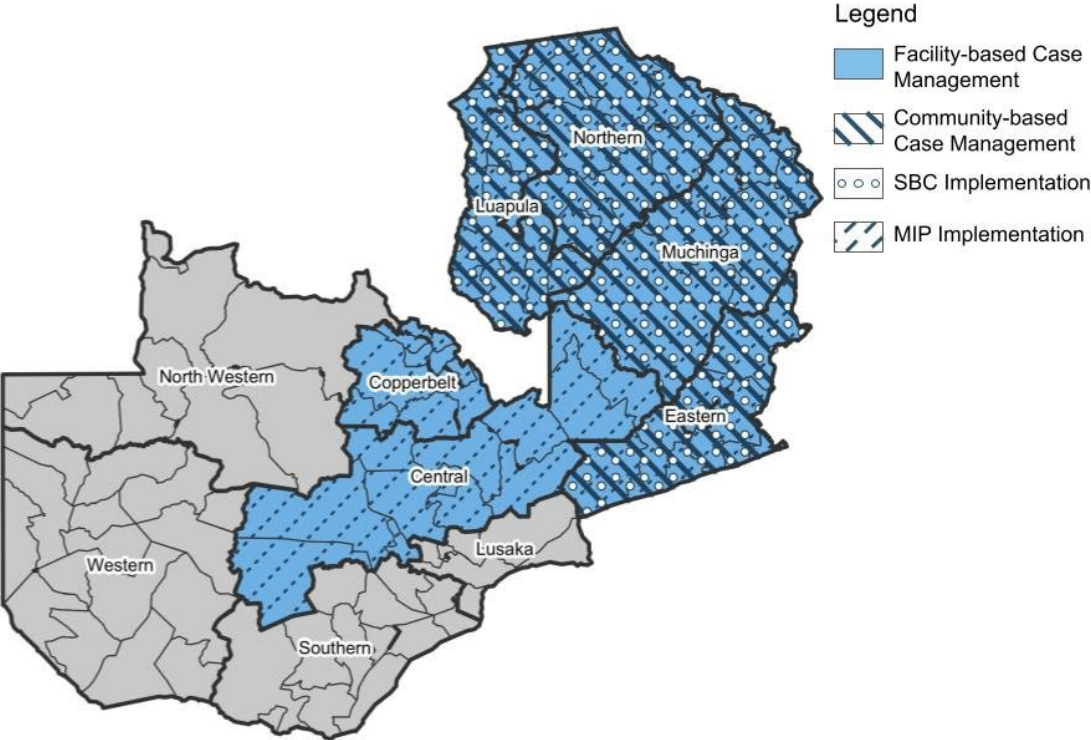
Source: Zambia MOP Funding Table 2, Fiscal Year 2021 Malaria Data Integration and Visualization (M-DIVE).

Figure 12. PMI-supported vector control activities in Zambia

Source: Zambia MOP Funding Table 2, Fiscal Year 2021 Malaria Data Integration and Visualization (M-DIVE).

Figure 13. PMI's geographic focus 2014–2021

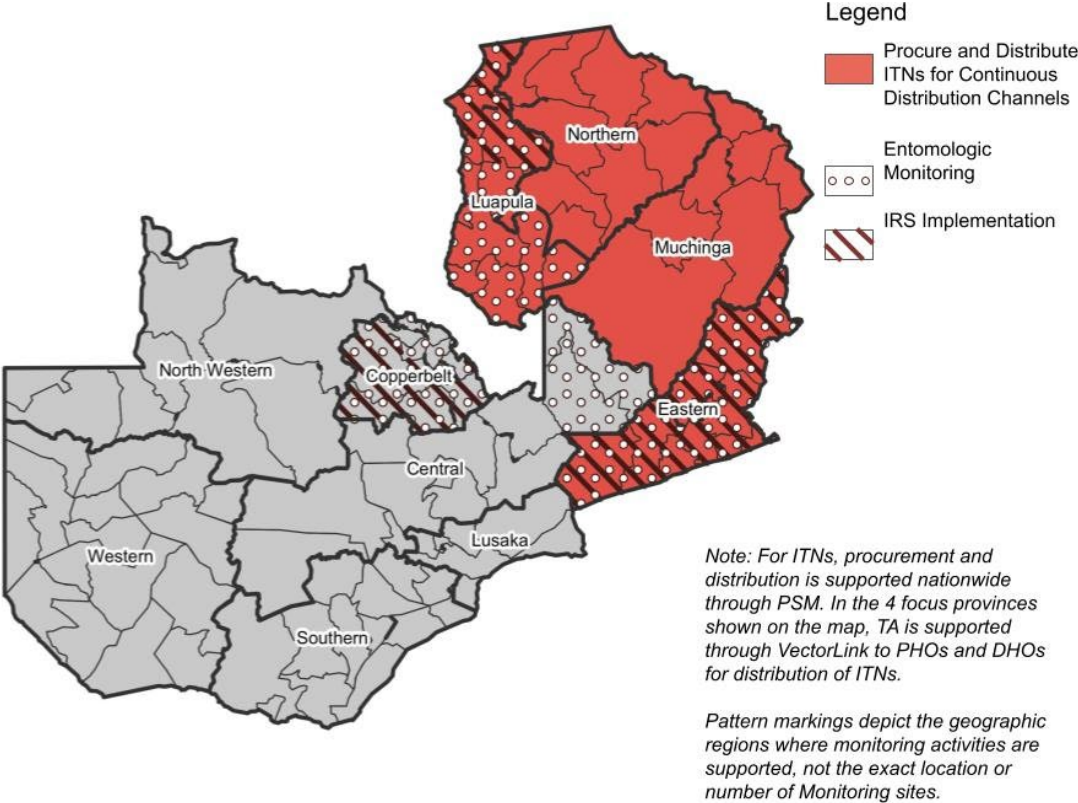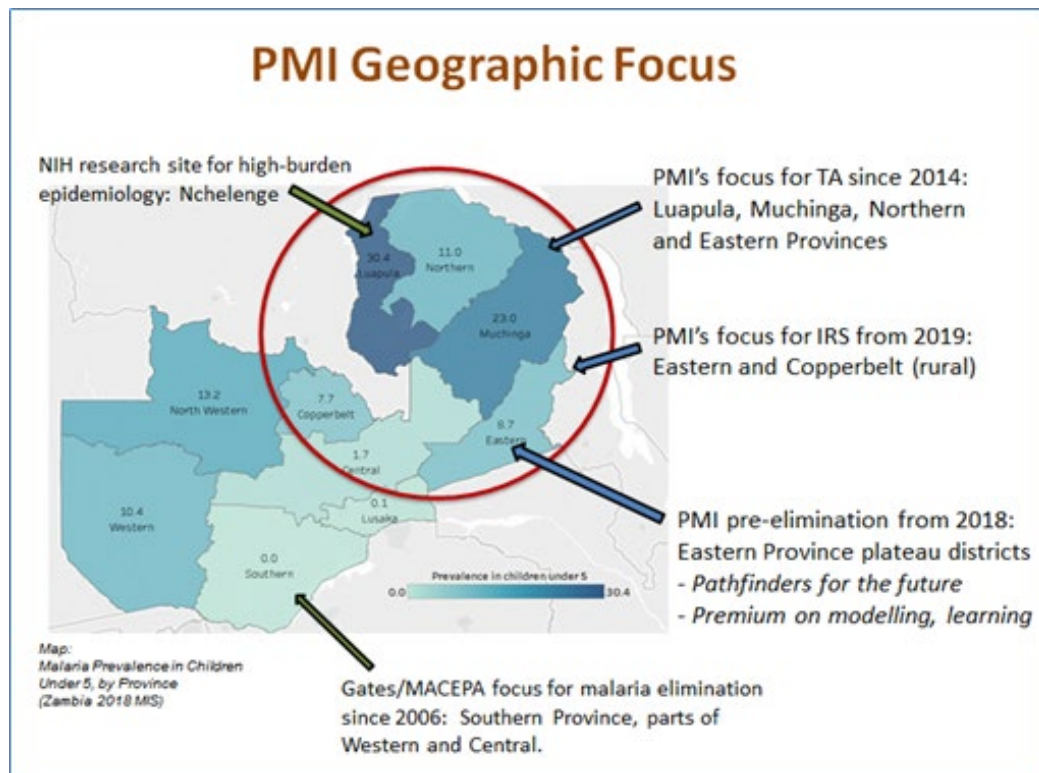While setting forth ambitious goals, the NMESP recognizes that "the goal of elimination is still distant in some areas, due to the relatively high disease burden, low coverage of interventions, insufficient development of the local health system, and technical and operational constraints." The NMEC and stakeholders have recently come to consensus around recognizing that the original goal of nation-wide elimination by 2021 is not realistic. They have drafted a malaria policy document (still unsigned at the time of the FY 2022 MOP deliberations) that proposes a still-ambitious goal of elimination by 2030, which is more in line with SADC and WHO aspirations for Zambia.

The NMESP distinguishes between "tactical approaches" that apply in the country's high- versus low- burden settings. As previously alluded to, the geographic unit of analysis and operations is defined as the health facility catchment area (HFCA). In low-transmission HFCAs with malaria incidence between Level 0 with zero cases of malaria per 1,000 population per year and Level 1 with under 50 malaria cases per 1,000 population, surveillance and response are the core interventions informed by population-based reporting from HFCAs with high and reliable case notification (≥95 percent reporting completeness). In higher-transmission HFCAs with malaria incidence between Level 2 with 50–199 malaria cases per 1,000 population and Level 3 with 200–500 cases per 1,000 population, to Level 4 with more than 500 malaria cases per 1,000 population, strategies will aim to bring to scale the coverage of effective curative and preventive interventions and strengthen information systems.

In low-transmission settings (HFCAs) or "where recent progress has markedly reduced transmission," the NMESP states that "priority should be given to elimination," and the recommended actions include the following:

- Interrupting malaria transmission

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

For *high-transmission settings (HFCAs),* the tactical approach comprises the following recommended actions:

- Achieving effective coverage and utilization with malaria curative and preventive services
- Improving the quality, timeliness, and use of information systems for decision-making to further reduce malaria transmission
- Reducing the malaria burden to a sufficiently low level to enable the implementation of parasite-clearance strategies

PMI's investment strategy embraces the national, stratified approach. However, as in many countries, at a more granular level PMI/Zambia's strategic approach does not align 100 percent with the national strategy. For example, PMI takes a more cautious approach regarding the cost-effectiveness of mass drug administration (MDA), especially in higher-transmission settings, as the effect is often transient and attaining high population coverage rates is challenging. Some deviations are noted on an operational level such as the current MOH plan to conduct MDA in 15 high-burden districts using non-PMI and non-Global Fund resources. No PMI funding for MDA has yet been programmed. However, PMI/Zambia may consider collaboration in a trial of MDA in pre-elimination districts in the future, in the context of operations research.

<u>PMI/Zambia's Designated Funding for Malaria Elimination Activities</u>

Since FY 2010, PMI/Zambia has been allocated $24–25 million per year through the MOPs to support interventions #1 through #6 in our "main program," which supports a set of high-burden provinces and districts (Luapula, Muchinga, Northern, and Eastern, as well as targeted support to rural Copperbelt and Central). In addition, since FY 2017 PMI/Zambia has been fortunate to receive an additional $5m per year in funding designated for investments in pre-elimination districts. The rationale for this additional support to Eastern Province includes (1) the commitment of the political and public health leadership to malaria elimination, as embodied in the country's National Malaria Elimination Strategic Plan 2017–2021 (NMESP) and in the rebranding of its National Malaria Control Program as the National Malaria Elimination Center; (2) sustained, well-documented success since 2006 in reducing malaria burden in Southern Province, offering a set of tools and approaches that the NMEP and partners aim to replicate in a contiguous corridor along the southern borders of Zambia; (3) history of effective collaboration among GRZ and partners in malaria control in Eastern Province; and (4) lower baseline caseloads and reduced inherent malaria transmission potential in the higher, cooler terrain of the plateau area in Eastern; among others.

Initial funding supported activities in three pre-elimination districts (Sinda, Katete, and Chadiza). In 2020 and 2021 under NMEP guidance the target area has expanded to four additional districts (Petauke, Kasenengwa, Chipata, and Chipangali). Figure 14 provides a district map.

Figure 14. Map of districts in Eastern Province targeted under the PMI/Zambia pre-elimination investment strategy.

The districts of Sinda, Katete, and Chadiza (shaded in blue) have been targeted since late 2018. Four additional districts have been added since then.
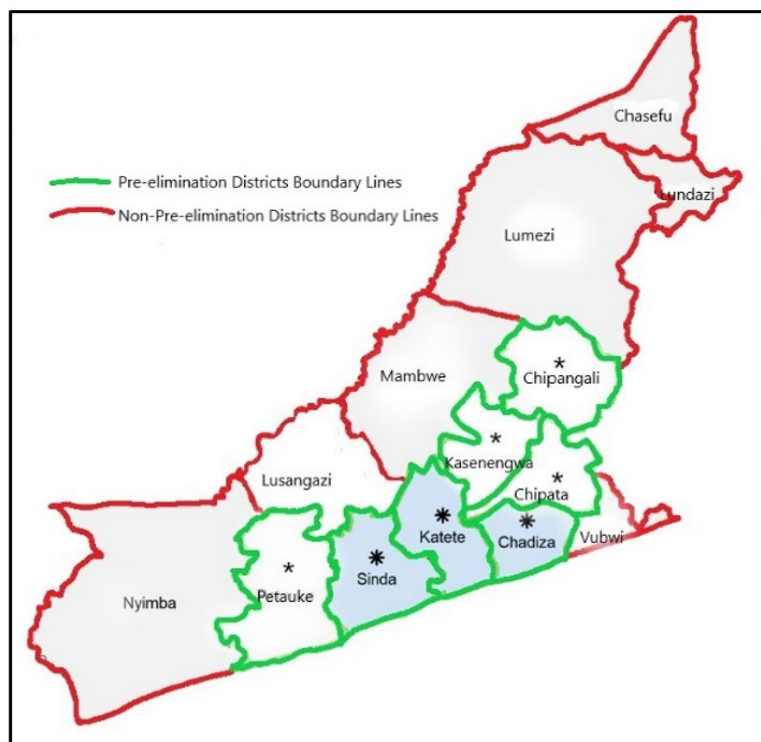
The incorporation of enhanced activities in pre-elimination districts since FY 2017 represents a new strategic direction for PMI/Zambia, where instead of investing all resources in the highest-burden areas to maximize reduction of morbidity and mortality, PMI would invest a portion in already low-burden areas to further reduce malaria burden to pre-elimination levels. Therefore, in consultation with the NMEP and partners, PMI developed an explicit strategy for investing this district funding stream in the pre-elimination districts. The approach is consistent with *PMI Technical Guidance* and is responsive to WHO and Zambia NMESP strategic frameworks. It facilitates the vigorous pursuit of elimination and learning about elimination as valuable albeit lesser objectives in their own right, while not distorting or distracting from the main thrust of PMI/Zambia's program. The approach is depicted in Figure 15.

Figure 15. PMI approach to supporting NMESP's intervention strategy
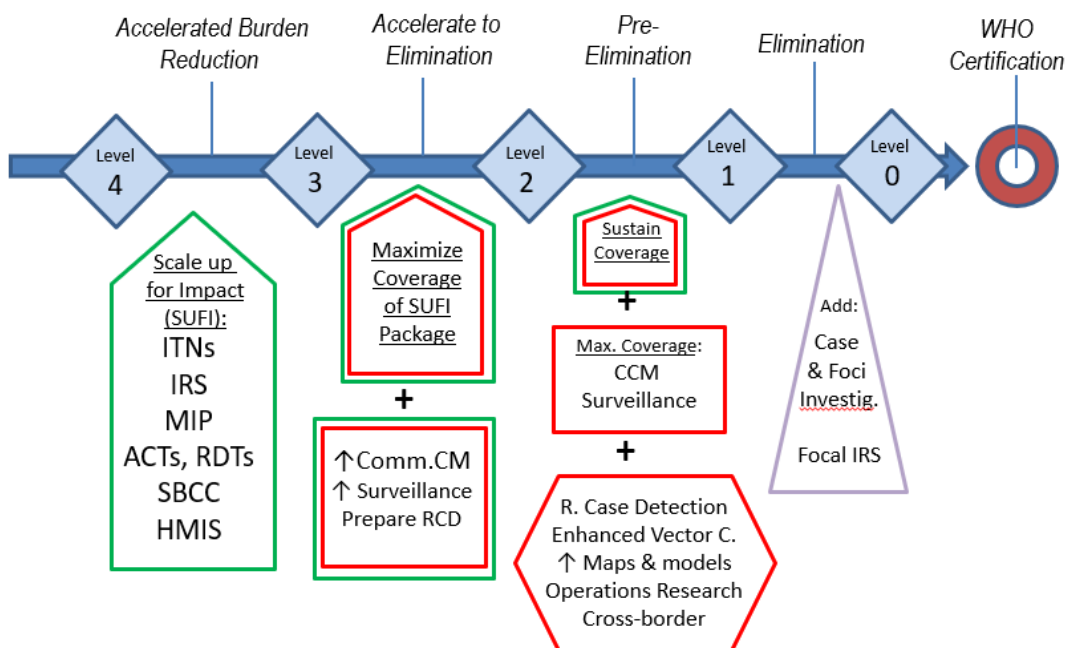
Following the Southern Province model, a phased approach has been employed in Eastern, whereby the first thrust has been to achieve sustained high coverage of the standard package of interventions, namely universal access to modern vector control (ITNs and/or IRS), universal access to community case management (with community health worker [CHW]-to-population ratio of 1:500), strengthened case management and supply chains at health facilities; robust SBC with strong community engagement; and intensive surveillance. This is accompanied by state-of-the-art mapping and modeling to maximize program learning, so that these districts may serve as pathfinders for the country. The first phase, lasting two to three years, is followed by reassessment and introduction of additional or modified approaches as warranted. Strengthened local systems for data collection, management, and analysis permit close monitoring of intervention coverage and impact throughout.

In the 2018 baseline assessment, modeling suggested that Katete and Sinda districts could attain pre-elimination status in three to four years by applying the standard intervention package, whereas Chadiza would likely need enhanced interventions. The modeling highlighted the potential impact of iCCM and reactive case detection (RCD), and of switching from standard to piperonyl butoxide (PBO) ITNs, among other findings. As of the time of FY 2022 MOP writing, an interim assessment was underway, which is expected to guide interventions as the elimination investments enter the next phase. Preliminary findings document high intervention coverage but suggest that, although the pre-elimination districts did not succumb to the 2020 national and provincial increases in malaria indicators, the majority of HFCAs have not yet attained Level 1 status on a sustained basis. The pre-

elimination districts did buck provincial trends and saw a decrease in the test positivity rate by early 2021, indicating that the intensive interventions prevented transmission resurgence in these districts. PMI has yet to support case-based and focal epidemiologic and entomologic investigation, and plans for potentially introducing MDA in the context of operations research remain on hold.

III.   PARTNER FUNDING LANDSCAPE

PMI emphasizes the importance of partner alignment for malaria control, recognizing that different partners bring complementary expertise and resources. In recent years, PMI, the Global Fund, and the BMGF have harmonized financial, supply chain, and programmatic data. In particular, PMI and the Global Fund agreed to a harmonized financial taxonomy to aid comparison of our investments to better identify potential overlap or gaps.

Partnership in Support of the National Strategy

The NMEC continues to count on close support for the NMESP from various malaria partners "through TA, commodity procurement and operations. These partners include, among others: WHO, [African Leaders Malaria Alliance], the South African Development Community Malaria Elimination 8 (SADC/E8), The Global Fund, PMI, PATH/MACEPA, Isdell Flowers Foundation, the World Bank, Rotarians, and Mobilising Access to Maternal Health Services (MAMaZ) Against Malaria; mines, plantations and other private sector partners; research and academic institutions; and local civil society organizations (CSOs)."

- In 2020, Zambia submitted a Global Fund continuation grant request with an emphasis on strategic continuity with the 2018–2020 grant, but with operational improvements to reflect various lessons learned. The within grant allocation amount offered was $65M, a decrease from $69M. In light of the GRZ's continued highly constrained fiscal situation, Zambia is effectively counting on approximately $35M in an above-allocation request (PAAR) to cover anticipated implementation gaps. Historically, Zambia has secured PAAR funds and the Global Fund Portfolio Manager at the MOH is optimistic that at least a portion of the PAAR will indeed come through.
- There are as-yet undefined plans for increased TA from the Chinese government, potentially in such technical areas as surveillance, laboratory capacity, and MDA, with a possible focus on urban geographies such as Lusaka and Copperbelt provinces.
- Zambia's End Malaria Council has formally set up provincial-level councils and a national End Malaria Fund as part of its effort to mobilize domestic resources. Contributions from members have been innovative and demonstrative of great potential, if limited in financial scope as of yet.

Funding Analysis

Due to the U.S. Government fiscal year budget cycle and approximate timing of annual appropriations, PMI MOP resources fund activities that largely occur during the following fiscal year. For example, this FY 2022 MOP is anticipated to largely fund implementation of activities starting in 2023. Global Fund resources are based on the calendar year (CY) and planned for a three-year grant cycle. Most partner country governments and other partners also budget based on the calendar year.

The tables below summarize contributions by key external partners and partner country governments in calendar years 2020–2022, providing insight into total country investments. Because new grants funded through the Global

Fund 2021–2023 grant cycle are just beginning, or will begin later in 2021, Global Fund country investments may still evolve in some countries. The partner country government invests substantial funding into the national-to-local infrastructure and service delivery that benefits malaria programs and many others. However, it is not always possible to attribute funding for malaria specifically from the partner country government without a standardized method. There may be similar challenges for attributing other partner funds.

Zambia's rapid population growth, estimated at 2.9 percent (World Bank) creates resource challenges for malaria control programming, which relies on achieving high population coverage of key interventions. PMI's funding levels of $30.0M in FY17 and $28.0M in FY 2021 imply a 17 percent decrease in per capita spending over four years. Similarly, Global Fund's base funding allocations of $69M for 2018–2021 and $65M for 2021–2024 imply an 18 percent drop in per capita support over 6 years. In addition, the kwacha has continued on a sustained devaluation path amid GRZ financing constraints.

Table 3a. Annual budget by Level 1 category for FY 2019/CY 2020

Funder	Vector Control	Case Management	Drug-Based Prevention[1]	Supply Chain[2]	Monitoring, Evaluation & Research	Cross-cutting and HSS[3]	Total Per Funder
PMI	$13.8M	$10.3M	$0.8M	$1.8M	$1.9M	$1.3M	$30.0M
Global Fund	$34.3M	$10.6M		$0.0M	$0.5M	$4.0M	$49.5M
Gov	$6.61M	$0.162M	$5.366M			$0.217M	$12.355M
Isdell Flowers[4] MACEPA Rotary Club	$0.4M $0.3M $0.0	$0.16M $0.15M $0.204M	$0.0 $0.08M $0.0	$0.0 $0.0 $0.0	$0.0 $1.45M $0.0	$0.0 $0.08M $0.0	$0.56M $2.06M $0.204M
Total Per Category	$55.41M	$21.576M	$6.246M	$1.8M	$3.85M	$5.597M	$94.479M

Table 3b. Annual budget by Level 1 category for FY 2020/CY 2021

Funder	Vector Control	Case Management	Drug-Based Prevention[1]	Supply Chain[2]	Monitoring, Evaluation & Research	Cross-cutting and HSS[3]	Total Per Funder
PMI	$10.8M	$11.0M	$0.9M	$0.9M	$2.4M	$4.1M	$30.0M
Global Fund	$11.2M	$17.0M	$0.6M		$1.8M	$8.2M	$38.8M
Gov	$4.756M	$0.068M	$4.159M			$0.033M	$9.016M
Isdell Flowers,[4] MACEPA, Rotary Club	$0.855M $0.3M $0.0	$0.3M $0.15M $0.256M	$0.0 $0.08M $0.0	$0.0 $0.0 $0.0	$0.286M $1.45M $0.0	$0.0 $0.08M $0.0	$1.4M $2.06M $0.256
Total Per Category	$27.911M	$28.774M	$5.739M	$0.9M	$5.936M	$12.413M	$81.673M

Table 3c. Annual budget by Level 1 category for FY 2021/CY 2022

Funder	Vector Control	Case Management	Drug-Based Prevention[1]	Supply Chain[2]	Monitoring, Evaluation & Research	Cross-cutting and HSS[3]	Total Per Funder
PMI	$10.1M	$10.2M	$0.5M	$1.1M	$2.5M	$3.7M	$28.0M
Global Fund	$2.7M	$6.7M	$0.6M		$0.5M	$6.5M	$17.0M
Gov	$5.198M	$0.070M	$4.574M		$0.050M		$9.892M
Isdell Flowers,[4] MACEPA	$0.83M $0.3M	$0.5M $0.15M	$0.0 $0.08M	$0.0 $0.0	$0.415M $1.45M	$0.0 $0.08M	$1.7M $2.06M
Total Per Category	$19.128M	$17.62M	$5.754M	$1.1M	$4.915M	$10.28M	$58.793M

1. Drug-based prevention, including seasonal malaria chemoprevention (SMC) and malaria in pregnancy (MIP) where applicable. 2. Covers management of in-country warehousing and distribution of malaria commodities, except for ITNs, which are separately captured under Vector Control. 3. HSS = health systems strengthening. 4. Isdell Flowers data received from Isdell Flowers by email on 20 Apr 2021 through an implementing partner. GRZ data received from NMEC by email on 20 Apr 2021 through an implementing partner. Rotary Club data received from Rotary Club on 22 Apr 2021 through an implementing partner. MACEPA data received from MACEPA on 21 Apr 2021 through an implementing partner.

Table 4a. Annual budget, breakdown by commodity, FY 2019/CY 2020

Funder	ITNs Continuous Distribution	ITNs Mass Distribution	IRS[1] Insecticide	ACTs	RDTs	Severe Malaria	SMC-Related	IPTp-Related	Total
PMI[2]	$1.5M	$3.4M	$7.4M	$5.5M	$2.5M	$0.5M			$20.8M
Global Fund	$0.7M	$11.2M	$2.3M	$4.4M	$4.0M	$0.2M			$22.7M
Gov									$0.0M
Other									$0.0M
Total	$2.2M	$14.6M	$9.7M	$9.9M	$6.4M	$0.7M	$0.0M	$0.0M	$43.5M

Table 4b. Annual budget, breakdown by commodity, FY 2020/CY 2021

Funder	ITNs Continuous Distribution	ITNs Mass Distribution	IRS[1] Insecticide	ACTs	RDTs	Severe Malaria	SMC-Related	IPTp-Related	Total
PMI[2]	$2.1M		$5.2M	$3.4M	$3.7M	$0.5M			$14.93M
Global Fund			$2.2M	$7.0M	$4.4M			$0.5M	$14.1M
Gov									$0.0M
Other									$0.0M
Total	$2.1M	$0.0M	$7.4M	$10.4M	$8.1M	$0.5M	$0.0M	$0.5M	$29.0M

Table 4c. Annual budget, breakdown by commodity, FY 2021/CY 2022

Funder	ITNs Continuous Distribution	ITNs Mass Distribution	IRS[1] Insecticide	ACTs	RDTs	Severe Malaria	SMC-Related	IPTp-Related	Total
PMI[2]	$2.1M		$4.8M	$3.2M	$3.5M	$0.6M			$14.1M
Global Fund			$2.0M		$4.3M			$0.5M	$6.8M
Gov									$0.0M
Other									$0.0M
Total	$2.1M	$0.0M	$6.8M	$3.2M	$7.8M	$0.6M	$0.0M	$0.0M	$20.9M

Note: Categories reflect the harmonized financial taxonomy (Levels 1-3) developed by BMGF, Global Fund, and PMI in 2019, as part of a broader data harmonization initiative but may continue to evolve. 1. IRS insecticide: for PMI, commodity costs may be inextricable from IRS implementation costs in historical data – field identified as ND where this is the case. 2. PMI commodity costs are fully loaded, including costs for the ex-works price of the commodity, quality control, freight, insurance, and customs.

IV.   ACTIVITIES TO BE SUPPORTED WITH FY 2022 FUNDING

The FY 2022 budget tables contain a full list of activities that PMI proposes to support in Zambia with FY 2022 funding. Please visit www.pmi.gov/resource-library/mops for these FY 2022 budget tables. Key data used for decision-making for this MOP planned investments is provided in Annex A of this document.

ANNEX A: INTERVENTION-SPECIFIC DATA

This section outlines key data that helped inform decision-making around FY 2022 MOP funding allocations to PMI-supported activities.

1. VECTOR CONTROL

NMEP Objective

- The primary objective of the NMEP is to provide access to effective vector control at high coverage (i.e., 100 percent of the population living in areas covered by IRS and/or ITNs). In the MIS 2018 survey, 84 percent of households reported either owning at least one ITN, receiving IRS in the past 12 months, or both. By the more stringent criteria of owning one net per two people or receiving IRS in the past 12 months, the figure was 61 percent. The goal is to rapidly accelerate the combined coverage of ITNs and IRS toward 100 percent, while minimizing co-deployment.
- A secondary objective of the NMEP is to implement additional interventions such as larviciding, environmental manipulation, baited traps, and other vector control approaches, where specifically appropriate. (Some of the interventions of the NMEP strategy are not supported by PMI.)
- All activities should be supported by vector surveillance data (e.g., bionomics and insecticide resistance status) to direct and update actions.

NMEP Approach

- Indoor residual spraying (IRS): Zambia allocates IRS resources to nearly all districts in the country for IRS, unlike most PMI-focus countries. From 2011 to 2018, IRS resources were typically rationed out such that 20 percent to 30 percent of the population in each district would receive IRS in a targeted approach, with prioritization of higher malaria burden districts. Since 2016, the stated MOH target for IRS is an ambitious 80 percent of the national population. From 2017 to 2020, annual operational IRS coverages have increased toward this goal, resources permitting. In the 2017–2018 campaign, 35 percent of households were sprayed nationwide according to the MIS. In the 2019 and 2020 campaigns, the NMEP achieved an interim national target of 65 percent of the population, for which it mobilized increased resources from PMI, Global Fund, GRZ, and, to a minor degree, the private sector. Per long-standing Zambian practice, targeting IRS at the subdistrict level is based on criteria such as operational feasibility, high burden, history of past spraying, and population density. Each local area that has been targeted for spraying should achieve the WHO recommended threshold of >85 percent coverage of eligible structures. WHO prequalified insecticides are used in rotation to mitigate the reported vector resistance to insecticides in Zambia, informed by annual deliberations of the Technical Advisor Committee (TAC).
- Insecticide-treated nets (ITNs) – mass campaigns: Mass ITN campaigns had been conducted every three years to ensure universal coverage, with the last such universal coverage campaign taking place in 2017–2018. Since then, the MOH has seen IRS as the primary vector control intervention, with ITNs as a gap-filler. In the 2020–2021 season, IRS and ITN campaigns were deployed so as to create a "mosaic" coverage at the subdistrict level. During coordinated planning, settlements that were not selected for IRS were designated for ITNs, with prioritization of high-burden and hard-to-reach areas, aiming for one ITN per 1.8 persons in targeted communities and allowing for an operational buffer of 10 percent co-deployment of IRS and ITNs to minimize community coverage gaps. Of note, this approach to ITN mass campaigns is highly challenging operationally and is not consistent with PMI recommendations. However, as national policy, the approach garnered cautious and exploratory support from PMI and other partners.

For example, to optimize population coverage while minimizing gaps at the subdistrict level, partners supported development of innovative mapping tools to guide joint campaign planning.

- For the 2023 ITN mass campaign, the NMEC intends to revert to ITNs as the primary vector control intervention, with IRS deployed in a localized manner. The subdistrict mosaic is likely to be replaced by a district-level mosaic, where entire districts would be targeted for blanket coverage with either IRS or ITNs. This approach is captured in the current Global Fund grant and is expected to be formalized in the new national strategy (2022–2026). Referencing WHO guidelines, the NMEC would consider areas that have received high IRS coverage for a minimum of three years potentially suitable for transition to ITNs. A task team is being convened to define additional epidemiologic, entomologic, and operational criteria for targeting.

- PMI/Zambia is supportive of this shift, after advocating for a return to universal ITN coverage in high-burden areas. International best practice for withdrawing IRS, including strengthened entomological and epidemiological surveillance, SBC activities, and strengthened case management and supply chain to guard against potential rebound, will be followed.

- <u>ITNs – continuous distribution</u>: Continuous distribution of ITNs are provided nationwide through antenatal care (ANC) and Expanded Program for Immunization (EPI) clinics. This is complemented by distributions in selected primary schools where support is available. The NMEC is interested in piloting community-based distributions as well. Continuous distribution targets vulnerable groups, namely young children and pregnant women. Operationally, these routine channels received lower priority during the 2020 campaign but were not suspended as they had been national practice during past campaign years.

- <u>Larval source management (LSM)</u>: Larval control is part of the integrated vector management (IVM) strategy of the NMEP. However LSM has not been widely implemented because attention and resources have been primarily invested in the IRS and ITN strategies, and LSM is difficult to implement in the innumerable rural breeding sites during the rainy season. Although LSM is part of the IVM strategy, implementation has been funded on a very limited basis, typically at the city council level in large urban centers, in which objectives for malaria control and nuisance mosquito control overlap.

- <u>Entomological surveillance</u>: The NMEP and partners aim to ensure the operation of a nationwide network of entomologic monitoring sites, supplemented by spot checks if needed, and supervised by qualified entomologists and vector control specialists. The purpose of this surveillance system will be to inform the monitoring and decision-making needs of the NMEP and partners, in terms of optimizing vector control interventions and implementing the insecticide resistance management plan. Fixed-point entomological sentinel sites increased from 12 in 2017 to 22 in 2019, with plans to expand to 39 sites by 2022 in response to the expanding program.

- <u>Insecticide resistance</u>: The *National Insecticide Resistance Management and Monitoring Plan*, last revised in 2018, continues to guide resistance monitoring and the deployment of insecticides for malaria control. Given documented widespread pyrethroid resistance, especially in *Anopheles gambiae* s.l., Zambia's policy is to (1) use non-pyrethroid pesticides in IRS campaigns and implement a mosaic approach at the district or provincial level that includes clothianidin only/clothianidin-deltamethrin formulations, dichlorodiphenyltrichloro-ethane (DDT), and other emerging insecticides once available (e.g., chlorfenapyr, or potentially others) and (2) switch from standard long-lasting insecticide-treated mosquito net (LLINs) to PBO ITNs when resources permit.

PMI Objective in Support of NMEP

- Oversight, planning, and coordination: PMI provides TA and facilitation of multi-sectoral national technical and governing bodies including the Vector Control Technical Working Group (TWG), the Technical Advisory Committee of Insecticide Resistance Management, and *ad hoc* task forces and organizing committees such as the 2020–2021 ITN Mass Campaign Planning Task Force.
- Technical assistance and commodity support: PMI is the country's largest partner in supporting entomologic surveillance, IRS campaigns, and ITN distribution, eclipsing even the Global Fund. Through the annual work planning process, PMI works within its MOP allocations to align these contributions with those of other partners, such as Global Fund, MACEPA, and Tropical Diseases Research Centre, in support of the NMESP.
- IRS and ITNs for vector control: PMI provides national-level TA to improve MOH capacity to plan, manage, and implement these priority interventions using a range of GRZ and partner resources; provides operational and commodity support for implementing IRS and ITN campaigns in selected districts and provinces; assists with environmental compliance procedures; and provides commodity support for ITN distribution through routine channels nationwide as well as operational support in selected provinces and districts.
- Cross-cutting: PMI provides health system support to benefit vector control in areas such as management training, SBC, surveillance, data integration and visualization, program evaluation, and, occasionally, in operations research.
- PMI's technical strategy in vector control does not align fully with the national approach in all respects. Notably, PMI advocates universal access to ITNs and does not fund larval source management. While PMI did support use of DDT in Zambia through 2010, PMI is currently unable to procure or spray with DDT for the foreseeable future, due to the current absence of a WHO pre-qualified supplier. However, PMI/Zambia remains committed to supporting the country to meet its goals of providing access to evidence-based, high-quality vector control to 100 percent of households. In spite of these differences in strategic approach, we find common ground in our shared goal of maintaining or improving upon Zambia's already high rates of household coverage with effective vector control. In the 2018 MIS, 84 percent of households reported owning at least one ITN and/or receiving IRS within the past 12 months.

PMI-Supported Recent Progress (past ~12 months)

Entomological assessment:

Entomological monitoring of IRS has been occurring in 14 sites distributed in the districts of Chililabombwe, Katete, Lufwanyama, Mambwe, Milenge, Nchelenge, and Serenje to assess the impact of IRS on entomological indicators after the 2020 campaign. Entomological monitoring took into consideration mitigation measures to reduce risk of COVID-19 transmission. Through PMI support, (1) annual insecticide susceptibility tests to assess local vector susceptibility status and vector surveillance to determine species composition were obtained to guide the NMEP on the selection of insecticides; (2) monthly cone wall bioassays were done to assess the decay rate of sprayed insecticides on different wall surfaces to inform the NMEP's programmatic choice of insecticide; (3) equipment, reagents, and supplies were provided to the NMEC to enhance laboratory capacity to perform molecular analysis on mosquito samples (polymerase chain reaction [PCR] and enzyme-linked immunosorbent assay [ELISA]); (4) assistance was provided to the NMEP to train environmental health technicians on basic

entomological surveillance techniques; (5) assistance was provided to draft and develop standard operating procedures for entomological monitoring; (6) an electronic entomologic database for inputting of entomological data was introduced; and (7) national technical documents and work plans on entomology have been developed or are under development.

Integrated Data Analytics and Visualization:

Technical assistance and development was provided for the rollout and use of the DHIS2 modules that capture IRS and ITN campaigns at the HFCA level. This was integrated in the existing DHIS2 dashboard already used by the NMEP. This support assisted with data visualizations, improving IRS insecticide product choice, and integrated ITN and IRS data across partners.

ITN distribution planning:

Assistance was provided to the NMEP in establishing national planning structures and produced various plans of action and allied tools for the ITN mass distribution campaign. A comprehensive ITN work plan for the 2020–2021 mass campaign was developed and the NMEP was supported in the ITN mass campaign planning and training of staff. A senior ITN advisor was embedded at the NMEC to support ITN mass campaign activities. TA was provided to NMEP to optimize interaction with the Alliance for Malaria Prevention by facilitating weekly teleconference conferences. COVID-19 guidance was mainstreamed in the 2020–2021 net campaign, which included procurement of personal protection equipment for 20,000 community-based volunteers. Monitoring and supervision support was provided for all campaign stages (training, household registration, door-to-door distribution, data collation, validation, and entry in DHIS2). Four provincial site managers were installed to assist the provincial health officers (PHOs) and district health officers (DHOs) to monitor and supervise the campaign in the four PMI-focus provinces. Last mile net delivery efforts was supported by mobilizing "surge" support staff from the IRS program and transportation support to help monitor and address net distribution challenges in the four provinces.[2]

ITN distribution results, 2020:

A total of 5,680,200 ITNs were recorded in the NMEC DHIS2 as being required nationally.

- 98.8 percent of the ITNs received by health facilities (HFs) had been issued or distributed to the households.
- 85.9 percent of the required ITNs were distributed to the beneficiaries nationally.
- Luapula Province has received 498,934 (99.4 percent) of the 501,905 ITNs required and has distributed 498,610 (99.9 percent) of the received ITNs.
- Northern Province has received 657,101 (97.1 percent) of the 676,865 ITNs required and has distributed 653,058 (99.4 percent) of the received ITNs.
- Muchinga Province has received 408,313 (95.5 percent) of the 427,411 ITNs required and has distributed 351,048 (86.0 percent) of the received ITNs.

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[2] https://pmivectorlink.org/2021/02/12/vectorlink-zambia-goes-the-last-mile-for-itn-distribution/

- Eastern Province has received 428,164 (88.4 percent) of the 484,267 ITNs required and has distributed 426,292 (99.6 percent) of the received ITNs.

PMI's contribution to the ITN campaign was over 2.1M ITNs. In addition to the support for the mass ITN campaign, PMI also provided 417,000 ITNs through the continuous distribution channels, ANC and EPI, and 20,000 ITNs were distributed through school-based distribution in selected districts.

Other ancillary ITN activities

PMI has also conducted a durability monitoring study from the 2017–2018 ITN campaign in Katete and Lundazi. Olyset ITNs were tested in Katete and PermaNet 2.0 ITNs were tested in Lundazi. A health facility assessment is also being conducted to strengthen ANC/EPI continuous distribution.

Indoor Residual Spraying:

- Implementation of Zambia's IRS program in 2020 was built upon lessons learned as the country entered its 13th year of PMI support for IRS. The program continued to implement IRS in the same provinces that had been sprayed in 2019: Eastern (nine districts), Luapula (three districts), and Copperbelt (three rural districts). In Copperbelt, to improve operational efficiencies, PMI discontinued direct operational support from the seven urban districts but provided training, planning support, and other TA to the MOH and mining companies' IRS program. In two districts in northern Luapula, the Global Fund/GRZ program supplied insecticide while PMI covered the other costs.
- In 2020 the PMI-supported campaign sprayed 648,952 structures out of 672,620 structures found by spray operators, resulting in 97 percent spray coverage and exceeding the target of 629,155 structures. The campaign protected 2,776,502 people, including 391,460 children under five years of age and 73,965 pregnant women. Overall, 14,766 people were trained; 2,576 of these were spray operators, team leaders, supervisors, and team leader assistants. Gender equity continued to improve, with females accounting for 43 percent of all staff hired to deliver IRS and 35 percent of supervisory positions.
- In light of the NMEC's interest in developing models for community IRS, PMI supported the second year of a community-based IRS pilot in one district (Petauke). Local recruitment of spray operators was enhanced, and cost savings from reduced transportation costs were realized from the use of bicycles. However, a cost analysis demonstrated that six years of implementation will be needed to recoup the high start-up costs associated with the expanded number of operational sites (from 2 to 16).
- The program continued to innovate in the use of geospatial systems. For example, in 2020, in collaboration with the BMGF-funded GRID3 project, PMI and partners developed customized mapping tools to inform coordinated planning of ITN and IRS campaigns. The physical maps, paired with user-friendly electronic spreadsheets, were used during microplanning in over 100 districts. Additionally, in two "learning lab" districts, the satellite-based Reveal system (formerly mSpray) was deployed to guide real-time operations. This enhanced planning and mop-up visits and is informing geospatial analysis of malaria control effectiveness in collaboration with PATH in Chadiza District and the U.S. National Institutes of Health (NIH)-funded International Center of Excellence in Malaria Research (ICEMR)[3] research station in Nchelenge District.

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[3] https://www.niaid.nih.gov/research/southern-central-africa-international-center-excellence-malaria-research

- At the national level, PMI provided TA to the NMEP, leveraging Global Fund and GRZ resources. In response to bottlenecks encountered during previous spray campaigns and informed by a capacity assessment conducted in 2018, in 2020 PMI focused capacity-building efforts on adherence to spray preparation protocols, timely start of spraying, and ensuring good IRS data quality for decision-making. In 2020, PMI supported IRS monitoring and supervision in the seven urbanized Copperbelt districts; environmental compliance training, monitoring, and supervision of dichlorodiphenyltrichloroethane (DDT) use in Northern, Muchinga, and Luapula provinces; quality of spray assessment in three DDT districts; and procurement of sprayers and personal protective equipment. PMI also supported data integration and visualization for decision-making using the Tableau platform.
- In the PMI-supported areas in 2020, no significant challenges were experienced to delay or prevent implementation, in spite of rigorous adherence to the COVID-19 mitigation measures. This was attributable in part to improvement to the work week, the approach to community engagement, the timing of spraying, and other aspects, based on lessons learned from previous years. In the non-PMI supported districts, a continuing concern in 2020 was the late start of IRS campaigns due to delayed release of funds, delayed procurement of personal protective equipment, and other bottlenecks.

### Combined ITN and IRS coverage in the 2020 Campaign

The following map depicts the results of the 2020 IRS and ITN campaigns, as reported through the DHIS2 (Figure A-1). Findings would be validated during the upcoming 2021 Malaria Indicator Survey.

Figure A-1. Geographic distribution of population protected by 2020 IRS and ITN campaigns

Population is based on GRID3 estimates. Summed coverage assumes zero co-deployment of IRS and ITNs to local populations.

84 (72%) districts meet or exceed the 85% population protected target

Exceeds target (110%+)	53 (46%)
High (85%-110%)	31 (27%)
Mid (50%-85%)	30 (26%)
Low (<50%)	2 (2%)
Grand Total	116 (100%)
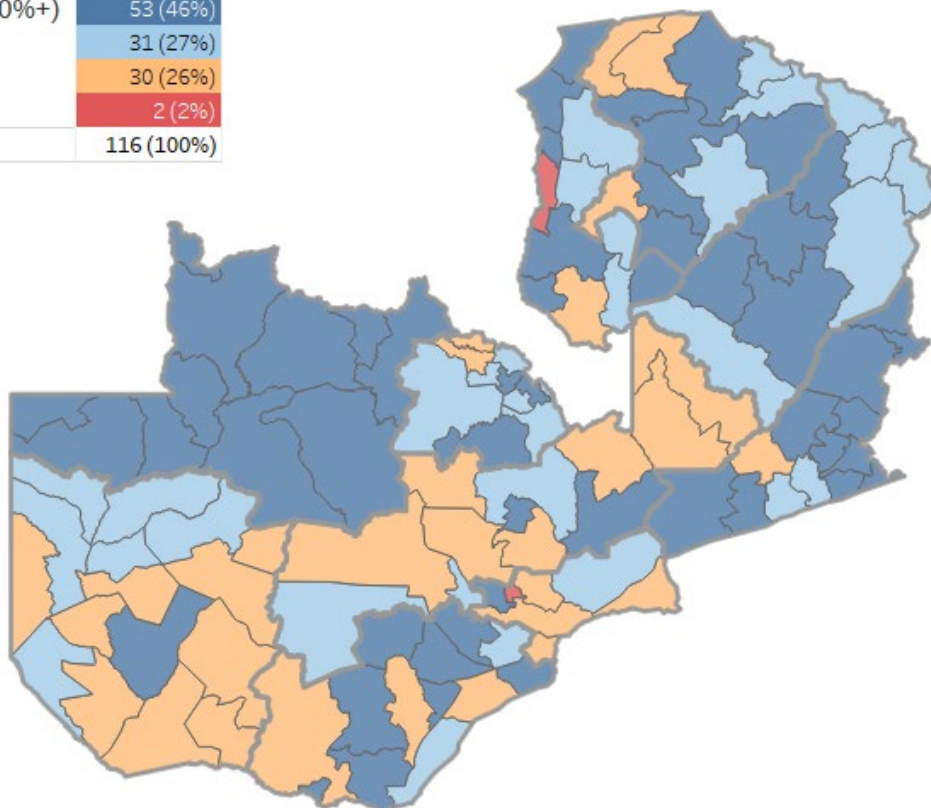
Source: NMEC, PATH.

PMI-Supported Planned Activities (next ~12 months with currently available funds)

- Conduct insecticide resistance monitoring in 14 sites from June 2021 to August 2022.
- Conduct vector bionomics monitoring monthly in 14 sites from June 2021 to August 2022.
- Procure 600,000 PBO ITNs for continuous distribution.
- Distribute 600,000 PBO ITNs via ANC and EPI, and a to-be-determined number of ITNs for school-based channels in 2021.
- Continue to support for the 2020–2021 mass campaign (note month/subregions, if not nationwide, and type of support [e.g., procure/distribution nets or TA]).
- Conduct 24-month durability monitoring data collection in 2021.
- Conduct IRS in 16 districts from September to November 2021. This will continue support for the same 15 districts supported in 2020 (now numbering 20 due to the re-delineation of boundaries), while adding

one peri-urban district on the Copperbelt. The Global Fund/GRZ will supply insecticide for three districts, with PMI covering other costs.

- Provide targeted TA to IRS campaigns in Global Fund/GRZ districts, including support for planning, monitoring, and environmental compliance as well as limited procurement to fill gaps and protect worker safety.
- Continue to support innovative approaches to enhance data analysis for decision-making such as data visualization and mapping/geo-referencing activities. For example, PMI will incorporate HFCA boundaries in the district mapping tools which were introduced in 2020.

1.1. ENTOMOLOGICAL MONITORING

Key Goal

Determine the geographic distribution, bionomics, and insecticide resistance profiles of the main malaria vectors in the country to inform vector control decision-making.

Key Question 1

Where is entomological monitoring taking place, what types of activities are occurring, and what is the source of funding?

Supporting Data

The figures and tables below provides details of the districts and subnational areas where entomological activities (i.e., insecticide resistance monitoring, vector bionomics monitoring, and cone bioassays) are being conducted for the 2020–2021 work plan cycle.

Table A-1. Location of entomologic monitoring activities nationwide, by district, supporting partner, and activity type

Province	District	Longitudinal Bionomics Monitoring	Insecticide Resistance	Cone Bioassays	Supported by
Central	Itezhi-tezhi	●			Active Global Fund (GRZ)
	Serenje	●	●		PMI
Copperbelt	Chililabobwe	●	●	●	PMI
	Lufwanyama	●	●	●	PMI
Eastern	Katete	●	●	●	PMI
	Mambwe	●		●	PMI
	Nyimba	●			AFRO II*
Luapula	Kawambwa			●	PMI
	Milenge	●		●	PMI
	Nchelenge	●	●	●	PMI
	Samfya		●	●	Active Global Fund (GRZ)
Muchinga	Chinsali			●	Active Global Fund (GRZ)
	Isoka	●	●	●	Active Global Fund (GRZ)
Northern	Kasama	●	●	●	Active Global Fund (GRZ)
Southern	Gwembe	●	●		BMGF (MACEPA)
	Monze	●			BMGF (MACEPA)
	Siavonga	●	●		BMGF (MACEPA)
	Sinazongwe	●	●		BMGF (MACEPA)
Western	Mongu	●			Active Global Fund (GRZ)

* Integrated Vector Management project in southern Africa (http://afro-ii.icipe.org/); GRZ = Government of Zambia; BMGF = Bill & Melinda Gates Foundation; MACEPA = Malaria Control and Elimination Partnership in Africa.

Figure A-2. Geographic locations of entomological monitoring sites of all partners in Zambia
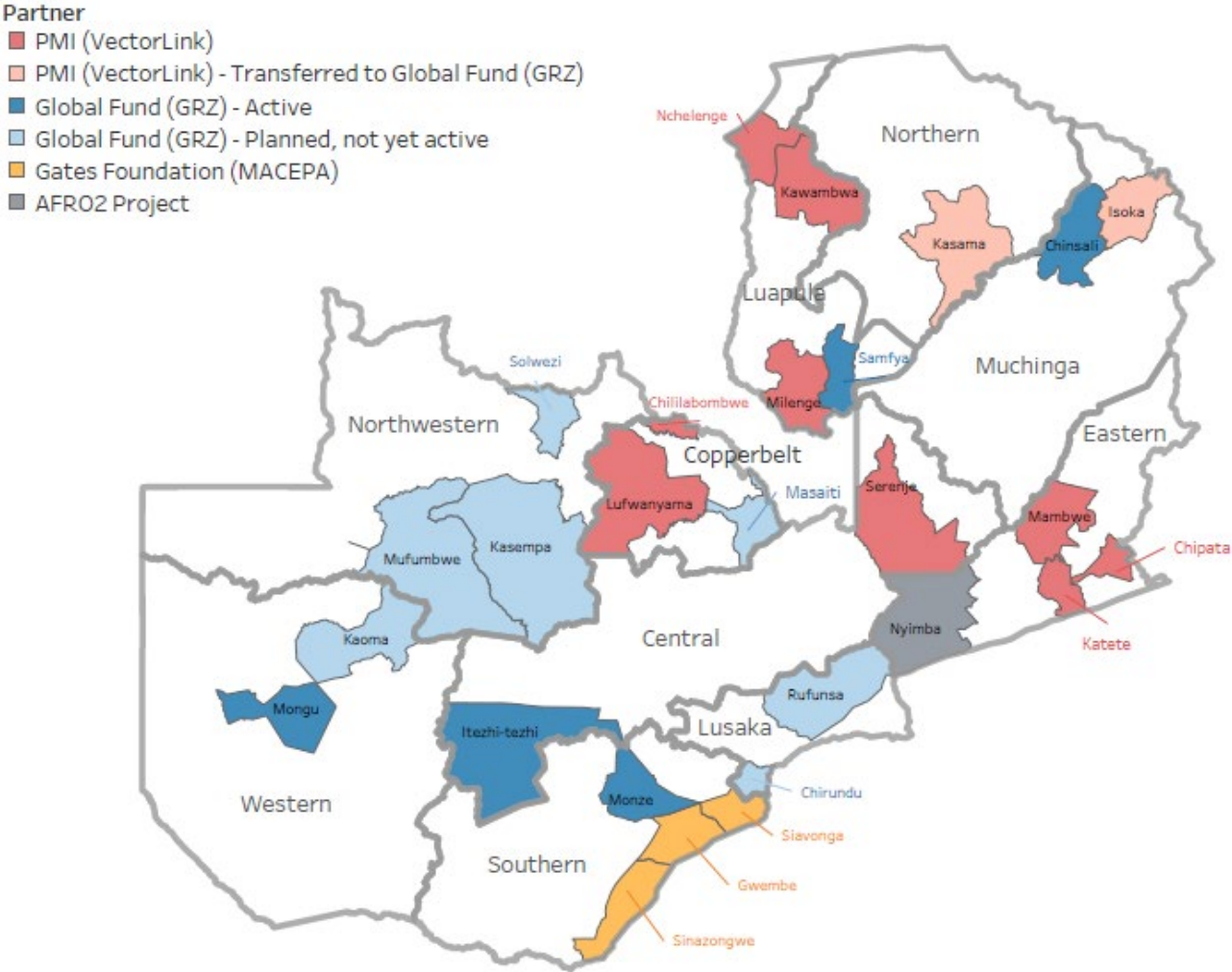

Partner
- ■ PMI (VectorLink)
- ▢ PMI (VectorLink) - Transferred to Global Fund (GRZ)
- ■ Global Fund (GRZ) - Active
- ▢ Global Fund (GRZ) - Planned, not yet active
- ■ Gates Foundation (MACEPA)
- ■ AFRO2 Project

Table A-2. Entomological monitoring activities in PMI village sites for 2020–2021

Province	District	Sites	Spray Status	Longitudinal Bionomics Monitoring	Insecticide Resistance	Cone Bioassays
Luapula	Nchelenge	Shikapande	Sprayed	●	●	●
		Manchene	Non-sprayed			●
		Mutono	Sprayed	●	●	●
	Milenge	Lunga	Sprayed	●	●	
		Miyambo	Non-sprayed			●*
	Kawambwa	Chama	Sprayed	●	●	●
Eastern	Mambwe	Chikowa	Sprayed	●	●	
		Chasela	Non-Sprayed	●	●	
	Katete	Chiloba	Sprayed	●	●	
		Robert	Non-sprayed			●
		Kafunka	Sprayed			●*
	Chipata	Jerusalem	Sprayed			●
		Faisako	Sprayed	●	●	
Central	Serenje	Chibobo	Sprayed	●	●	
		Chishi	Non-sprayed	●	●	●
Copperbelt	Lufwanyama	Nkana	Sprayed	●	●	●
		Bulaya	Non-sprayed	●	●	●
	Chililabombwe	Kawama	Sprayed	●	●	●
		Maina Soko	Non-sprayed			●
	Masaiti	Shikapansula	Sprayed			●

* IRS quality check only.

Figure A-3. Geographic locations of PMI-supported entomological sentinel sites in Zambia
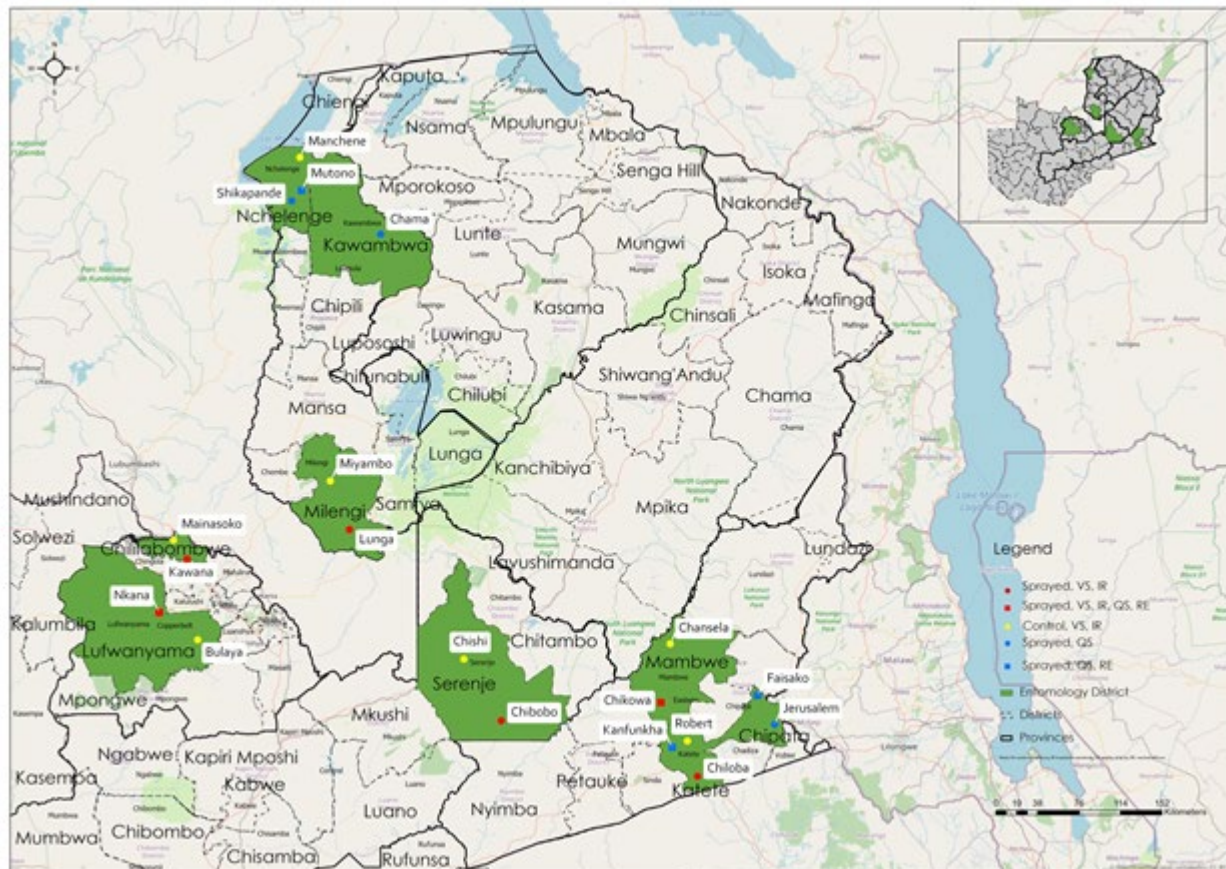
Table A-3. Distribution and bionomics of malaria vectors

Site/District	Vector*	Season (month)	Preferred Biting Location	Peak Biting Time	Preferred Resting Location**	Preferred Host	Annual EIR†
Chilabombwe	*An. funestus* s.l. *An. gambiae* s.l.	Oct–Jan	Indoor/ outdoor (0.63/0.37)	11:00 p.m.–1:00 a.m. (smaller peak) 2:00 a.m.–5:00 a.m. (larger peak)	N/A	Human	22
Katete	*An. funestus* s.l.	Oct–Jan	Indoor/ outdoor (0.52/0.48)	No definitive peak	N/A	Human	0

Site/District	Vector*	Season (month)	Preferred Biting Location	Peak Biting Time	Preferred Resting Location**	Preferred Host	Annual EIR†
	An. gambiae s.l.						
Lufwanyama	**An. gambiae s.l.** *An. funestus s.l.*	Oct–Jan	Indoor/ outdoor (0.72/0.28)	11:00 p.m.– 2:00 a.m. (larger peak) 1:00 a.m.– 4:00 a.m. (smaller peak)	N/A	Human	91
Mambwe	**An. gambiae s.l.** *An. funestus s.l.*	Oct–Jan	Indoor/ outdoor (0.19/0.81)	9:00 p.m.– midnight	N/A	Human	14
Milenge	**An. funestus s.l.**	Oct–Jan	Indoor/ outdoor (0.60/0.40)	1:00 a.m.– 7:00 p.m.	N/A	Human	1110
Nchelenge	**An. funestus s.l.** *An. gambiae s.l.*	Oct–Jan	Indoor/ outdoor (0.67/0.33)	midnight– 7:00 a.m.	N/A	Human	284
Serenje	**An. funestus s.l.** *An. gambiae s.l.*	Oct–Jan	Indoor/ outdoor (0.42/0.58)	10:00 p.m.– 11:00 p.m.	N/A	Human	0

*Primary vector listed first, in bold, followed by secondary vectors.

** Marked as N/A if simultaneous indoor and outdoor collections are not conducted.

†EIR = Entomological inoculation rate.

The results of Table A-3 are based on the 2019–2020 Zambia Annual Entomological Report.[4]

Some contextual factors:

Of all mosquitoes collected in the Chilabombwe District, *An. gambiae* s.l. made up 7 percent and *An. funestus* s.l. was 49 percent; for the Katete District, *An. gambiae* s.l. was 10 percent and *An. funestus* s.l. was 34 percent; for the Lufwanyama District, *An. gambiae* s.l. was 53 percent and *An. funestus* s.l. was 26 percent; for the Mambwe District, *An. gambiae* s.l. was 24 percent and *An. funestus* s.l. was 6 percent; for the Milenge District *An. gambiae* s.l. was 0 percent and *An. funestus* s.l. was 72 percent; for the Nchelenge District, *An. gambiae* s.l. was 3 percent and *An. funestus* s.l. was 62 percent; and for the Serenje District, *An. gambiae* s.l. was 7 percent and *An. funestus* s.l. was 80 percent. Molecular analysis of the sibling species of the *An. gambiae* complex detected *An. gambiae* s.s. (71 percent) and *An. arabiensis* (29 percent). Molecular analysis of the sibling species of the *An. funestus* complex detected *An. funestus* s.s. (31 percent), *An. parensis* (0.3 percent), *An. rivulorum* (62 percent), *An. rivulorum*-like (6 percent) species, and *An. vaneedeni* (0.3).

In Figure A-3, the preferred biting location is reported for the primary vector at each site. However, comparisons of the proportion of preferred indoor and outdoor biting rate of *An. funestus* s.l. and *An. gambiae s.l.* were similar in proportion of indoor and outdoor biting at all districts except in Serejene, where the proportion of outdoor biting was higher in *An. gambiae* s.l. than *An. funestus* s.l. (*An. gambiae* s.l. indoor and outdoor biting rate was 0.13 and 0.88, respectively; *An. funestus* s.l. indoor and outdoor biting rate was 0.42 and 0.58, respectively).

Currently, there are no studies on preferred resting locations of malaria vectors. Resting behavior is only evaluated by pyrethrum spray catches done indoors.

The preferred host for *An. gambiae* s.l. and *An. funestu*s s.l. is humans with the proportion of vectors with human blood ranging between ~85 percent and ~95 percent of mosquitoes tested. Other blood meals found in the vectors consisted of cow, goat, and dog ranging from ~1 percent to ~10 percent of mosquitoes tested.

Annual entomological inoculation rates (EIRs) are based on June 2019 to January 2020 surveys, corresponding with the activity period. Data from seven collection months (June 2019, August 2019, October 2019, November 2019, December 2019, and January and February 2020) was used to extrapolate the annual EIR.

More detailed information on entomological trends from past reports can be found on the PMI.gov website.

Key Question 2

What is the current insecticide resistance profile of the primary malaria vectors?

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[4] The U.S. President's Malaria Initiative (PMI)/VectorLink Project. Zambia Annual Entomology Report (June 2019–August 2020). Rockville, MD. The PMI VectorLink Project, Abt Associates. (https://www.pmi.gov).

Supporting Data

Figure A-4. Insecticide resistance profile from PMI-supported sentinel sites

A — WHO Tube Test: Percent Mortality of An. funestus s.l. tested against insecticides at 24 hrs, Zambia 2020

B — WHO Tube Test: Percent Mortality of An. gambiae s.l. tested against insecticides at 24 hrs, Zambia 2020

C — WHO Tube Test: Percent Mortality of An. funestus s.l. tested against pyrethroids and pyrethroids+PBO at 24 hrs, Zambia 2020

D — WHO Tube Test: Percent Mortality of An. funestus s.l. tested against Clothianidin, Zambia 2020

E — WHO Tube Test: Percent Mortality of An. funestus s.l. tested against Chlorfenapyr, Zambia 2020
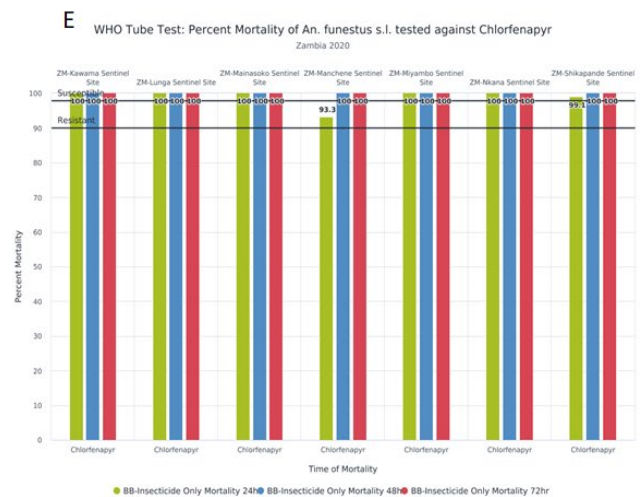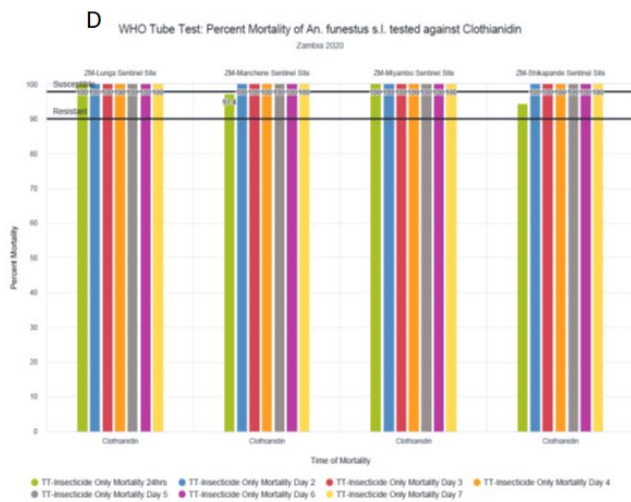
4Figure A-4 provides insecticide resistance data from August 2020 to February 2021. In Figure A-4.A, pyrethroid resistance (alpha-cypermethrin and deltamethrin) in *An. funestus* s.l. populations were observed in the Luapula Province. For alpha-cypermethrin, mortality rates ranged from 40.8 percent in Manchane to 44.5 percent in Lunga. For deltamethrin, mortality ranged from 31.4 percent in Miyambo to 74.3 percent Shikapande; *An. funestus* s.l. populations were susceptible to deltamethrin in Lunga (98 percent mortality rates). *An. funestus* s.l. was susceptible to DDT in Lunga, Miyambo, and Shikapande (98 to 100 percent mortality rate) but resistant in Manchene (98 percent mortality rate).

In Figure A-4B, *An. gambiae* s.l. was resistant (<90 percent mortality) to alpha-cypermethrin at the sites tested in Copperbelt and Eastern provinces (mortality rates range from 26.7 percent in Nkana to 77 percent in Robert), while probable resistance (90 to 97 percent mortality) was observed in Luapula (93.9 percent mortality rate in Lunga). For deltamethrin, resistance was also probable in Luapula (93.9 percent mortality rate in Lunga). *An. gambiae* s.l. were susceptible to DDT at the two sites tested in Eastern Province.

In Figure A-4C, full or partial susceptibility was restored among pyrethroid resistant mosquitoes in Luapula Province when *An. funestus* s.l. were exposed to the synergist piperonyl butoxide (PBO), suggesting metabolic resistance plays a role in insecticide resistance in the region.

In Figure A-4D, *An. funestus* s.l. were completely susceptible to clothianidin 2 percent at all sites tested in Luapula Province. *An. funestus* s.l. were completely susceptible to chlorfenapyr 100 μg at all seven sites tested in Luapula and Copperbelt provinces (Figure A-4E).

Susceptibility tests are ongoing for additional sites and priority insecticides.

Figure A-5. Geographic distribution of insecticide resistance in Zambia by insecticide class and the most recent test year
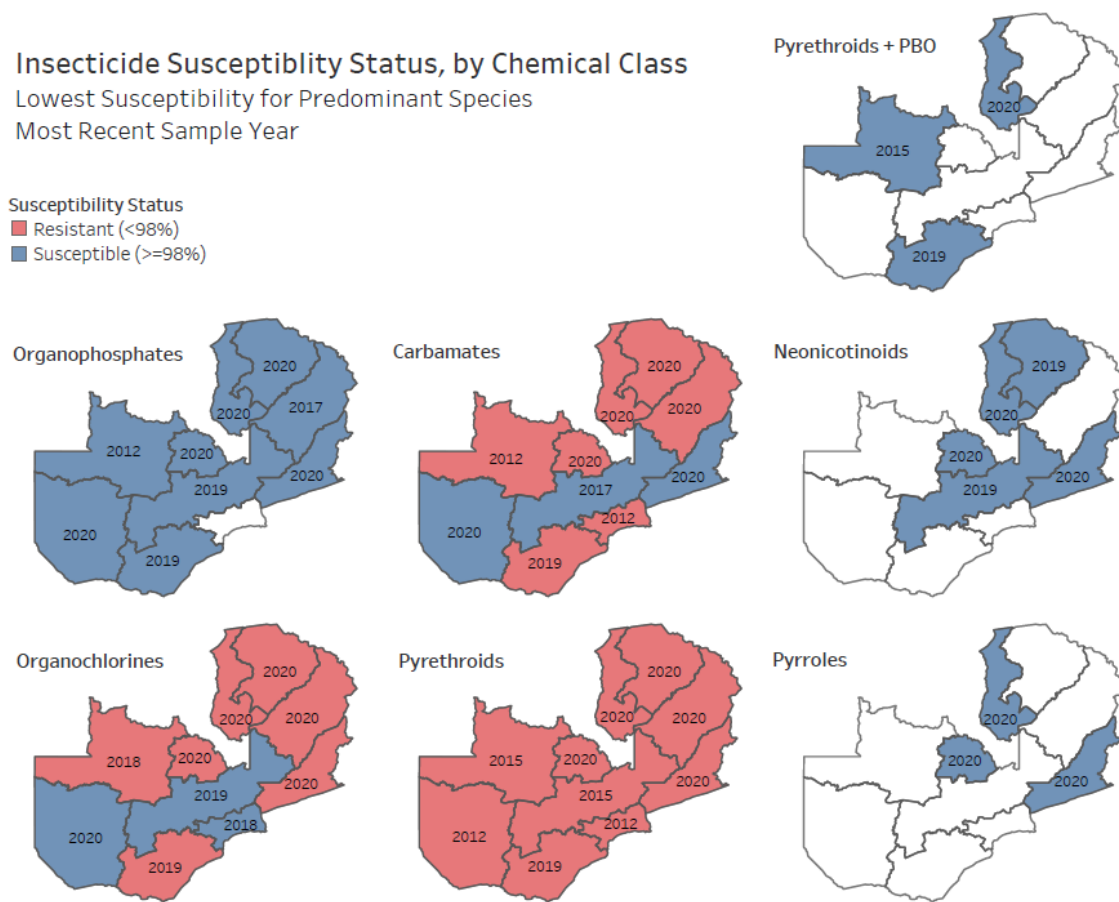

Figure A-5 shows that the dominant local vectors are susceptible to neonicotinoids, organophos-phates, pyrethroids plus PBO and pyrroles where and when they have been tested (source: PATH-PMI for the TAC). However, there are large spatial gaps in data because not all Zambian provinces have information due to lack of testing. In the PMI-IRS supported areas (Central, Copperbelt, Eastern, Luapula, and Northern provinces), the dominant local vectors were susceptible to clothianidin in the 2019 and 2020 IRS campaigns. Although resistance to pirimiphos methyl has not yet emerged, all IRS programs are preemptively rotating away from organophosphates in the 2019 season, in accordance with national insecticide resistant management policies. The data also suggests that chlorfenapyr would be an option for preemptive rotation away from clothianidin in the future, should the product receive WHO prequalification PQ listing. Tests with pyrethroids plus PBO suggest that PBO ITNs may be effective in Zambia. However, more tests are required in different provinces. Resistance to carbamates, organochlorines, and pyrethroids remains a serious threat to vector control in Zambia. DDT resistance is apparent in *An. gambiae* s.l. in some localities, and pyrethroid resistance remains widespread.

With FY 2022 funding, it is anticipated that in CY 2023 support for entomological monitoring and insecticide resistance monitoring in the same seven sites as in previous years will be maintained. Monitoring will also include resistance intensity/synergist testing and molecular analysis.

The key rationale for this decision is that the NMEP has undergone a vector control strategy shift where ITNs will be the primary vector control approach. In this strategy, ITNs will be more widely distributed and IRS will be scaled back to well-defined focal areas. The criteria for IRS targeting is still under consideration. In preparation for reducing IRS, PMI/Zambia will help support the NMEP's action plans generated in response to the Global Fund Technical Review Panel's recommendations on scaling down IRS in Zambia.

To accommodate this vector control transition, it will be crucial to prepare for IRS withdrawal through contingency planning and build entomological capacity to assess vector population rebound. Additionally, as sites transition from IRS to PBO ITNs, it is important to track impact on entomological and epidemiological malaria trends.

Additional rationale for maintaining entomological monitoring includes the following:

- The national entomologic surveillance network continues to depend on external partner funding and TA. This is based on a review of Global Fund implementation budgets, the NMESP gap analysis, and midterm review exercise in May 2019, among other sources. NMEP staff will take the lead in operating a set of Global Fund-funded sites in one set of provinces, while MACEPA support in Southern Province and PMI support in its focus areas will continue to be required.
- The NMEP expectation is that PMI will continue to provide direct support to a set of sites and will generate data on key entomological indicators including malaria vector species composition, insecticide resistance, vector density, human biting behavior (when and where biting occurs), and measures of transmission (parity rate, sporozoite rate, and blood meal sources) in seven districts.
- A well-funded program is necessary to inform future vector control interventions, given Zambia's fluid and challenging vector control setting. Key issues include the high rates of resistance to pyrethroids in both major vectors (*An. gambiae* s.l. and *An. funestus* s.l.), and to DDT in *An. gambiae* s.l.; the recent (clothianidin) and anticipated introduction of new IRS insecticide classes (chlorfenapyr, perlite, etc.); the policy of rotating to new insecticide classes in the near future; widespread reintroduction of DDT by the GRZ, sourced from a non WHO-prequalified manufacturer; assuring entomological monitoring is well integrated in IRS withdrawal plans; evaluation of impact of standard ITNs versus PBO ITNs versus IRS; and the need to make sound investment decisions around procurement of next-generation ITN products, if necessary and feasible.

Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.

1.2. INSECTICIDE-TREATED NETS (ITNs)

Key Goal

Achieve high ITN coverage and use targets with effective nets, based on insecticide resistance data, in PMI-supported areas; and maintain high coverage and use with consistent ITN distribution (via campaigns and/or continuous channels).

Key Question 1

How has net ownership evolved since the start of PMI in the country?

Supporting Data

Figure A-6. Trends in ITN ownership

Percentage of households that own ITNs
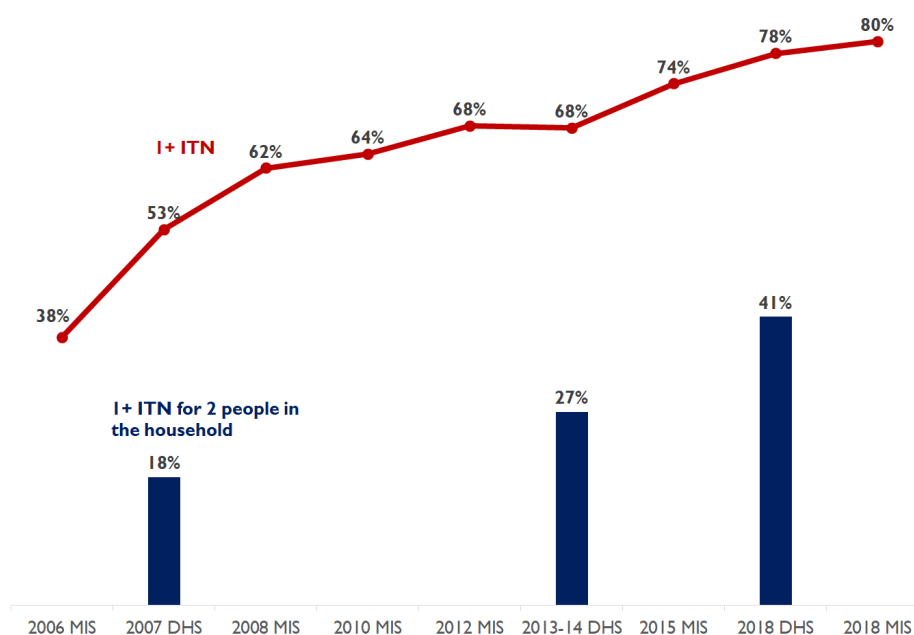
From 2006 to 2018, the household ownership of at least one ITN (1+ ITN) increased by 42 percent. From 2007 to 2018, the ownership of at least one ITN for two people in the household increased by 23 percent. Of the households having at least one ITN, approximately a third to a half had at least one ITN for two people, in the survey years of 2007, 2013–2014, and 2018 (Figure A-6).

Figure A-7. Urban, rural, and national household possession of at least one ITN from 2008–2018 MIS surveys
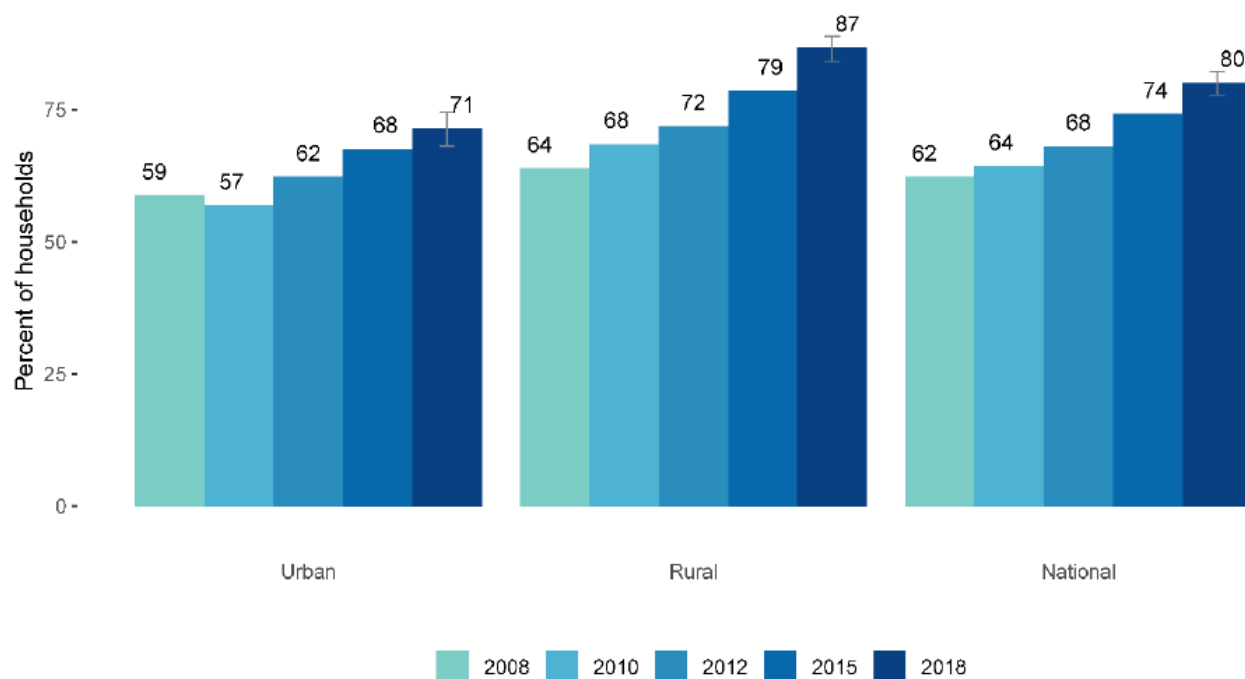
Figure A-7 shows that the overall household-level possession of at least one ITN has risen nationally and in rural areas since 2008. Coverage has risen about 20 percent since 2008 in rural areas, ranging from 64 percent in 2008 to 87 percent in 2018. In urban areas, household-level possession of at least one ITN increased slightly from 68 percent in 2015 to 71 percent in 2018. When compared with 2008, there has been a general increase in coverage in urban areas but this increase has not matched the increase reported in rural areas.

Key Question 2a

What proportion of the population has access to an ITN? Of those who have access, what proportion of the population reports using an ITN?

Figure A-8. Trends in ITN access and use

Percentage of household population with access to an ITN and percentage of those who slept under an ITN the night before the survey
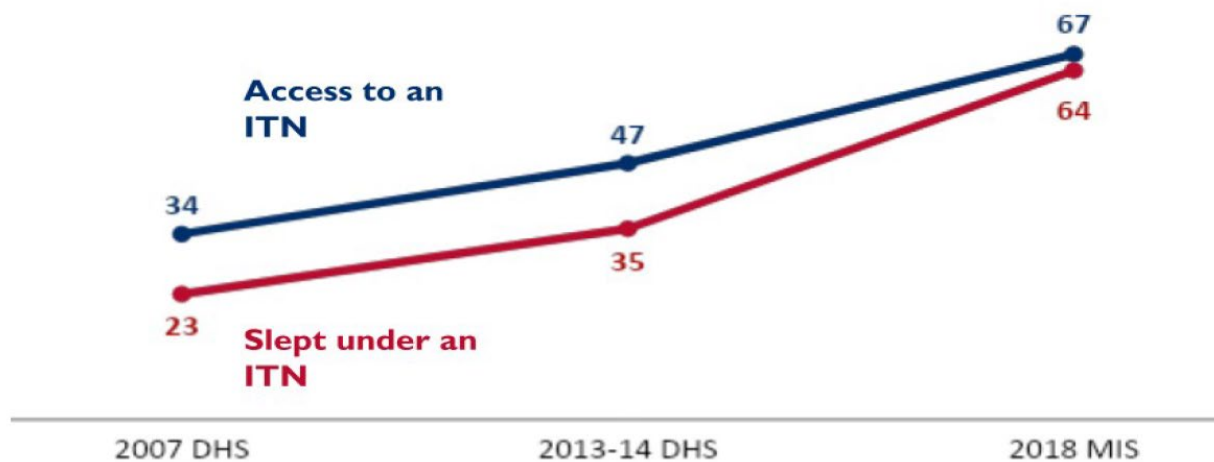
Figure A-8 shows that from 2007 to 2018 there has been a positive trend in both increased access to ITNs and the number of people who slept under an ITN the night before the survey.

Figure A-9. Geographic distribution of use:access ratio
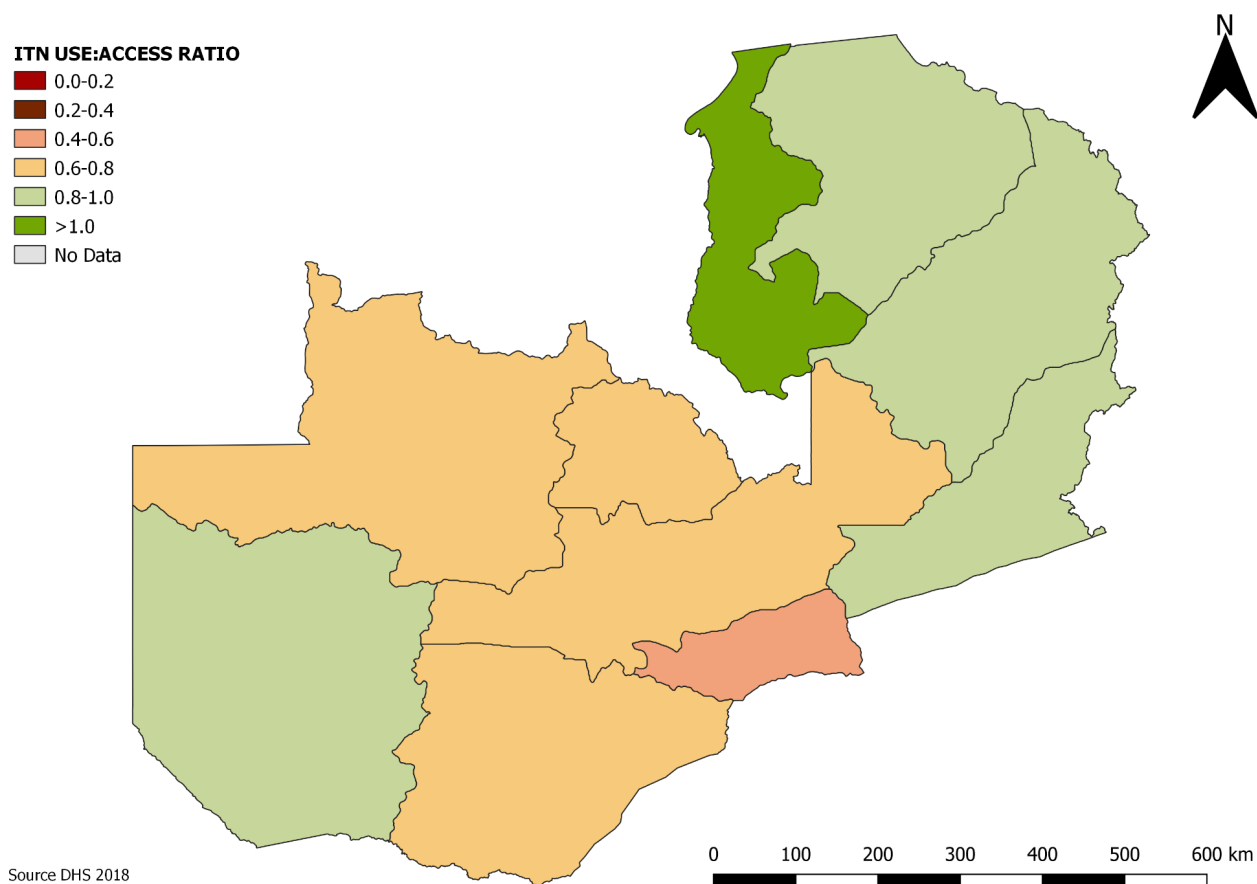
Figure A-9 suggests that the use:access ratio is modest in Zambia. Interestingly, there is stronger reported net use behavior in Luapula Province, which has one of the highest malaria transmission rates among Zambian provinces. The ITN use:access ratio ranges from 0.8 to 1.0 in the provinces of Eastern, Muchinga, Northern, and Western, and 0.6 to 0.8 in the provinces of Central, Copperbelt, North-Western, and Southern. Lusaka has the lowest ITN use:access ratio ranging from 0.4 to 0.6.

Key Question 2b

What percent of pregnant women and children under five years of age report sleeping under an ITN?

Figure A-10. Trends in ITN use among children and pregnant women

Children under five years of age and pregnant women 15 to 49 years of age who slept under an ITN the night before the survey
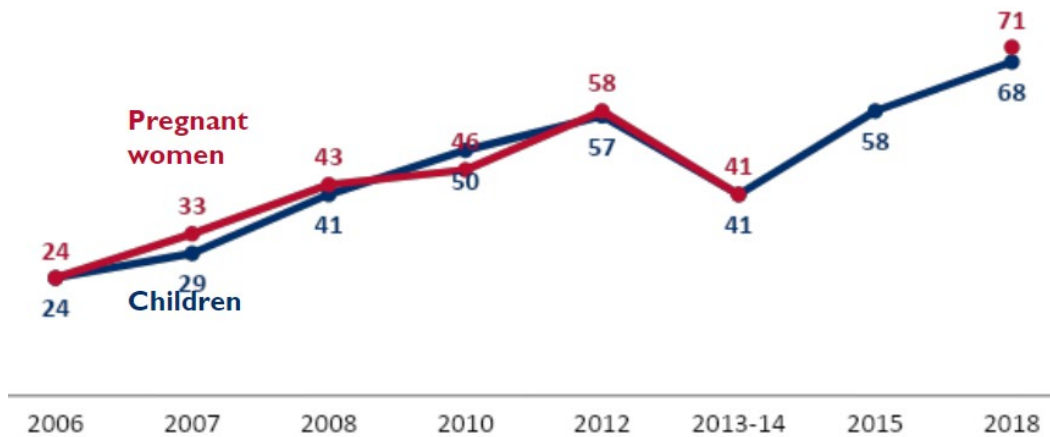
Figure A-10 shows that ITN usage progress has steadily increased over the years (tracking the improvements in ITN ownership). In the 2018 MIS, 71 percent of pregnant women and 68 percent of children under five years of age slept under a net the previous night, which is higher than the general population and shows that these vulnerable groups are being appropriately prioritized. Resources will need to be invested in net use efforts to continue increasing this positive trend.

Key Question 3

If ITN access is high but use is low, what significant structural and/or behavioral challenges affect the adoption and maintenance of ITN use and care behaviors?

Table A-4. Key barriers and facilitators to ITN use

Facilitator	Type of Factor	Data Source	Evidence
Household Availability of ITNs	Environmental	MIS 2018	ITN coverage in rural areas has risen from 64% in 2008 to 87% in 2018.
Knowledge of ITNs	Internal	MIS 2018 and SBC Formative Research Report 2019	Among women 15 to 49 years of age, 85.7% reported mosquito nets as a prevention method. This finding is supported by a recent cross-sectional household survey, which found that 98% of respondents correctly identified mosquito bites as a cause of malaria.
High Self-Efficacy Around ITN Use	Internal	SBC Formative Research Report 2019	82% of respondents indicated they could hang a bed net where their child was sleeping.
Barrier	**Type of Factor**	**Data Source**	**Evidence**
Safety Concerns About Insecticides	Internal	SBC Zambia Desk Review 2018	Children were reported to be less likely to sleep under an ITN than adults due to concerns over the safety of the insecticide for children and fetuses.

The overall barrier and facilitators to ITN use are summarized in Table A-4. Knowledge about the benefits of sleeping under an ITN is generally high across all demographics. Optimal net availability of at least one ITN per two people is fairly low and should be an area of continued focus. The ITN use: access ratio is moderate to high except in the Lusaka Province.

While the use:access ratio is encouraging, additional information is still needed to understand the internal and social factors that may be limiting net use among the general population with special focus on pregnant women and children under five years of age. A greater understanding of factors limiting net use is needed in areas with lower net use, especially in the Lusaka Province. PMI will explore the reason for this lower use:access ratio.

Please refer to Section 3.4 for information on how SBC interventions will be directed to address the challenges identified above.

Key Question 4

What type of nets are being distributed via which channels?

Table A-5. Insecticide-treated net (ITN) distribution

Level Nationwide/Region/ State/Province	Mass Campaign August 2020– March 2021	ANC	EPI	School	Community	Other
Nationwide	Standard/PBO	Standard/ PBO	Standard/ PBO			
Selected districts				Standard		

Key Question 5

What is the estimated need for ITNs during calendar years 2021–2023? How many, and what types, of ITNs will be procured, and by what partners? Through what channels will ITNs be distributed? Are there any projected ITN gaps?

Supporting Data

Quantification numbers for the 2023 ITN mass distribution campaign have yet to be determined given that this will depend on the tactical shift of increased ITN distribution and reduced targeted IRS, currently in the early development stage in-country. A 10 percent buffer for ITNs will be added to the mass campaign projection needs once the numbers are known. ITNs for continuous distribution will be based on population growth estimates. Zambia has agreed to use PBO ITNs for all distribution channels including mass distribution, ANC, EPI, and school-based, as guided by the NMEP.

The GRZ is not expected to procure any ITNs in 2021. Global Fund commitments for ITNs are about 1.5M in 2021 and 1.0M in 2022 for continuous distribution channels; and about 1.4M in 2023 for the mass distribution campaign. The Global Fund grant has allocated $22 million to the above allocations in support of the ITN mass distribution campaign in 2023. If these funds become available, the country will be well placed for a successful campaign.

PMI commitments for PBO ITNs are about 600,000 ITN each year of 2021, 2022, and 2023 for continuous distribution and 1.1M PBO ITNs for the 2023 mass distribution campaign (850,000 ITNs from the FY 2022 MOP and an additional 279,944 nets from prior years' reprogramming). PMI will carry over 437,000 ITNs that arrived in 2021 but were procured in 2020.

Table A-6. ITN Gap Analysis Table

Calendar Year	2021	2022	2023
Total Country Population	18,400,556	18,926,743	19,456,692
Total Population at Risk for Malaria	18,400,556	18,926,743	19,456,692
PMI-targeted at-risk population	18,400,556	18,926,743	19,456,692
Household registration population	23,571,126	24,278,260	24,958,051
Population Targeted for ITNs	8,249,894	8,497,391	8,735,318
Continuous Distribution Needs			
Channel #1: ANC	1,060,701	1,092,522	1,123,112
Channel #2: EPI	942,845	971,130	998,322
Channel #3: School	30,000	40,000	50,000
Channel #4:	0	0	0
Additional ITNs Required to Avoid ITN Stockouts	0	0	0
Estimated Total Need for Continuous Channels	2,033,546	2,103,652	2,171,434
Mass Campaign Distribution Needs			
Mass distribution campaigns	0	0	1,694,915
Estimated Total Need for Campaigns	0	0	1,694,915
Total ITN Need: Continuous and Campaign	2,033,546	2,103,652	3,866,349
Partner Contributions			
ITNs carried over from previous year	437,000	527,546	23,894
ITNs from Government	0	0	0
ITNs from Global Fund	1,524,092	1,000,000	1,430,403
ITNs from other donors	0	0	0
ITNs planned with PMI funding (total - continuous + campaign)	600,000	600,000	1,729,944
ITNs planned with PMI funding (continuous)	600,000	600,000	600,000
ITNs planned with PMI funding (2023 campaign)	0	0	1,129,944
Total ITNs Contribution Per Calendar Year	2,561,092	2,127,546	3,184,241
Total ITN Surplus (gap)	527,546	23,894	(682,108)

Key Question 6

What is the current status of durability monitoring?

Supporting Data

Table A-7. Timing of durability monitoring

Campaign Date	Site	Brand	Baseline	12-month	24-month	36-month
2017–2018	Katete	Olyset	X	X	X	
2017–2018	Lundazi	PermaNet 2.0	X	X	X	

Conclusions will be presented at the end of the monitoring activity when the 12- and 24-month reports are final.

Conclusions for ITN Investments

For CY 2023, there will be an increase in ITN activities to align with the shifts in the NMEP vector control strategy to ITNs as the primary vector control strategy. This increase will involve support of mass ITN campaigns and continuous distribution channels. To address pyrethroid resistance in the vector population in Zambia, distribution of PBO ITNs in districts that require them will be a key strategy supported by PMI.

Critical steps in shifting the vector control strategy in Zambia consists of transitioning away from the IRS/ITN mosaic approach and focusing on high (>80 percent) national coverage of ITNs with an effective insecticide(s), and scaling back IRS to focal areas based on to-be-determined criteria.

The 2018 MIS suggests high use of ITNs (>85 percent) could be obtained among all household members if sufficient ITNs are available in the household. But currently only 47 percent of households have one ITN per sleeping space. For this reason, increased investment in procuring sufficient ITNs for mass distribution campaigns and improving continuous distribution channels will be a major focus of PMI/Zambia. This will not only be limited to commodity procurement and distribution but will also include TA at the national, provincial, district, and community levels. Assessment of continuous distribution channels will also be done to determine the most effective method for Zambia.

Acceptance of malaria interventions such as IRS and ITNs are still a challenge in some communities. There is limited application of systematic methodology to measure impact of SBC activities and a need for targeted and measurable SBC interventions in Zambia. In an effort to achieve more impactful SBC interventions, PMI/Zambia will pivot from a communication-heavy SBC strategy to a strategy focused more on identifying key behaviors that can be modified to improve ITN use. Once these behaviors are identified, steps will be taken to motivate individuals and communities to practice the modified behaviors. This may include a full range of strategies and activities at all levels (individual, community, and structural) that promote and allow for behavior change. PMI/Zambia, with support of the PMI SBC team, will work with the NMEP and partners to actualize these changes.

To prepare for the 2023 mass campaign, reprogramming of the FY 2021 MOP will be done to resource the campaign. PMI will support continuous distribution of ITNs through ANC, EPI, and selected primary schools as well as through the next mass campaign in 2020 and 2021.

Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.

1.3. INDOOR RESIDUAL SPRAYING (IRS)

Key Goal

Ensure high spray quality and coverage, with an appropriate insecticide, in targeted endemic PMI-supported areas, in alignment with the national insecticide resistance management strategy.

Key Question 1

What areas are targeted for IRS and why?

Supporting Data

Zambia is unusual for targeting almost all districts in the country with IRS. 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. Historically, no Zambian district receives "blanket" IRS coverage by the definition used in other countries. IRS in Zambia is applied at a subdistrict level. For a detailed exposition of the approach at the subdistrict level, refer to the FY 2019 and FY 2020 MOPs.

Under the guidance of the NMEC, the Global Fund (through the MOH Program Management Unit) and PMI in effect divided the country into respective operational areas at the provincial and district level. Complementary funding and operational support is provided by MACEPA/BMGF in Southern Province, and by a small number of mines and plantations on the Copperbelt and elsewhere. The geographic funding landscape for 2021 is indicated in Figure A-11. The following brief history provides background to the current geographic targeting.

PMI-focus areas in 2014–2017: During this period, the *de facto* national approach was to ration IRS resources to most rural districts to provide IRS for up to 20 percent to 50 percent of the population. PMI focused its IRS support on the four high-burden provinces of Luapula, Muchinga, Northern, and Eastern, reaching approximately 50 percent to 60 percent of the population, and with an increase to >80 percent in Luapula in 2017. This overlapped with USAID health programming in maternal and child health, and was part of a more comprehensive package of support for malaria control interventions including ITNs, case management, MIP, and surveillance.

PMI-focus areas in 2018: The NMEP issued a directive to aggressively intensify IRS deployment toward the goal of 80 percent population coverage in each district. In response, PMI concentrated its resources to spray with pirimiphos-methyl in Luapula, Muchinga, and Northern, effectively shifting its IRS resources out of six districts in Eastern Province. In the context of its new pre-elimination program, PMI sprayed three districts in Eastern using clothianidin, while GRZ covered the remaining six districts. Unfortunately, most GRZ funding did not materialize in time for the 2018 spray season, so coverage in those areas was reduced.

PMI-focus areas in 2019, 2020, and 2021: The PMI-supported IRS operations again adjusted its geographical scope following the MOH 2018 decision to deploy DDT for IRS in Luapula, Muchinga, and Northern provinces. PMI only procures and sprays insecticides from WHO prequalified manufacturers (of which there is none for DDT). PMI shifted support to Copperbelt Province, where DDT-resistant *An. gambiae* s.l. predominates and where WHO pre-qualified clothianidin-based insecticides could be used. The Nchelenge District in Luapula Province was also included as a PMI site to work closely with the ICEMR project. PMI/Zambia obtained assurance from the MOH that this new geographic configuration would remain stable for at least three consecutive years. This was done to ensure programmatic stability, allow for operational efficiencies, and sustain

population protection. The programmatic rationale for this targeting included synergy with other PMI pre-elimination investments in Eastern, opportunities for private sector engagement with the mines in the Copperbelt, and opportunities to leverage NIH-investments to assess program impact longitudinally in Nchelenge. Minor adjustments in 2020 and 2021 included focusing support on the Copperbelt to the three high-burden districts of Lufwanyama, Mpongwe, and Masaiti, as well as agreeing to spray two districts neighboring Nchelenge using insecticides procured by the Global Fund/GRZ.

Figure A-11. IRS program funding support, by district and partner, 2020 actual and 2021 planned
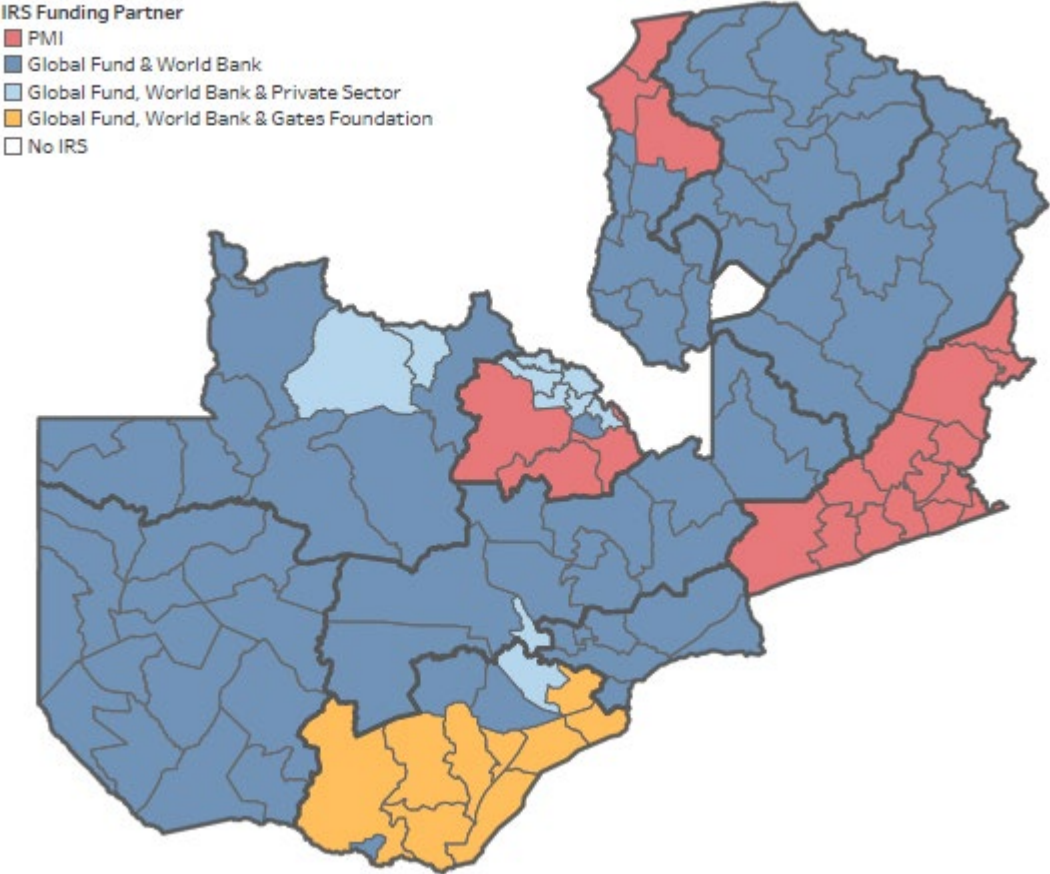
In PMI-supported areas, what spray coverage rates have been achieved in the past three years and what are the plans for 2021?

Table A-8. IRS coverage

Calendar Year	Districts Sprayed (#)	Districts	Structures Sprayed (#)	Coverage Rate (percent)	Population Protected (#)
2018	29	Luapula (10 districts), Northern (9 districts), Muchinga (7 districts), Eastern (3 districts)	579,490	90%	2,818,176
2019	20	Eastern (9 districts), Luapula (1 district), Copperbelt (10 districts)	536,983	90%	2,273,188
2020	15	Eastern (9 districts), Luapula (3 districts), Copperbelt (3 districts)	648,914	97%	2,776,336
2021*	16	Eastern (9 districts), Luapula (3 districts), Copperbelt (4 districts)	TBD	TBD	TBD

*Denotes targets for current year; TBD= to be determined.

Key Question 3

What is the residual efficacy of the insecticides used for IRS in PMI-supported areas?

There are two pesticides deployed in PMI-supported areas, clothianidin only and clothianidin + deltamethrin. During the initial implementation of clothianidin only-based IRS in PMI-supported monitoring sites in the 2018–2019 monitoring period, the residual efficacy of the insecticide reached seven months' efficacy against wild type anophelines. Clothianidin + deltamethrin-based IRS was found to have an eight-month efficacy against the mosquito laboratory strain *An. gambiae* Kisumu in a manufacturer-sponsored trial in Nchelenge District in 2017–2018. However, data from the 2019–2020 IRS campaign have shown residual efficacy up to 11 months post-spray.

Supporting Data

Table A-9. IRS insecticide residual efficacy

Site/District	Year	Insecticide	Average Residual Efficacy (months)
Eastern	2018–2019	Clothianidin	7
Nchelenge	2018–2019	Clothianidin + deltamethrin	8
Mambwe, Katete	2019–2020	Clothianidin	11
Lufwanyama, Chililabombwe, Nchelenge	2019–2020	Clothianidin + deltamethrin	11

What is the insecticide rotation plan in PMI-supported areas?

Supporting Data

The insecticide rotation plan, captured in Table A-10, calls for continued deployment of neonicotinoid/pyrethroid in 2021, until a long-lasting, WHO prequalified alternative may become available in 2022 and beyond.

No ideal insecticides are available for rotation with clothianidin-based insecticides in 2021 for PMI-supported areas due to programmatic and technical constraints. Out of necessity, insecticide selections are made as decision compromises, informed by entomologic surveillance data and guided by the *National Insecticide Resistance Management and Monitoring Plan.* The plan calls for rotation of pesticide classes every two years, where feasible. Based on susceptibility data, reversion to the organophosphate, pirimiphos-methyl capsule suspension (CS), which was used in PMI areas until 2018, would be permissible. However, pirimiphos-methyl is considered undesirable due to the documented short residual efficacy of four months in settings where intense malaria transmission persists for over six months per year. Twice-per-year spraying of pirimiphos-methyl or other short-acting insecticides such as carbamates is considered cost-prohibitive by the NMEC and PMI, and hence is not recommended.

Table A-10. Insecticide rotation plan

Target Spray Area	2020	2021	2022*	2023*
Eastern	Neonicotinoid/ Pyrethroid	Neonicotinoid/ Pyrethroid	TBD** (Chlorfenapyr?)	TBD** (Chlorfenapyr?)
Copperbelt	Neonicotinoid/ Pyrethroid	Neonicotinoid/ Pyrethroid	TBD** (Chlorfenapyr?)	TBD** (Chlorfenapyr?)
Luapula – Nchelenge	Neonicotinoid/ Pyrethroid	Neonicotinoid/ Pyrethroid or No IRS	No IRS?	No IRS?
Luapula – Other	Neonicotinoid/ Pyrethroid	Neonicotinoid/ Pyrethroid	TBD	No IRS?

* Denotes planned insecticide classes. Some areas are expected to be transitioned to PBO ITNs in 2023, as explained above. An earlier transition in 2021 is under consideration in Nchelenge.
** We will include new IRS insecticides such as chlorfenapyr and others as they become WHO PQ listed and available on the market; TBD = to be determined.

Figure A-12. Planned pesticide deployment in the 2021 spray season, nationwide

Insecticide
- Clothianidin & Deltamethrin (Fludora Fusion)
- Clothianidin (SumiShield)
- DDT
- No Planned IRS
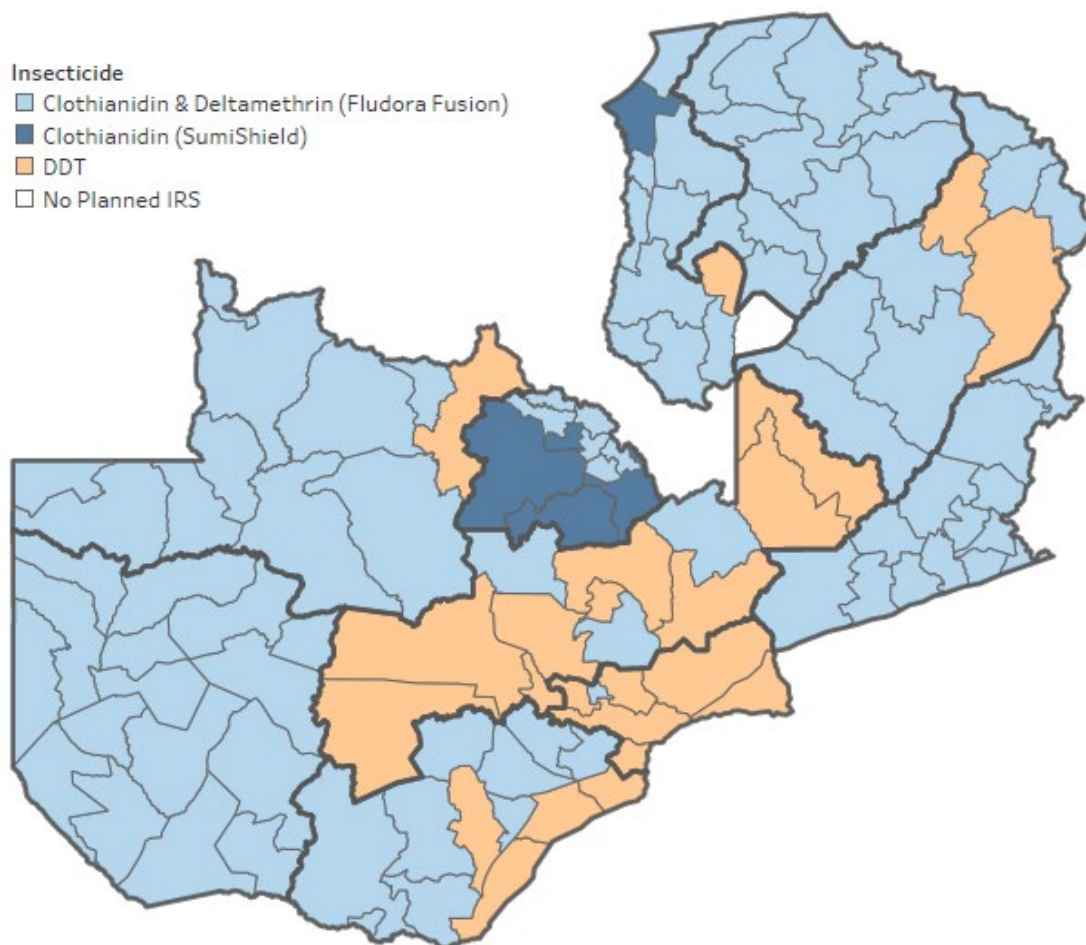
Conclusions for IRS Investments

In CY 2023, we propose to support a robust but scaled down IRS program in Zambia, with a commensurate shift of resources from the IRS program to the mass ITN campaign. As cited previously, from 2023 the NMEC intends to revert to ITNs as the primary vector control intervention, with an emphasis on procuring and distributing PBO ITNs, and deploying IRS in a localized manner. Moreover, the subdistrict mosaic approach that guided the 2020 ITN and IRS deployment is likely to be replaced by a district-level mosaic, where entire districts would be targeted for blanket coverage with either IRS or ITNs. PMI is supportive of this change in approach and proposes to realign vector control funding priorities accordingly.

The specifics of IRS targeting and operational approach in CY 2023 will be determined during development of the work plan in CY 2021 and CY 2022. In line with Global Fund requirements, the NMEP is creating a task force dedicated to exploring the operational and financial aspects of the planned transition and guiding partner contributions. PMI will fully participate in this process. PMI's support for IRS activities in 2023 will be guided by the following planning parameters:

- Maintain viable PMI IRS operations, albeit in a reduced geography, and continue to provide TA to leverage Global Fund and GRZ investments in IRS in other geographies.
  - Prioritize a subset of districts in Eastern Province where PMI support of intensified IRS would aid in consolidating gains from past PMI efforts in 2018–2019. Other districts would be supported to attain universal coverage of PBO ITNs.
  - Consider prioritizing rural districts in the Copperbelt, assuming the 2021 epidemiologic surveillance and entomological monitoring data have demonstrated clear and significant reduction in epidemiological and entomological indicators compared with the pre-2019 level, before the PMI IRS program.
  - Consider a full transition from IRS to PBO ITNs for Nchelenge and neighboring districts in northern Luapula, in light of data that suggests ITNs have been protective, while the challenging local transmission dynamics have been unresponsive to years of intensified IRS. PMI is exploring with the NMEP an option to transition Nchelenge District early (in 2021 or 2022), as a national test case, since the ongoing collaboration with the NIH-funded ICEMR study site offers a unique opportunity to monitor outcomes and impacts.
  - Continue to support Global Fund/GRZ IRS operations through TA in such areas as planning, monitoring, quality assurance, environmental compliance, and worker safety, to fill gaps.
- Work with NMEP to redefine geographic and epidemiologic niche(s) for IRS, including the development of guidelines to operationalize the NMEP's plans to scale up focal IRS.
  Support responsible withdrawal of IRS in certain areas:
  - Follow WHO, PMI, Global Fund, GRZ, and TAC guidelines. For example, the transition to ITNs would be prioritized for areas that had received high IRS coverage for at least three years, and co-deployment of PBO ITNs and IRS should be minimized.
  - Support resource mobilization to ensure adequate ITN coverage is in place in any district where IRS would be withdrawn. Beyond optimization of PMI, Global Fund, and GRZ investments, this will presumably require robust outreach to additional multilateral, bilateral, NGO, and/or private sector partners.
  - Continue to support the strengthening of the NMEP in national entomology monitoring and support evidence-based vector control decision-making. This is important in the detection and response of potential rebound of transmission in the wake of local IRS withdrawal.
  - Ensure increased and targeted SBC activities to ensure high utilization of ITNs as a means to guard against possible rebound effect.

Spray coverage as measured in the above tables (structures sprayed out of structures found) is an important indicator of IRS operational quality, and PMI-supported operations have performed well in this regard. Thus, the overall approach of PMI-supported spray operations will remain similar. However, IRS impact will be greatest if spray teams can also maximize the proportion of structures they find out of eligible structures which truly exist on the ground. The PMI/Zambia program will continue to deploy satellite-based mapping systems (such as GRID3 and Reveal) where feasible, affordable, and consistent with program objectives. Based on several years' experience such systems can add value in areas of mapping and enumeration before spraying, spatially orientation of spray teams and monitoring of their performance during IRS, and collection of household and operational data which can be analyzed after the spray season. Depending on local needs and campaign objectives, one, two or all three functions may be utilized during a campaign.

Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.

2. HUMAN HEALTH

2.1. CASE MANAGEMENT

NMEP Objective

The national objective is to ensure that 100 percent of all suspected malaria cases in all districts receive parasitological (microscopy or RDT) analysis and 100 percent of parasitologically confirmed malaria cases receive prompt (within 24 hours) and effective antimalarial treatment. Universal coverage, namely service for anyone who requires it with early diagnosis and effective treatment, is a key strategy in reducing morbidity and mortality. 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 workload, and at the community level by CHWs trained in iCCM.

NMEP Approach

Table A-11. Case management policy overview

Status of Case Management Policy in Zambia According to the *Guidelines for the Diagnosis and Treatment of Malaria in Zambia* (MOH, 5th Edition, 2017)	
What is the first-line treatment for uncomplicated *P. falciparum* malaria?	Artemether-lumefantrine (AL) Dihydroartemisinin-piperaquine (DHAPQ) (alternate)*
What is the second-line treatment for uncomplicated *P. falciparum* malaria?	None
What is the treatment for severe malaria?	Injectable artesunate (first-line) Intramuscular Artemether or Intramuscular/Intravenous Quinine (alternate) Course of ACTs to follow once patient is stable for discharge
In pregnancy, what is the first-line treatment for uncomplicated *P. falciparum* malaria in the first trimester?	Oral quinine + clindamycin

Status of Case Management Policy in Zambia According to the *Guidelines for the Diagnosis and Treatment of Malaria in Zambia* (MOH, 5th Edition, 2017)	
In pregnancy, what is the first-line treatment for uncomplicated *P. falciparum* malaria in the second and third trimesters?	AL DHA-PQ (alternate)
In pregnancy, what is the first-line treatment for severe malaria?	Intravenous quinine in the 1st trimester Injectable artesunate in 2nd and 3rd trimester
Is pre-referral treatment of severe disease recommended at peripheral health facilities? If so, with what drug(s)?	Rectal artesunate** Injectable artesunate**
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 of age)	For children under six years of age

*To be used only in non-mass drug administration areas.

**If these two options are not available, intramuscular quinine is recommended.

Health Facilities Overview

Government-run health facilities, which provide the great majority of the healthcare in Zambia, offer a package of basic healthcare services that are provided for free or on a cost-sharing basis, depending on the location and level of the system. In rural districts these services are free. Church-affiliated facilities are common and are well integrated into the government system in terms of service delivery practices and reporting. Churches Health Association of Zambia (CHAZ) is an interdenominational umbrella organization for coordinating church health services in Zambia that has over 110 health facilities including hospitals, health centers, health posts, community-based organizations, and 11 health training schools, most of which are staffed by GRZ health workers. Altogether, these institutions are responsible for over 50 percent of formal health services in the rural areas of Zambia and about 30 percent of healthcare in the country as a whole. The private sector accounts for just 14 percent of all health facilities nationally, the vast majority of which are found in the large cities, especially on the Copperbelt and in Lusaka.

Cross-sectional surveys consistently suggest that the great majority of rural households seek healthcare from formal institutions (facility or CHWs, e.g., 88.6 percent in the recently released *2019 In-Depth Vulnerability and Needs Survey*), but this may reflect under-reporting of access to traditional healers and self-care.

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

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

Systems for quality improvement including biannual performance assessments of health facilities by district and provinces offices, and the Outreach Training and Supportive Supervision (OTSS) program. Due to worsening financial constraints impacting supervisors' mobility, these programs have been curtailed except in provinces where partner funding has been available (e.g., PMI in Luapula, Northern, Muchinga, Eastern, Copperbelt, and Central; Global Fund/CHAZ in Southern, North-Western, and Eastern).

Community Health Worker Overview

Zambia has invested heavily in scaling up community case management of malaria in the context of iCCM. According to the national guidelines, in the iCCM approach the community health workers (CHWs) and community health assistants (CHAs) are provided with diagnostic tools and medicines for the management of common childhood illnesses including the treatment of uncomplicated malaria. The malaria component targets all ages. Commodities for treatment of childhood fever and diarrhea are typically unavailable due to chronic under-resourcing, as in many countries.

CHAs serve as a bridge between health facilities and communities, and where available they play an important role in coordinating iCCM. CHWs are unpaid volunteers, but depending on resource availability typically receive various incentives such as starter kits (bicycles, T-shirts, hats, medication boxes), lunch allowances for meetings, per diems during trainings, and so on. After training, CHWs spend one month "on attachment" at their local facilities, and are supported to return to those facilities to submit reports and pick up supplies on at least a monthly basis. As resources permit, the CHW supervisors conduct biannual supportive field visits to the CHWs in their communities.

In contrast, the CHAs are MOH employees, but their deployment has been quite limited to date due to human resource system bottlenecks and financial constraints (fewer than 1,500 deployed and on the payroll out of a national target of 5,000 by 2020).

The defined roles of CHWs and CHAs in the management of uncomplicated malaria include:

- Carrying out diagnoses according to their training and recognizing danger signs.
- Using RDTs in all cases of fever to confirm malaria before treatment.
- Administering the first-line medicine.
- Administering pre-referral treatment when danger signs are recognized (rectal artesunate [RAS]).
- Instituting measures to reduce body temperature.
- Following up with patients, particularly children under five years of age.

- Providing education to the community on the need for compliance to treatment, recognition of danger signs, and prevention of malaria.
- Advising when to return if the condition persists.

In the lower-level epidemiologic settings (<200 cases/1,000 population/year), the CHWs or CHAs also venture out to test and treat asymptomatic households and neighbors in a reactive case detection (RCD) approach (aka "Step D," or "Active Response"). CHWs are trained in a one-week harmonized curriculum that covers iCCM and RCD. Under the RCD program, which is based on the model developed in Southern Province, CHWs follow up as high a portion of passively detected cases that were diagnosed at community or facility level ("index cases") as feasible, typically from 2 percent to 40 percent of cases depending on setting. Whereas iCCM implementation is supposed to be universally applied, the implementation of RCD is supposed to be scaled up only in the lower epidemiologic settings where it would be expected to be cost-effective in terms of commodities and CHW time. Due to inconsistent messaging, some high-burden districts have pursued RCD with premature enthusiasm. Since May 2020, in the face of RDT supply shortage, this practice has been curtailed in an effort to conserve limited RDT and ACT resources.

Uptake of RAS for pre-referral treatment by CHWs and low-level HFs has been limited, but the NMEC is calling for further scale up. A pilot program in Serenje in 2017–2018 supported by the Medicine for Malaria Venture, local NGO MAMaZ, and other partners demonstrated improved severe malaria outcomes (Bull, WHO December 2019). Zambia has since accumulated additional experience with use of RAS by CHWs for initial management of severe malaria during urgent referral to health facilities. As documented in Serenje and during recent PMI-supported scale-up in Chama District, the approach appears to be feasible when it builds on village-level emergency transport systems linked to safe motherhood investments.

PMI Objective in Support of NMEP

- PMI supports the national strategy with significant investments in case management commodities as well as TA for training, supervision, and quality assurance.
- PMI-provided commodities and related supply chain strengthening efforts are generally directed centrally, for distribution and impact throughout the country. PMI is a major source of ACTs and RDTs for the country, and has also played a role in filling gaps in microscopy supplies and severe malaria medication including injectable artesunate and RAS.
- TA is more circumscribed geographically, because since 2014 PMI has focused consistently on the high-burden provinces of Luapula, Northern, Muchinga, and Eastern. Except for a gap in 2017–2018, PMI has also been providing TA in Central and Copperbelt provinces.
- TA has focused on training clinical and laboratory personnel in diagnosis and treatment and training, deploying, and ongoing support of CHW iCCM. PMI also focuses on training national, provincial, and district-level staff in providing outreach training and support supervision (OTSS) for quality assurance of malaria diagnostics and case management.
- PMI has not procured DHAPQ, which in Zambia has been used largely for MDA. PMI has also been more cautious than the NMEP and some partners in funding the expansion of RCD in higher-burden areas, where the cost-effectiveness of testing and treating asymptomatic individuals is questionable, and the need to prioritize limited case management resources to maximize coverage of symptomatic individuals is clear.

Supervision and Quality Assurance

The NMEP has a well-established national OTSS program that is implemented with support from various partners throughout the country. The OTSS program includes a standardized checklist with modules covering OPD, inpatient department, ANC, laboratory, and pharmacy. Supervisors observe health providers and provide on-site feedback and mentoring. Supervision data is also collected and used at the district, provincial, and national levels to monitor quality of services provided and identify areas for further follow-up and training.

The NMEP laboratory oversees a proficiency testing program in all microscopy sites to maintain skills and has a policy of conducting national competence assessments for each laboratory staff once in three years.

PMI-Supported Recent Progress (past ~12 months)

General

- PMI procured and distributed over 9.5 million ACT treatment courses in FY 2020 for the treatment of malaria at health facility and community levels.
- PMI procured and distributed over 6.7M RDTs in FY 2020 for the testing of suspected malaria cases at health facility and community levels.

Health Facility Level

- PMI supported the OTSS program in 6 out of 10 provinces in the country. This is a well-established, high-priority program under the case management unit of NMEP. In Q4 2019 and 2020, with PMI funding, over 840 health facilities received OTSS visits. In Central and Copperbelt provinces alone, over 3,100 healthcare workers participated. Over 350 microscopists received refresher training, and private sector facilities were included routinely in OTSS on the Copperbelt for the first time.
- PMI supported the continued decentralization and routine implementation of OTSS at the provincial and district level, building capacity and reducing the reliance on central supervisors. All facilities with microscopes in each province are targeted for OTSS visits. Historically, 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. However by 2020, in the four focus provinces, the proportion reached had climbed to 92 percent.
- These activities were complemented by quality assurance activities such as further development of a national malaria slide bank for purposes of training and quality assurance, microscopist accreditation, and distribution of the recently published national *Malaria Quality Assurance Diagnostic Manual*.

Community Level

Community case management of malaria remains a national priority. The NMEC and partners continue to prioritize further expansion of community case management to improve access to prompt diagnosis and treatment. In 2019 and 2020, the NMEP partners continued to rally behind this approach, minimizing duplication of effort. Out of the national goal target of 36,000 CHW (ratio of 1:500 pop) by 2020 over 10,000 had been trained according to the harmonized national curriculum, deployed, and registered in DHIS2, of which PMI

supported over 25 percent. Key partners include the Global Fund, CHAZ, BMGF/MACEPA, Rotary Club, and the Isdell Flowers foundation. The map in Figure A-13 depicts the achievements of this partnership.

In CY 2020, PMI facilitated the training of 34 MOH staff (29 district staff and 5 provincial staff) as master trainers in iCCM, and trained 3,294 CHWs in iCCM and surveillance in 14 districts. PMI procured and distributed 2,056 bicycles for use by CHWs and CHA. In the four PMI-focus provinces, between January 2019 and December 2020, 440,978 children under five years of age were tested for malaria by CHWs, of which 40 percent were found positive and treated accordingly or referred.

In Chama District, Muchinga Province, PMI continued to support a referral system for children under six years of age with severe malaria, wherein community-based emergency transportation is coupled with use of RAS. Chama has been selected due to its poor road network and its high malaria incidence. In 2020, this small-scale program was rolled out to four health facilities: 16 health facility staff (9 male and 7 female) were trained to manage severe malaria, 107 CHWs were trained in iCCM and RAS, and 64 bicycle ambulance operators were trained. Best practices and lessons learned were documented to inform future scale-up.
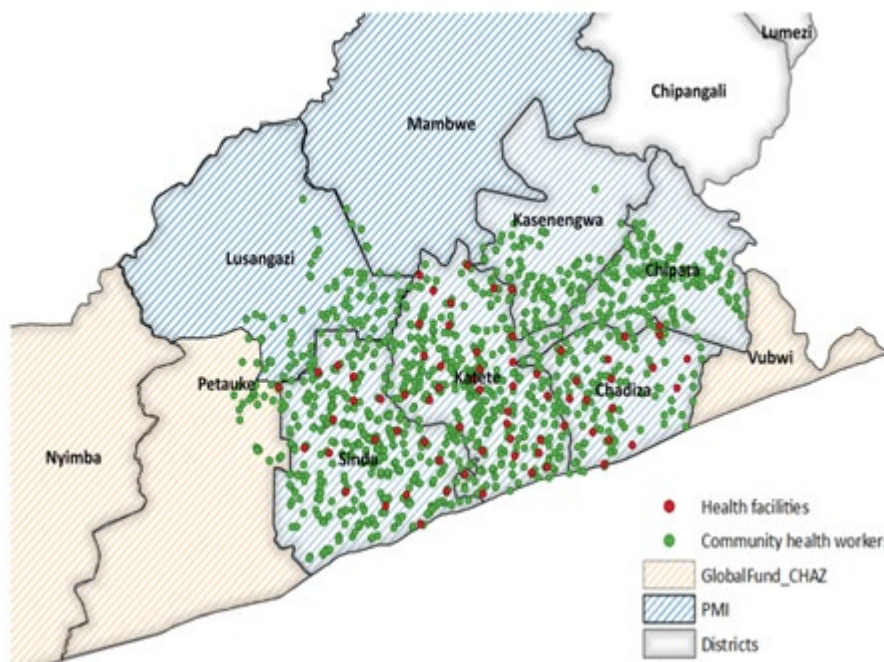
Figure A-13. CHWs deployed in malaria community case management, Zambia, 2020
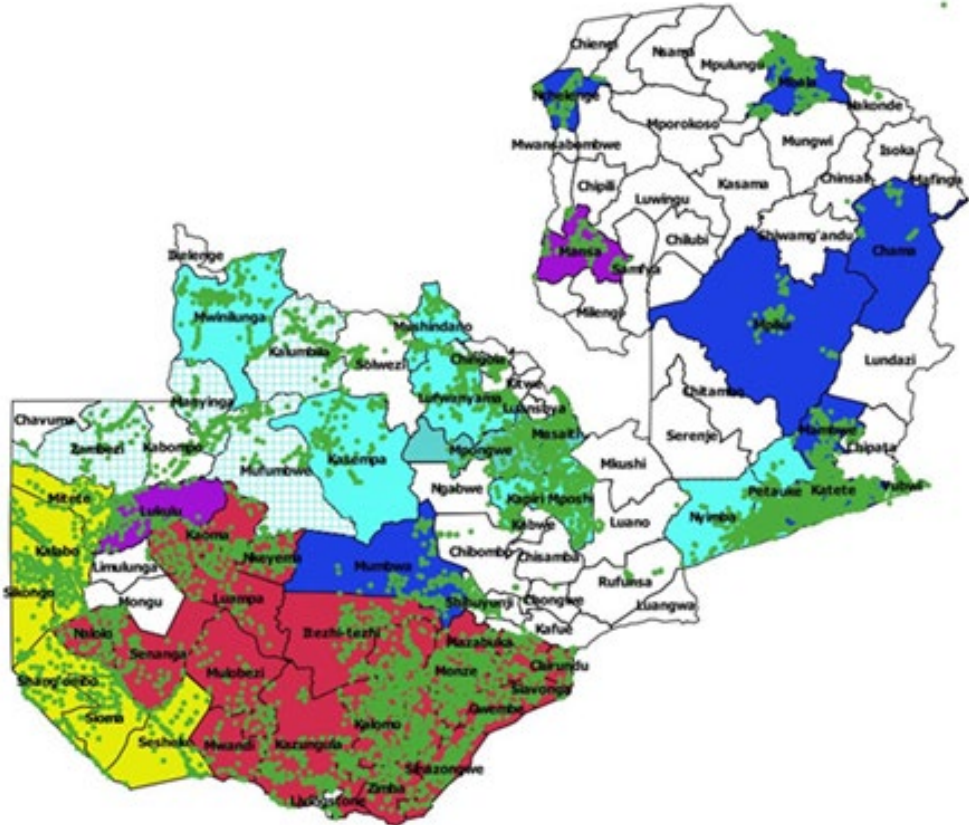
Source: DHIS2, PATH/MACEPA.

Community health workers
Districts
Funding support
IsdellFlowers
MACEPA
PMI
GlobalFund_CHAZ
Rotary
Global Fund - MoH

Figure A-14. Closer view of distribution of CHWs in the pre-elimination districts in Eastern Province, 2020

PMI-Supported Planned Activities (next ~12 months with currently available funds)

Selected highlights of planned activities in case management in CY 2021 include the following:

- Building technical and financial management capacity in PHOs and DHOs to transition iCCM training and OTSS to government-to-government support by CY 2022. Best practices and lessons learned from USAID and the President's Emergency Plan for AIDS Relief (PEPFAR) program experience with government-to-government funding mechanisms in Copperbelt, Central, Luapula, and Northern provinces will inform the transition.
- Continuing to support CHW deployment in iCCM, but with renewed emphasis on helping maintain their activity levels, such as increased supervision, monitoring, and support. In Central and Copperbelt, the OTSS program will be extended to incorporate iCCM.
- Strengthening collaboration with the Rotary Club in iCCM, especially in Muchinga Province. In early 2021 the Rotary Club in Zambia announced that, with funding support from BMGF and implementation support from PATH/MACEPA and World Vision, it is embarking on a new $6M, three-year program to train and equip 2,500 CHWs in Muchinga and Central provinces.
- Further strengthening the OTSS and diagnostics quality assurance programs by:
    - o Piloting an advanced version of the Electronic Data System for digitized supervision checklists and data collection in selected provinces for eventual roll out to 10 provinces.
    - o Further strengthening the national malaria slide bank by procuring *Pv* and mixed *Pv/Pf* slides.
    - o Making increased use of malaria case management e-learning and distance learning approaches.
    - o Expanding private provider participation in the OTSS program.

o Supporting and expanding the implementation of quality improvement activities in malaria case management through refresher training in case management and MIP, proficiency testing in all microscopy sites to sustain the skills gained from refresher trainings, and national competence assessments for each laboratory staff once in three years.

Improve access to and use of timely, quality, and well-documented malaria testing and treatment by providing facility- and community-based health workers with training, supervision, and malaria commodities to provide quality, effective care.

Key Question 1a

What is the status of care-seeking and/or access to care for children under five years of age with fever?

Supporting Data

According to the 2018 Zambia Malaria Indicator Survey (MIS), prompt care-seeking for children with fever was low, and only 19.7 percent sought treatment from a health facility/provider on the same day or next day. Unlike most indicators in the MIS, this showed a worsening from the 2010 and 2015 MIS. Promptness of treatment seeking was found to be moderately higher in urban (24.1 percent, n = 62) than in rural areas (16.4 percent, n = 507). Although the small sample size limits the confidence with which we can conclude that there is a worsening trend in prompt treatment seeking, the finding that 80 percent of children with fever were not seen by a healthcare worker within one or two days is concerning. Of note, in spite of greater delays in seeking treatment, a steadily increasing proportion of febrile children are eventually brought to care, tested, and treated with appropriate medications. (See graph under Question 2a.)

The delays in treatment seeking may be linked to findings that just 72 percent of respondents recognized fever as a symptom of malaria and 35 percent knew the location and role of CHWs in their community.

Figure A-15. Trends in care-seeking for fever

Among children under five years of age with fever in the two weeks before the survey, percentage for whom advice or treatment was sought

Legend: ■ Care or treatment was sought ■ Care or treatment was sought the same or next day

	2007 DHS	2008 MIS	2010 MIS	2013-14 DHS	2015 MIS	2018 MIS
Care or treatment was sought	70			75		61
Care or treatment was sought the same or next day	30	64	31	37	32	20
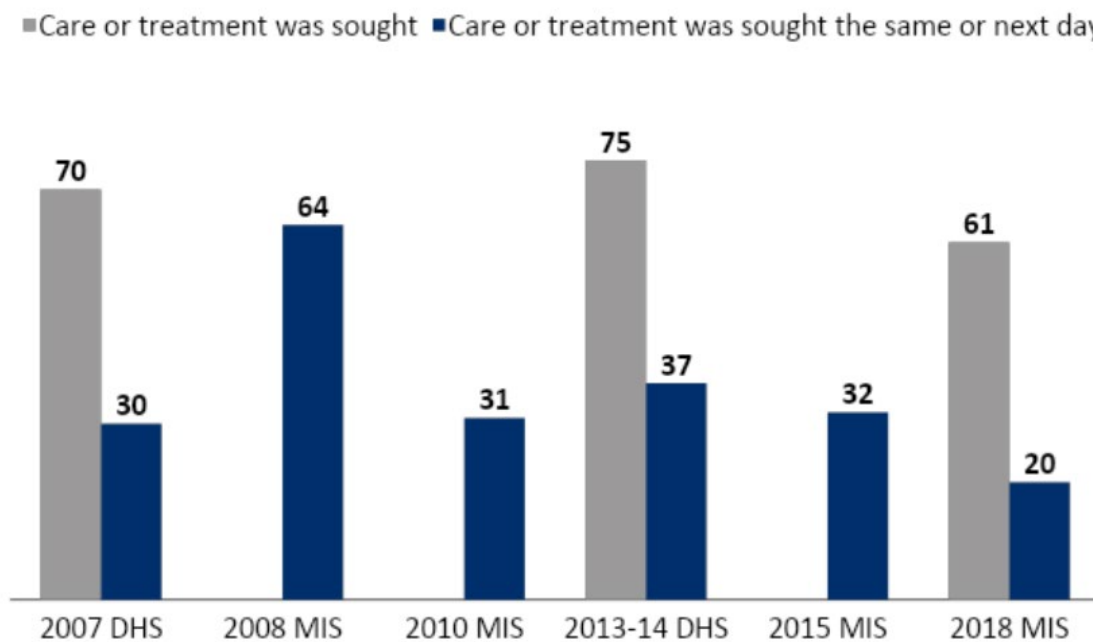
Key Question 1b

What significant structural and/or behavioral challenges affect prompt care-seeking?

Table A-12. Behavioral determinants associated with prompt care-seeking for children under five

Facilitator	Type of Factor	Data Source	Evidence
Recognition of fever as a symptom of malaria	Internal	Zambia MIS 2018	Seventy-one percent of women 15 to 49 years of age recognize fever as a symptom of malaria.
Strong messaging to women through ANC and under-five clinics	Environmental	Formative SBC Study 2018	In rural areas, 60.5 percent of women have heard about malaria during ANC visits, and 58 percent had heard about malaria through under-five clinics.
Barrier	**Type of Factor**	**Data Source**	**Evidence**
Low rate of malaria testing	Internal	Zambia MIS 2018	Fifty-five percent of children 0 to 59 months of age with fever reporting a finger/heel stick.
Delays in care-seeking for fever	Internal	Zambia MIS 2018	Twenty percent of children with fever sought treatment from a facility or provider the day of fever onset or the next day.
Limited messaging about prompt care-seeking	Environmental	Formative SBC Study 2019	Twenty-two percent of the population surveyed had heard "Children with fever should be taken to the health facility without delay."

Due to the predominantly rural setting of the PMI-focus provinces, lack of access to care is likely an important systemic contributor to care-seeking delays for most of the population. Therefore, strengthening iCCM is a high-priority focus and PMI continues to work closely with the MOH, the Global Fund, and MACEPA to ensure that resources are deployed for iCCM and surveillance in a complementary fashion.

Key Question 2a

What proportion of patients are being tested and appropriately treated for malaria?

Figure A-16. Trends in diagnosis and treatment of children with fever

Among children under five years of age with fever in the two weeks before the survey and with fever in the two weeks before the survey who received any antimalarial
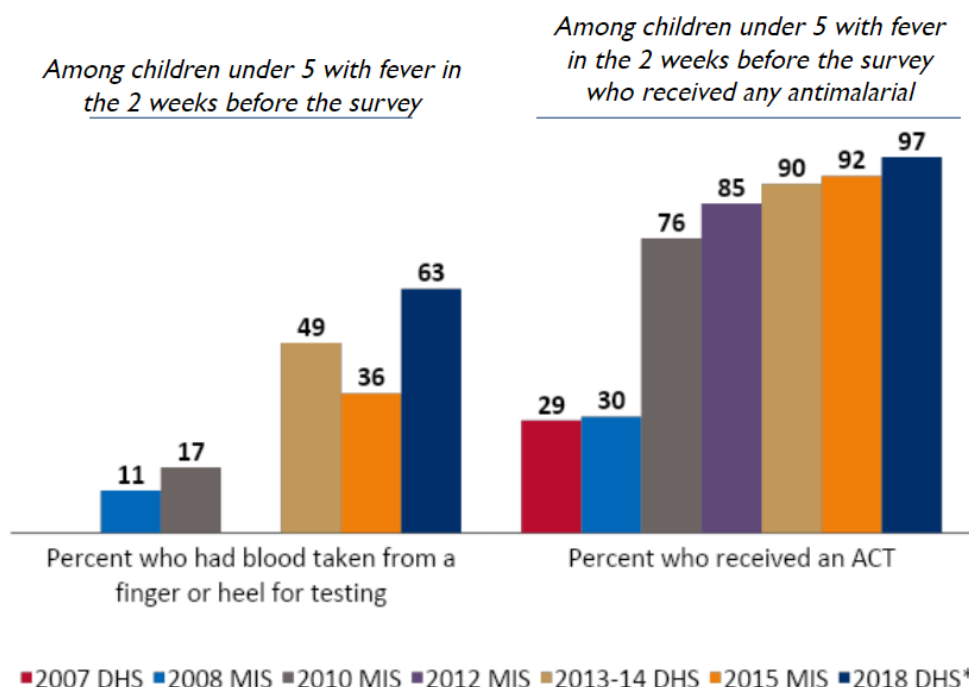
Figure A-17. Reduction in unconfirmed (clinically reported) malaria outpatient attendance, 2014–2020, in PMI-focus provinces
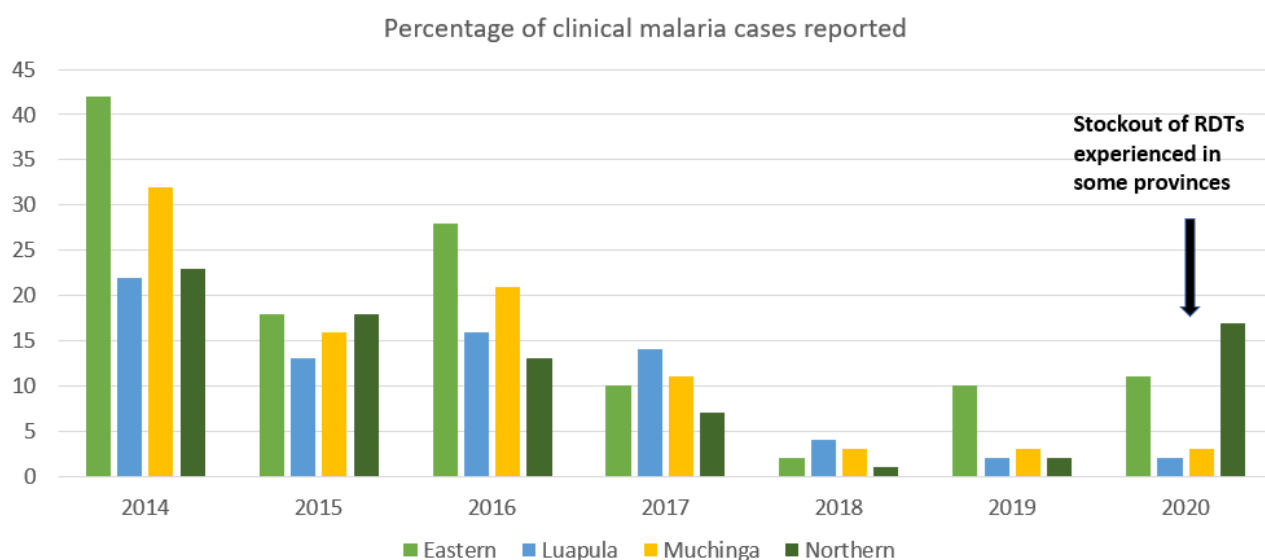
Source: PATH/NMEP.

Figure A-18. Increase in proportion of malaria cases confirmed with RDT or microscopy in the pre-elimination districts, 2014–2020

Proportion of cases confirmed
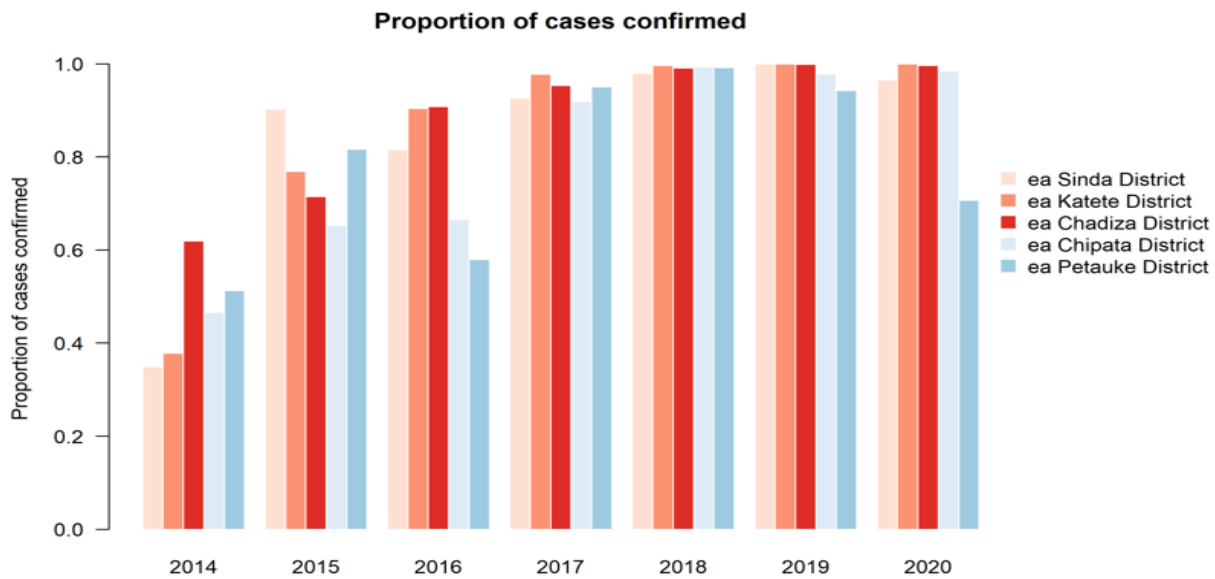
Figure A-19. Average competency scores by area of assessment and OTSS round, Central and Copperbelt provinces, 2019–2020
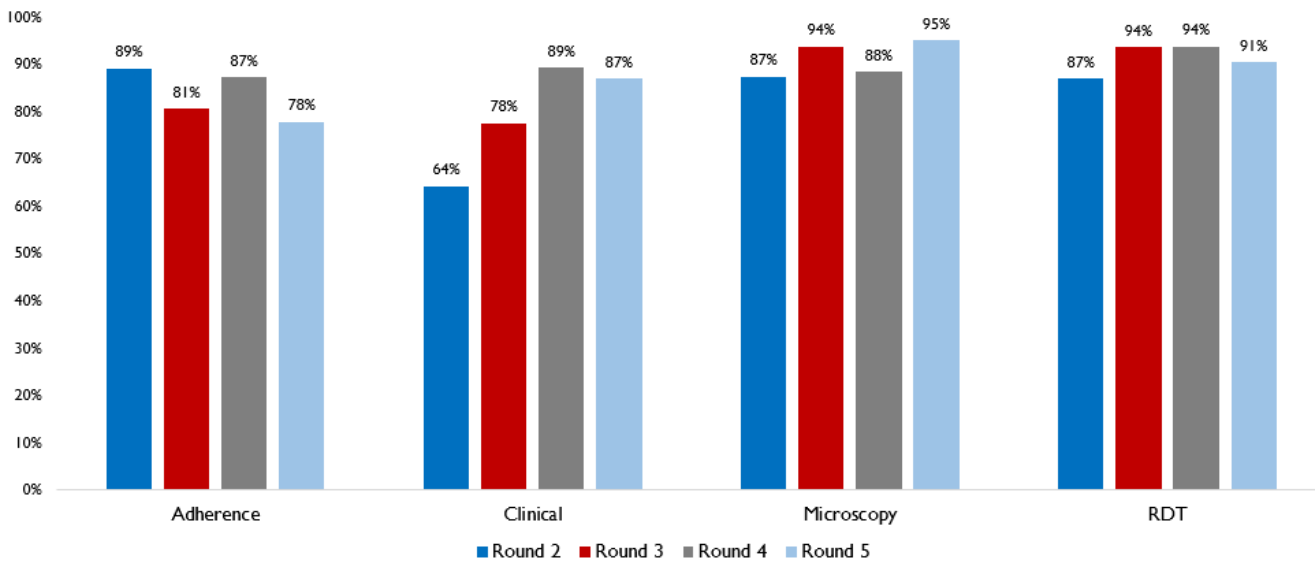
The trends in these indicators suggest that investments in improved case management practice services have been effective. A higher proportion of febrile children are being tested and treated appropriately. A higher proportion of malaria cases reported by districts have been confirmed through RDTs or microscopy. And observations of clinical practice demonstrated improved adherence to quality guidelines.

What significant structural and behavioral challenges affect testing and treatment practices among providers?

Supporting Data

Table A-13. Facilitators and barriers to appropriate testing and treatment practices

Facilitator	Type of Factor	Data Source	Evidence
Access to CHWs	Environmental	SBC Formative Study 2019	Three out of every four people reported having a CHW in their localities. More households in rural areas (82%) reported having CHWs than households in urban areas (63%).
Children taking ACTs for malaria	Internal	MIS 2018	Ninety-six percent of children 0 to 59 months of age with fever are taking antimalarial drugs (ACTs).
Barrier	Type of Factor	Data Source	Evidence
Promptness of care-seeking for children with fever	Internal	MIS 2018	Promptness of care-seeking for children with fever has decreased from 64% in 2008 to 20% in 2018.
Febrile children tested for malaria	Environmental	MIS 2018	Approximately 55% of children seen by healthcare workers for fever received a diagnostic test.

There is limited data on provider behavior to testing and treatment practices in Zambia. The data that does exist from the beneficiary side shows fairly high access to CHWs and high RDT and ACT use by facility health workers. While it is difficult to ascertain local clinical practices from household surveys, it is assumed that many of the finger/heel sticks are likely malaria RDTs, which have been scaled up throughout the country since 2007. Antimalarial treatment practices among febrile children saw a slight decrease since 2008. This indicator remains standard in an MIS, but has become difficult to interpret. Due to the increasing availability of malaria RDTs, it is assumed that this declining percentage of antimalarial treatments offered to children with fever is largely due to healthcare providers offering more appropriate treatment advice as a result of parasitological confirmation of clinical diagnoses. In short, it may be that fewer patients with symptomatic fever are being given antimalarial drugs in part because RDT results indicate that they do not have malaria. Over time, promptness to care has decreased since 2006, which is not the desired outcome. Programming will continue to focus on achieving even higher coverage of active CHWs and will maintain support for training and supervision to institutionalize the culture of testing before making a diagnosis of malaria

What is the current and planned support for case management at health facilities and in the communities by CHWs?

For an overview of current and planned PMI support for strengthening case management at the health facility and community levels, please see the first segments of the Case Management section.

Here, two deficiencies in the iCCM program that impact PMI programming priorities are addressed. Namely, in the provinces of Luapula, Northern and Muchinga, by late 2020 it was noted that a large proportion of districts and HFCAs have yet to reach CHW saturation, and moreover, among CHWs trained in 2018–2020, a large proportion became inactive in 2019–2020, in terms of diagnosing and treating malaria.

Due to the extra resources available, the pre-elimination districts in Eastern Province had been spared from both phenomena.

Supporting Data

Figure A-20. Location of CHWs in PMI-supported districts
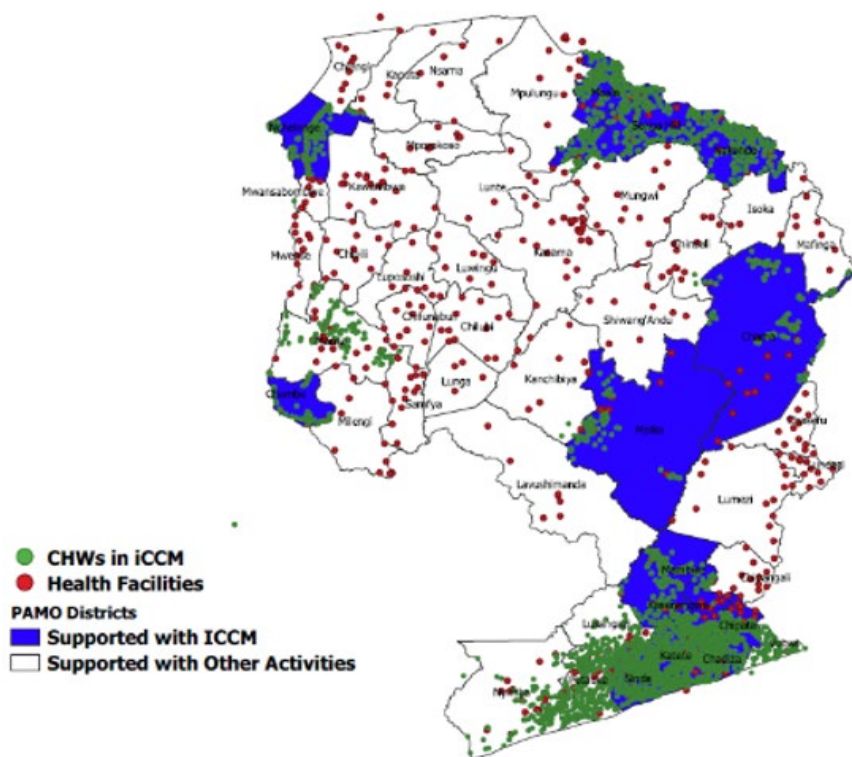
Source: PATH.

As illustrated in Figure A-20, although PMI resources have recently been applied to saturate selected districts, most districts in the PMI-focus provinces of Luapula, Northern, and Muchinga, have yet to scale up iCCM. The NMEP aims to build on this momentum to further expand iCCM, especially in high-burden and hard-to-reach areas. PMI has been communicating more consistently that its resources alone will not be sufficient. Fortunately,

Rotary and World Vision are bringing to bear significant new resources for Muchinga, as previously described; the local NGO MAMaZ has secured a new grant to further support severe malaria referrals among CHWs, and the new Global Fund grant may be able to add to the effort.

Figure A-21. Ongoing high, stable activity levels in community case management in Southern Province, 2015–2020

By Detection
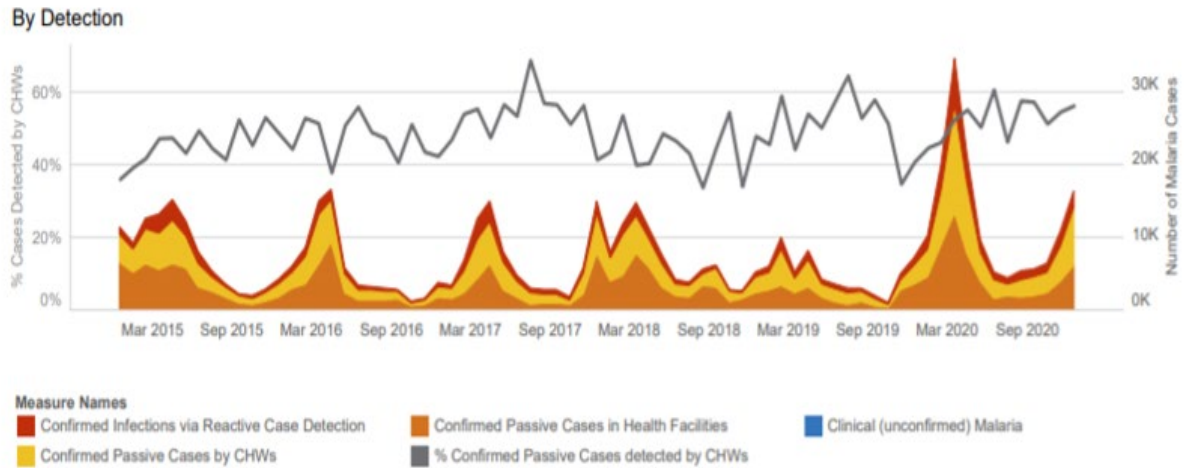
Source: NMEC instance of DHIS2.

Figure A-22. Establishment, then maintenance of high activity levels in community case management in Eastern Province, 2018–2020

By Detection
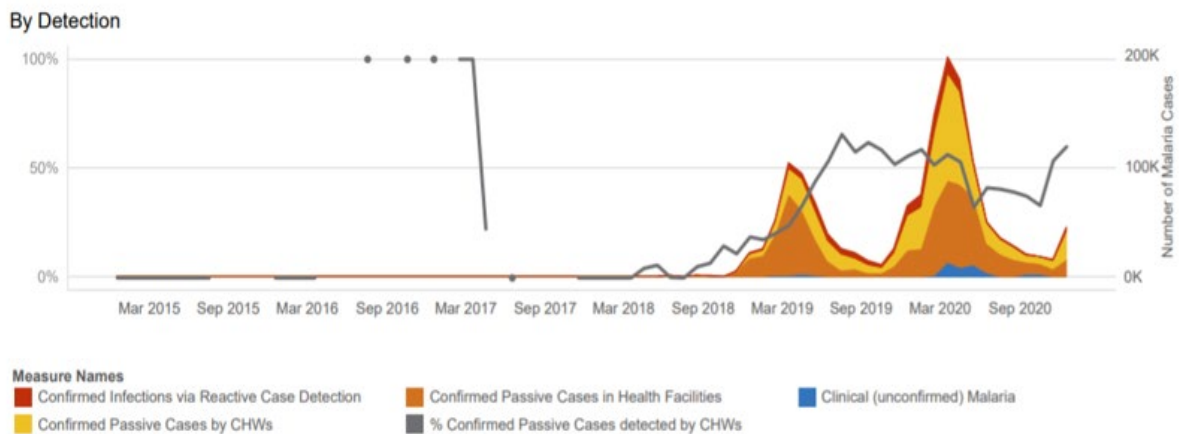
Source: NMEC instance of DHIS2.

Figure A-23. Establishment, then erosion of community case management activity in other locations: Western Province 2015–2020 and Muchinga and Northern provinces 2018–2020, and Nchelenge District, Luapula Province, 2018–February 2021

Points of downward inflection in 2019–2020 are highlighted with red arrows.

Western Province
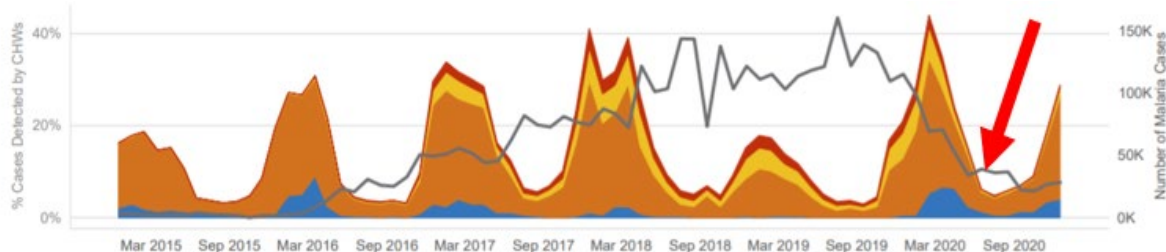
Muchinga Province
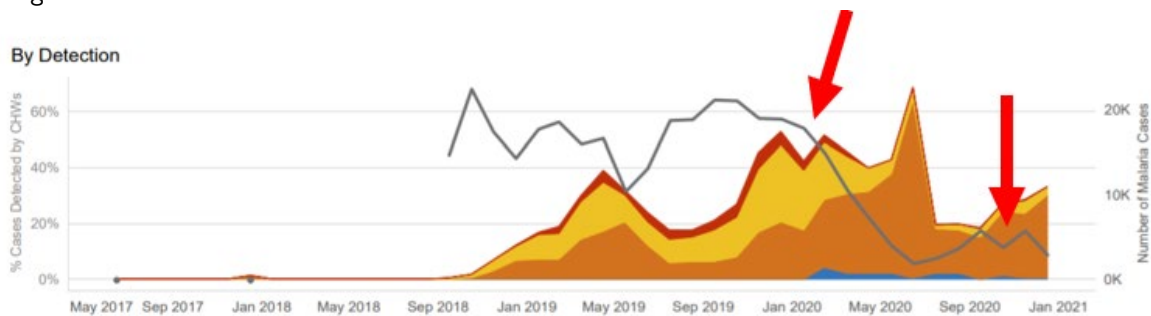
Northern Province
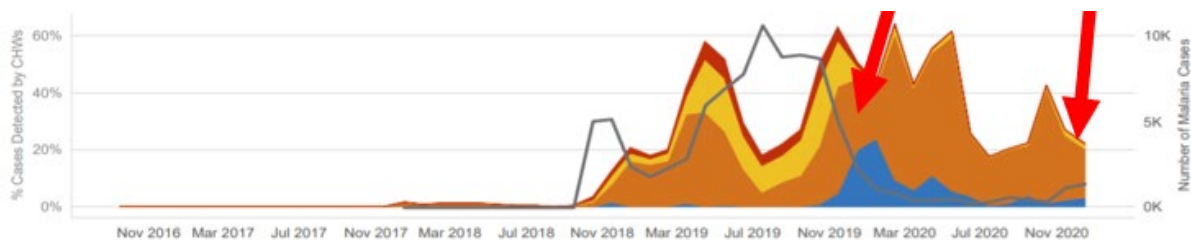
Nchelenge District, Luapula Province
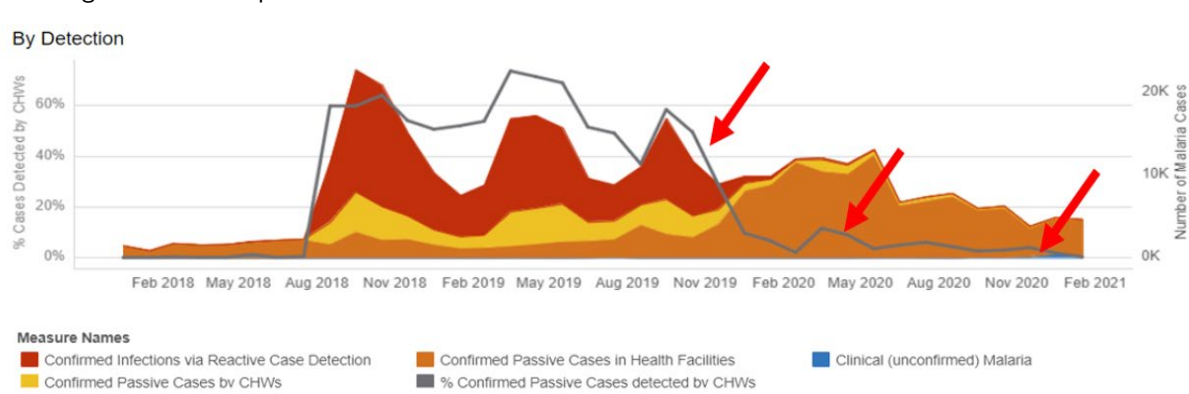
Source: NMEC instance of DHIS2.

The second area of concern is illustrated in Figures A-21-A-23. These graphics are generated monthly for review by the NMEC and stakeholders. Malaria cases reported by health facilities are shown by the lower brown band. Malaria cases reported by CHWs are shown by the middle yellow band for passive case detection (iCCM) and by the upper red band for RCD (also known as active response or Step-D). The case counts tend to rise and fall seasonally, as expected. The proportion of cases reported by CHWs out of all cases is depicted by the gray line. In general, a proportion of 30 percent to 40 percent or more would be consistent with a robust iCCM program.

Encouraging trends are observed in Southern Province, with its long-standing support from MACEPA and Global Fund, and Eastern Province, with its enhanced support since 2018 from the PMI elimination program and Global Fund (CHAZ). In contrast, the trends in Western, Muchinga, and Nchelenge demonstrate initial rises in CHW activity following training and initial deployment, followed by drop-offs starting in 2019 and worsening in 2020. This jeopardized the benefit to local populations of the extensive investments in iCCM.

In stakeholder discussion and field observations, irregular provision of commodities (ACTs and RDTs) by health facilities to the CHWs has been noted as the chief culprit. This phenomenon was initially associated with unsustainably high volumes of active case detection in some cases (e.g., Nchelenge). It became widespread and entrenched once COVID-related supply chain disruptions caused health facilities to experience ACT and RDT shortages in April through June 2020. A persistent problem of health facility "hoarding" of commodities was widely observed, even when central and facility stocks were restored. Additional factors cited include suboptimal recruitment approaches leading to excess turnover of CHWs, staff attrition affecting supervision of CHWs and reporting rates, and damaged phones and phone chargers affecting data transmission. It is also speculated that, when RCD was curtailed in high-burden areas to preserve commodities, CHWs may have inadvertently had their visibility in the community curtailed, to the detriment of the iCCM function.

In Southern and Eastern, familiarity with and prioritization of iCCM at all levels (PHO, DHO, and community), led to continued close supervision and sustained support for CHWs, which appears to have mitigated these factors.

The NMEC, PMI, and partners have made restoration of CHW activity levels a priority in 2021. Efforts are being made to strengthen supply chains, to enhance CHW supervision and support, to offer re-education and guidance to health facilities, and to improve recruitment approaches. All partners are now encouraged to measure the success of their programs not only in terms of CHWs trained and deployed, but also in CHWs who remain active over time.

Incidentally, the capacity of the Zambian program to detect, analyze, and respond to this issue illustrates the utility of the investments in the HMIS and MRR systems over the years, as well as the data visualization tools.

Key Question 4

What is the estimated need for RDTs during calendar years 2021–2023? Are there any projected RDT gaps based on anticipated partner contributions compared to estimated needs?

The estimated need for RDTs during the calendar years 2021–2023 are 31,928,910, 28,062,949, and 25,362,961, respectively (tests). Based on the anticipated partner contributions and with the assumption that the Global Fund will contribute funding (~$5.9M) toward commodities using the PAAR along with the PMI contributions, there are no projected gaps in RDTs. It should be noted that MOH commitments are not yet known for RDTs.

Supporting Data

Table A-14. RDT Gap Analysis Table

Calendar Year	2021	2022	2023
Total country population	18,400,556	18,926,743	19,456,692
Population at risk for malaria	18,400,556	18,926,743	19,456,692
PMI-targeted at-risk population	18,400,556	18,926,743	19,456,692
RDT Needs			
Total number of projected fever cases	8,924,270	9,179,470	9,436,496
Percent of fever cases tested with an RDT	90%	95%	95%
RDT Needs (tests)	**31,928,910**	**28,062,949**	**25,362,961**
Needs Estimated based on Other (specify in comments)			
Partner Contributions (tests)			
RDTs from Government	*0*	*0*	*0*
RDTs from Global Fund	26,275,654	19,770,951	19,666,666
RDTs from other donors	0	0	0
RDTs planned with PMI funding	14,684,625	8,025,000	*3,517,441*
Total RDT Contributions per Calendar Year	**40,960,279**	**27,795,951**	**23,184,107**
Stock Balance (tests)			
Beginning balance	9,364,675	18,396,044	18,129,046
- Product Need	31,928,910	28,062,949	25,362,961
+ Total contributions (Received/expected)	40,960,279	27,795,951	23,184,107
Ending Balance	18,396,044	18,129,046	15,950,192
Desired End of Year Stock (months of stock)	6	6	6
Desired End of Year Stock (quantities)	15,964,455	14,031,475	12,681,481
Total Surplus (Gap)	**2,431,589**	**4,097,572**	**3,268,712**

Key Question 5

What is the estimated need for ACTs during calendar years 2021–2023? Are there any projected ACT gaps?

The estimated need for ACTs during the calendar years 2021–2023 are 13,527,676, 10,879,879, and 8,232,083, respectively (treatments). The Global Fund contribution is unknown beyond 2021 but based on the anticipated PMI contributions, there are no projected ACT gaps in 2021 and 2022 but there is a projected gap in 2023. With this anticipated gap in 2023, there will be sufficient stock to cover the estimated need, but the buffer stock needed to end the year with sufficient stock will not be covered. It should be noted that MOH commitments are not yet known for ACTs.

Table A-15. ACT Gap Analysis Table

Calendar Year	2021	2022	2023
Total country population	18,400,556	18,926,743	19,456,692
Population at risk for malaria	18,400,556	18,926,743	19,456,692
PMI-targeted at-risk population	18,400,556	18,926,743	19,456,692
ACT Needs			
Total projected number of malaria cases	5,717,237	5,145,513	4,630,962
Total ACT Needs (treatments)	**13,527,676**	**10,879,879**	**8,232,083**
Needs Estimated based on Consumption Data			
Partner Contributions (treatments)			
ACTs from Government	0	0	0
ACTs from Global Fund	16,787,538	0	0
ACTs from other donors [specify donor]	0	0	0
ACTs planned with PMI funding	5,516,970	5,335,000	4,425,409
Total ACTs Contributions per Calendar Year	**22,304,508**	**5,335,000**	**4,425,409**
Stock Balance (treatments)			
Beginning balance	3,853,600	12,630,432	7,085,553
- Product Need	13,527,676	10,879,879	8,232,083
+ Total contributions (Received/expected)	22,304,508	5,335,000	4,425,409
Ending Balance	12,630,432	7,085,553	3,278,879
Desired End of Year Stock (months of stock)	6	6	6
Desired End of Year Stock (quantities)	6,763,838	5,439,940	4,116,042
Total Surplus (Gap)	**5,866,594**	**1,645,614**	**(837,163)**

Key Question 6

What is the estimated need for definitive treatment and pre-referral treatment for severe malaria during calendar years 2021–2023? Are there any anticipated gaps?

The estimated need for artesunate injection during the calendar years 2021–2023 are 1,169,364, 1,052,436, and 947,196 vials, respectively. Although commitments are known in 2021 from both Global Fund and MOH, in subsequent years of 2022 and 2023, funding commitments are yet to be determined. Based on the known funding commitments along with the PMI contributions, there will be anticipated gaps in 2021–2023 for artesunate injection.

The estimated need for RAS (suppositories) during the calendar years 2021–2023 is 148,382, 152,625, and 156,898, respectively. For this commodity, three districts are being supported and although the funding commitments are known in 2021 from Global Fund, in subsequent years of 2022 and 2023, funding commitments are yet to be determined. Based on the known funding commitments along with the PMI contributions, there will

be anticipated gaps in 2021–2023 for RAS. It should be noted that MOH commitments are not yet known for RAS.

Supporting Data

Table A-16. Inj. Artesunate Gap Analysis Table

Calendar Year	2021	2022	2023
Injectable Artesunate Needs			
Projected Number of Severe Cases	52,994	49,682	44,377
Projected # of severe cases among children	22,357	20,127	18,109
Average number of vials required for severe cases among children	7	7	7
Projected # of severe cases among adults	30,637	29,555	26,268
Average number of vials required for severe cases among adults	15	15	15
Total Injectable Artesunate Needs (vials)	**1,169,364**	**1,052,436**	**947,196**
Needs Estimated based on HMIS Data			
Partner Contributions (vials)			
Injectable artesunate from Government	200,000	0	0
Injectable artesunate from Global Fund	187,008	0	0
Injectable artesunate from other donors [specify donor]	0	0	0
Injectable artesunate planned with PMI funding	630,024	226,000	678,733
Total Injectable Artesunate Contributions per Calendar Year	**1,017,032**	**226,000**	**678,733**
Stock Balance (vials)			
Beginning balance	153,224	892	0
- Product Need	1,169,364	1,052,436	947,196
+ Total contributions (Received/expected)	1,017,032	226,000	678,733
Ending Balance	892	-825,544	-268,463
Desired End of Year Stock (months of stock)	6	6	6
Desired End of Year Stock (quantities)	584,682	526,218	473,598
Total Surplus (Gap)	**(583,790)**	**(1,351,762)**	**(742,061)**

Table A-17. RAS Gap Analysis Table

Calendar Year	2021	2022	2023
Artesunate Suppository Needs			
Number of severe cases expected to require pre-referral dose	105,987	109,018	112,071
Total Artesunate Suppository Needs (suppositories)	**148,382**	**152,625**	**156,899**
Needs Estimated based on Other (please specify in comment section)			
Partner Contributions (suppositories)			
Artesunate suppositories from Government	0	0	0
Artesunate suppositories from Global Fund	167,893	0	0
Artesunate suppositories from other donors	0	0	0
Artesunate suppositories planned with PMI funding	60,000	166,000	83,334
Total Artesunate Suppositories Available	**227,893**	**166,000**	**83,334**
Stock Balance (suppositories)			
Beginning balance	8,071	87,582	100,957
- Product Need	148,382	152,625	156,899
+ Total contributions (Received/expected)	227,893	166,000	83,334
Ending Balance	87,582	100,957	27,392
Desired End of Year Stock (months of stock)	6	6	6
Desired End of Year Stock (quantities)	74,191	76,313	78,449
Total Surplus (Gap)	**13,391**	**24,644**	**(51,057)**

Key Question 7

What is the estimated need for any other standard antimalarial drug used in the country (e.g., primaquine for *P. vivax*) during calendar years 2021–2023? Are there any anticipated gaps?

N/A

Supporting Data

Key Question 8

Are first-line ACTs effective and monitored regularly?

Table A-18. Recently completed and ongoing antimalarial therapeutic efficacy studies

Most recent study year	Sites	PMI Funded (Y/N)	Treatment Arms	PCR-Corrected Efficacy>90% (Y/N)
2014–2015[1]	Nchelenge	N	AL	Y
2016[2]	Katete	N	AL, ASAQ, DP	Y
2016[2]	Mansa	N	AL, ASAQ, DP	Y
2016[2]	Gwembe	N	AL, ASAQ, DP	Y

Ongoing Therapeutic Efficacy Studies (TES): NoneNext planned TES: TBD

ACPR: adequate clinical and parasitological response; AL: artemether-lumefantrine; ASAQ: amodiaquine-artesunate; DP: dihydroartemisinin-piperaquine.
[1]Ippolito, M.M., Pringle, J.C., Siame, M., Katowa, B., Aydemir, O., Oluoch, P.O., Huang, L., Aweeka, F.T., Bailey, J.A., Juliano, J.J., Meschnick, S.R., Shapiro, T.A., Moss, W.J., & Thuma, P.E. Therapeutic efficacy of artemether-lumefantrine for uncomplicated falciparum malaria in Northern Zambia. *American Journal of Tropical Medicine and Hygiene*. 2020; 00(0). doi: 10.4269/ajtmh.20-0852.
[2]Pre-publication: Hamainza, B., Moonga, H., Mwenda, M., Chirwa, J., Chalwe, V., Chileshe, J., Manyando, C., Kawesha, E.C., & Masaninga, F. *In-vivo* efficacy and safety of artemether-lumefantrine, artesunate-amodiaquine and dihydroartemisinin-piperaquine in the treatment of uncomplicated mono *Plasmodium falciparum* infection in all age groups in selected sites in Zambia.

Key Question 9

Are there other areas (e.g., lab strengthening, private sector support, etc.) that should be considered for PMI support?

With the concerning rise in malaria death reports by health facilities in 2020 (Figure 4) the NMEP and partners are renewing their interest in severe malaria prevention and treatment.

- On the preventative side, appropriate responses are strengthening vector control, prompt care-seeking, and early access to diagnosis and care, including pre-referral administration of RAS, each of which has been addressed in earlier sections of this MOP.
- On the treatment side, improving access to injectable medications has been addressed, but another key, life-saving tool for front-line clinicians has not been addressed here, and tends to be under-resourced, especially in high-burden rural areas: that is blood supply. Through reprogramming, PMI/Zambia will propose an assessment to inform options for providing targeted, cost-effective assistance to improve the availability of blood transfusions for the treatment of severe malaria.

Severe anemia is a common and often life-threatening complication of severe malaria infection, particularly in children. To date the Global Fund, PMI, and other malaria partners have not provided TA or commodity assistance in this area in Zambia. In the past, but not currently, cooperating partners in the field of safe motherhood including the European Union had provided modest support to blood banking systems. The NMEC sees this as a priority gap and is requesting PMI support with an assessment.

Supporting Data

N/A

Conclusions for Case Management Investments

- Funding for key case management commodities (ACTs, RDTs, injectable artesunate) will continue at the current, historically high levels due to the persistent threats of national stockouts, as described in the Supply Chain section of the MOP. In light of Zambia's constrained resource environment, a reduction of support by PMI would jeopardize hard-won gains in a range of malaria case management indicators, such as children receiving appropriate medication (improved from 76 percent in 2010 MIS to 96 percent in 2018 MIS); and parasitological confirmation of reported malaria cases (improved from 31 percent in 2010 HMIS to 96 percent in 2018 HMIS).
- PMI will continue to support decentralized strengthening of diagnostic and clinical capabilities at all levels. Funding for TA will be maintained at comparable levels, due to large unmet needs.
  - o CHW training and deployment has reached less than 30 percent of national targets, and the activity levels of CHWs once trained dropped precipitously in 2019–2020 in several focus provinces. Continued scale-up of community case management of malaria will reduce barriers to care-seeking such as time and cost of travel. PMI will seek expanded partnership with other funders such as Global Fund/CHAZ in Eastern and BMGF/Rotary Fund/World Vision in Central and Muchinga.
  - o Community case management will be coupled with surveillance activities that are appropriate to the local epidemiologic level and will be bolstered by cross-cutting interventions (described in later sections) including SBC investments to improve the population's knowledge and practices in regards to recognition of fever and the dangers of malaria; improved commodity security, which will increase community confidence that the needed medications and testing supplies will be available when they seek care; and strengthened systems to capture and utilize community-level case management data. Moreover, the upcoming Malaria Program Review, the ProACT study, and successes in Southern and Eastern provinces can identify best practices for CHW support.
  - o In OTSS, best practice would be to conduct health facility visits quarterly, but due to resource constraints OTSS rounds are currently conducted twice per year at most. To increase scope and build capacity, PMI will continue to transition funding both CHW training and OTSS implementation to government-to-government mechanisms with provincial health offices.
- PMI will continue to invest in measured scale-up of RAS deployment in community-based referrals for severe malaria. Given the long history of poor uptake of RAS in many country settings, PMI will continue to support linkage of CHW training and supply with support for community-based emergency transport systems, emulating the successful pilot in Serenje District in 2017–2018.
- For the first time, PMI will explore potential modalities for providing targeted, cost-effective assistance to improve the availability of blood transfusions for the treatment of severe malaria. This would begin with assessment of blood supply services to better understand specific, actionable blood supply bottlenecks that should be addressed for future investments by PMI and/or stakeholders in safe motherhood and surgery/trauma. (Proposed funding for the needs assessment and partner mapping would come from prior MOP reprogramming, with FY 2022 MOP funding covering operational/program support.)
- As per an agreement with the Global Fund across countries, PMI would support the planning and implementation of periodic TES including screening for antimalarial resistance markers.

Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.

2.2. DRUG-BASED PREVENTION

NMEP Objective (Malaria in Pregnancy)

The *National Malaria Elimination Strategic Plan (2017–2021)* does not provide specific objectives for intermittent preventive treatment of malaria in pregnancy (IPTp) or Malaria in Pregnancy (MIP). However, the new *National Malaria Policy* (November 2020, still in draft form) captures the national objectives well:

- All pregnant women [shall] have access to cost-effective preventive interventions including LLINs and IPTp. Intermittent Preventive Treatment in pregnancy shall consist of administration of antimalarial medicines according to the current guidelines for antenatal care services in Zambia.
- All pregnant women who present with suspected malaria shall receive prompt diagnosis and effective treatment using antimalarial medicines according to the current guidelines for the diagnosis and treatment of malaria in the country.

NMEP Approach (Malaria in Pregnancy)

The *National Malaria Elimination Strategic Plan (2017–2021)* includes three strategies to reduce the malaria burden in pregnant women: the provision of free IPTp with at least four doses of SP during pregnancy, the provision of free ITNs, and free prompt diagnosis and treatment of clinical malaria. These interventions are implemented as part of routine focused ANC.

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.

PMI Objective in Support of NMEP (Malaria in Pregnancy)

PMI's support of drug-based prevention strategy aligns with the NMEP national approach. This includes the provision of free IPTp and ITNs at ANC visits, as well as prompt diagnosis and treatment. Most of PMI's MIP and IPTp support takes place in the four high-burden provinces of Luapula, Northern, Muchinga, and Eastern. In Central and Copperbelt, modest support is provided in the form of the MIP module in the OTSS program.

PMI-Supported Recent Progress (past ~12 months) (Malaria in Pregnancy)

- PMI procured over 1.54 million doses of sulfadoxine-pyrimethamine (SP) in 2020. Since CY 2019, PMI has been procuring SP in relatively modest quantities to fill gaps in GRZ and Global Fund procurements. The continued erratic availability of SP occurred in a wider context of the GRZ's challenges in providing essential medicines in the face of mounting debt to drug vendors. PMI advocated at all levels to improve availability of SP.
- PMI supported the training of provincial and district-level health workers and supervision of provincial, district, and health facility-level health workers on the implementation of NMEP IPTp guidelines in four high malaria burden provinces (Luapula, Northern, Muchinga, and Eastern). Over 600 ANC providers were oriented on how to improve the provision of IPTp to pregnant women. Over 700 members of Safe Motherhood Action groups (SMAGs) were trained on the importance of IPTp to promote early ANC attendance.

- A malaria-in-pregnancy module has been incorporated into the OTSS program. The MIP module has been included on the Electronic Data System platform for data capture and analysis.

- PMI will continue to provide commodity support for ANC malaria services, meeting part of the national needs for SP and ITNs.
- PMI will support increasing the number of district OTSS supervisors from the current two to three, in order to allow a midwife to mentor ANC clinic staff.
- To improve patient knowledge and demand for prevention and treatment of malaria in pregnancy, PMI will continue to support national- and community-level SBC activities, with an emphasis on local SBC activities such as SMAGs in rural areas.

2.2.1. MALARIA IN PREGNANCY (MIP)

Key Goal

Support the national strategy for MIP, which includes provision of ITNs at the first antenatal care (ANC) visit, a minimum of four doses of intermittent preventive treatment for pregnant women (IPTp) in malaria endemic areas starting at 13 weeks gestational age, and effective case management of malaria per WHO guidelines.

Key Question 1a

What proportion of pregnant women are accessing ANC early and frequently (as recommended by national and/or WHO strategies) during their pregnancy?

Figure A-24. Trends in ANC coverage

Women 15 to 49 years of age with a live birth in the five years before the survey (most recent birth)
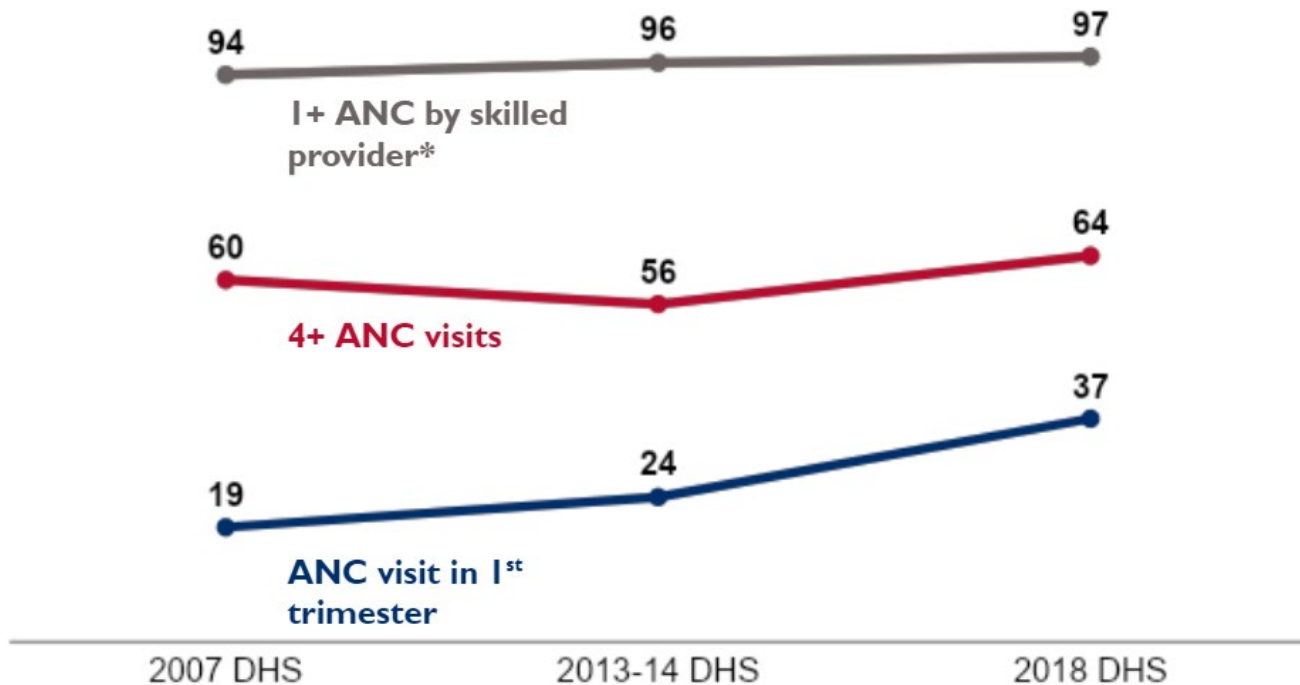
Skilled provider includes doctor, nurse, or midwife.

At the time of the last national survey (2018), the percentage of women who received ANC by a skilled provider had increased slightly from 94 percent in 2007 to 97 percent. Both women attending at least four ANC visits and women receiving at least one ANC visit during their first trimester of pregnancy had also seen modest gains. Zambia continues to place significant emphasis on ANC attendance and expects to see continued gains in this area. Yet, in spite of this high demand for ANC service, there is concern that in more recent years Zambian women may have received IPTp at reduced rates, due to persistent erratic supplies of SP. The 2021 MIS is expected to shed light on the matter.

In 2014, the NMEP aligned the national policy on IPTp with the updated WHO policy on IPTp, including updating the HMIS/DHIS2 to capture three doses of 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. Initially, national policy did not align with the recommendation for low-dose folic acid. PMI/Zambia worked with the Safe Motherhood TWG to advocate for a policy change to include low-dose folic acid. In early 2017, a final decision was made to update the Review Timeline:

- Batch 1 (9 MOPs): July 26–August 13
- Batch 2 (9 MOPs): August 16–September 3
- Batch 3 (9 MOPs): September 7–September 24, ANC guidelines to include low-dose folic acid, which is now being provided at ANC visits.

Are there important health system and/or behavioral barriers to ANC attendance at health facilities?

Supporting Data

Table A-19. Behavioral determinants associated with early ANC

Facilitator	Type of Factor	Data Source	Evidence
Men knowledgeable about ANC visits	Social	Formative SBC Study 2019	A recent study found that both male youths and male adults were able to share some informed level of detail about when pregnant women should generally start ANC visits.
Knowledge of IPTp administration during ANC clinic	Internal	Formative SBC Study 2019	Quote from community member: "Then, when a woman is pregnant, they go to an antenatal clinic, they are given medicine, however, it does not mean they already have malaria, no! It is for prevention. Since Fansidar is an anti-malaria drug, they are given this medicine."
Norm for women to seek preventive services during ANC	Social	Formative SBC Study 2019	About 9 in 10 households were of the view that pregnant women should seek preventive services during regularly scheduled ANC visits.
Barrier	**Type of Factor**	**Data Source**	**Evidence**
Cultural beliefs	Social	Formative SBC Study 2019	Hesitancy to begin ANC early due to women's perceived risk of losing the fetus and the unborn child and thus not wanting to acknowledge pregnancy early on.
Limited messaging for ANC and IPTp	Environmental	Formative SBC Study 2018	Forty-eight percent of people surveyed had heard that "pregnant women should go for antenatal care," and only 20% of people surveyed had heard that "pregnant women can obtain medicine for preventing malaria during antenatal care visit."
Limited knowledge of when IPTp should be started	Internal	Formative SBC Study 2018	A recent cross-sectional household survey found that only 21% of respondents knew correctly when IPTp should start. Limited understanding of when IPTp should be started may influence early ANC attendance.

In Zambia, there is a fairly high level of ANC awareness; however, additional SBC is needed to promote early ANC attendance which in turn will help ensure full coverage of IPTp. Women's malaria knowledge has not translated into action in regard to early ANC attendance. Both IPTp uptake and early care-seeking behavior should be approached through an integrated SBC approach with reproductive, maternal, and child health programs given that ANC visits have been identified as a successful medium for malaria messaging. Messaging at

ANC visits will be conducted through service communication and will focus on behavioral determinants in pregnant women. Based on SBC formative research results in Zambia effective messaging should also target community health meetings, under-five clinics, radio and in some cases, television. Given that billboards, posters, information leaflets, newspapers, and magazines appear to be the least effective channels for reaching communities with health-related information, including malaria, they will no longer be widely supported by PMI.

What proportion of pregnant women are receiving the recommended doses of IPTp?

Supporting Data

Figure A-25. Women with recent births reporting coverage of at least two, three, and four doses of IPTp, by urban and rural areas (Zambia 2010–2018)
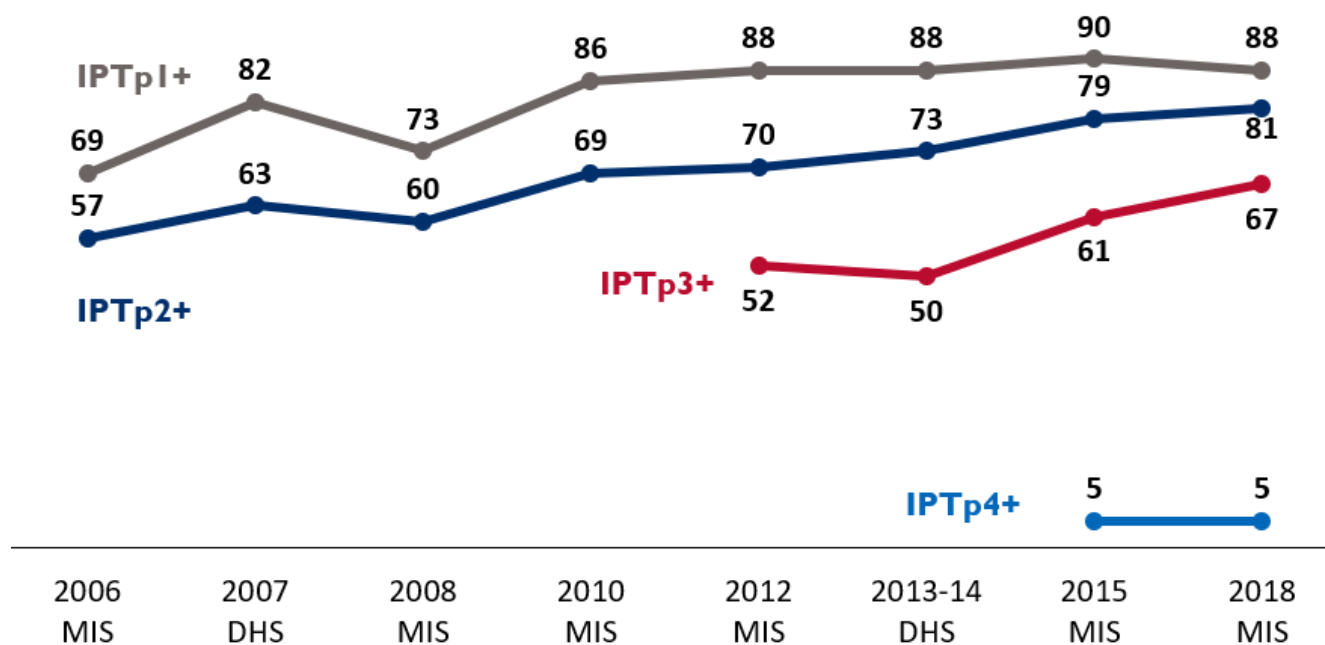
Source: MIS 2018

At the provincial level, the 2018 MIS showed that three of the four PMI-focus provinces of Luapula, Muchinga, and Northern had the highest IPTp access rates in the country (Figure A-26).

Figure A-26. Percentage of women with recent births who reported taking four doses of IPTp during pregnancy, by province.

PMI-focus provinces shown in red.
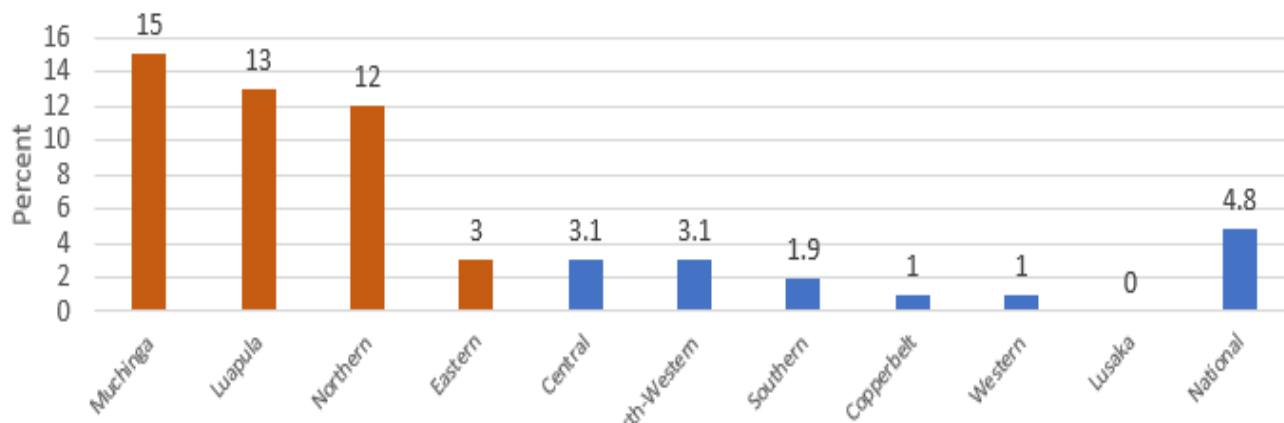
Source: 2018 MIS.

Key Question 3a

What is the gap between ANC attendance and IPTp uptake (i.e., missed opportunities for giving IPTp at ANC)?

Supporting Data

Figure A-27. Trends in missed opportunities for IPTp

Percentage of women 15 to 49 years of age

■ With a live birth in the past 5 years who received 4+ ANC visits
■ With a live birth in the past 2 years who received 3+ doses of IPTp
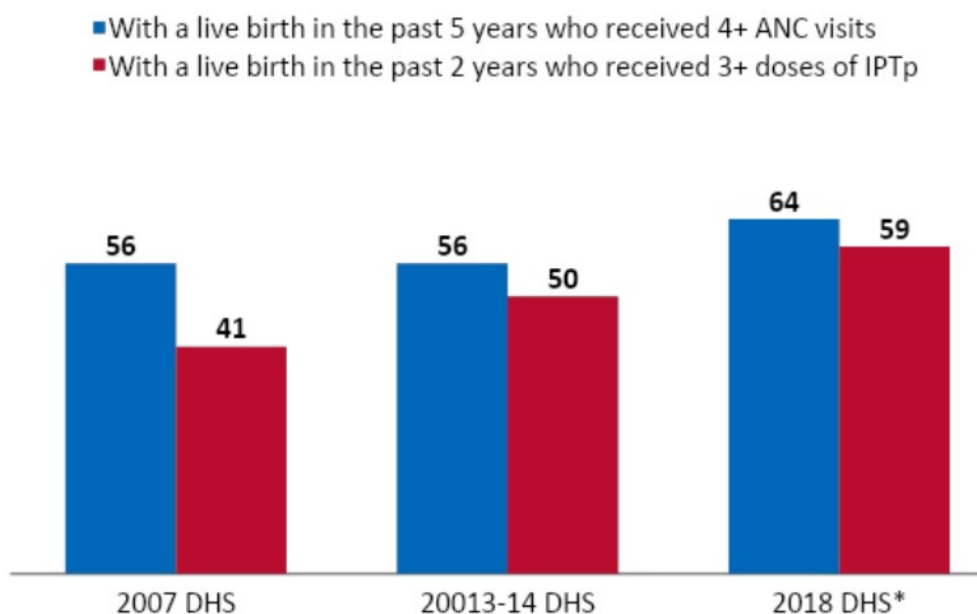
An increasing percentage of women reported taking two and three doses of IPTp in 2018 with 81 percent of pregnant women reporting at least two doses. The percentage of women reporting taking a fourth dose stayed the same at 5 percent between 2015 and 2018. *Data on the fourth dose are presented only for the 2018 MIS.

Key Question 3b

What significant health system and/or behavioral challenges affect provider delivery of MIP services (e.g., IPTp and ITN distribution at ANC)?

Table A-20. Facilitators and barriers to IPTp uptake among pregnant women

Facilitator	Type of Factor	Data Source	Evidence
Relatively high frequency of ANC visits	Social	MIS 2018 at least three	See previous figure showing a stable, relatively high frequency of at least three ANC visits.
Knowledge about malaria prevention services for pregnant women	Internal	SBC Formative Research Report 2019	Ninety-one percent of those surveyed knew pregnant women should seek malaria prevention during regularly scheduled ANC visits.
Barrier	**Type of Factor**	**Data Source**	**Evidence**
Lack of knowledge about IPTp guidelines	Internal	SBC Formative Research Report 2019	Over a third (35%) of the households surveyed were of the view that pregnant women should start IPTp at the beginning of their pregnancy, 24% thought that IPTp should start at the first antenatal care visit, and 21% thought IPTp should begin at the start of the second trimester.

Women attend ANC visits with relatively high frequency and are aware that malaria prevention is a service offered during ANC visits. However, there is a lack of accurate knowledge about IPTp guidelines and at what point during pregnancy women should initiate IPTp treatment. Social behavior change should emphasize dispelling IPTp misconceptions and myths and work to ensure that pregnant women, women of child bearing age, and their families, are aware of IPTp administration guidelines.

Key Question 4

Does the national ANC program or health information system collect data and track the proportion of pregnant women with fever, those tested for malaria, those found to have malaria infection, and those who are treated?

N/A. This statistic is not tracked.

Key Question 5

What is the estimated need for SP during 2021–2023? Are there any anticipated SP gaps? Are there gaps in other IPTp commodities?

The estimated need for SP (treatments) during CY 2021–2023 is 3,970,683, 5,790,033, and 7,609,383, respectively. Based on the known funding commitments from Global Fund and inclusive of the PMI commitments,

there is still an anticipated gap for the 2021–2023 period. PMI/Zambia has prioritized SP procurement with reprogramming to help fill the gap, although there will still be an unmet need.

Table A-21. SP Gap Analysis Table

Calendar Year	2021	2022	2023
Total Country Population	18,400,556	18,926,743	19,456,692
Total Population at Risk for Malaria	18,400,556	18,926,743	19,456,692
PMI Targeted at Risk Population	18,400,556	18,926,743	19,456,692
SP Needs			
Total Number of Pregnant Women	902,216	928,016	954,001
Proportion of women expected to attend ANC1 at 13 weeks or greater	94%	94%	94%
Proportion of women expected to attend ANC2	81%	86%	90%
Proportion of women expected to attend ANC3	67%	70%	75%
Proportion of women expected to attend ANC4	67%	70%	75%
Total SP Needs (treatments)	**3,970,683**	**5,790,033**	**7,609,383**
Needs Estimated based on Consumption Data			
Partner Contributions (treatments)			
SP from Government	0	0	0
SP from Global Fund	6,259,000	0	0
SP from Other Donors	0	0	0
SP planned with PMI funding	1,833,333	0	2,083,333
Total SP Contributions per Calendar Year	**8,092,333**	**0**	**2,083,333**
Stock Balance (treatments)			
Beginning balance	1,125,333	5,246,983	0
- Product Need	3,970,683	5,790,033	7,609,383
+ Total Contributions (Received/expected)	8,092,333	0	2,083,333
Ending Balance	5,246,983	-543,050	-5,526,050
Desired End of Year Stock (months of stock)	6	6	6
Desired End of Year Stock (quantities)	1,985,342	2,895,017	3,804,692
Total Surplus (Gap)	**3,261,642**	**(3,438,067)**	**(9,330,742)**

Supporting Data

Conclusions for MIP Investments

PMI will continue to support IPTp coverage through healthcare worker training, SBC, and the procurement of SP to fill countrywide gaps.

- Given the GRZ budget constraints, PMI will procure over two million treatments, or almost a third of the country's SP needs in FY 2022, complementing GRZ and Global Fund contributions. This is a pragmatic measure to ensure sufficient SP coverage at ANC visits and to maintain high ANC consultation rates.
- PMI will continue to provide TA to increase IPTp coverage in Zambia, focusing on supply chain strengthening; training and supervision of provincial, district, and health facility workers on IPTp implementation guidelines; and quality assurance through incorporation of an MIP module in OTSS.
- Technical assistance and commodities will support routine distribution of ITNs through ANC and EPI clinics, benefiting pregnant women and new mothers.
- To improve demand for prevention and treatment of malaria in pregnancy, PMI will continue to support national and community-level SBC activities.
- PMI is piloting ANC-based malaria surveillance in Chadiza, Eastern Province, with hopes of scaling up in additional provinces. This approach has the potential to provide cost-effective monitoring of intervention access and malaria infection rates among pregnant women.

Please see FY 2022 MOP budget tables for a detailed list of proposed activities with FY 2022 funding.

2.2.2. SEASONAL MALARIA CHEMOPREVENTION (SMC)

SMC is not a recommended intervention for this country.

3. CROSS-CUTTING AND OTHER HEALTH SYSTEMS

3.1. SUPPLY CHAIN

NMEP Objective

The National Malaria Elimination Strategic Plan 2017 to 2020 does not currently explicitly state a supply chain objective. Please see below for the NMEP supply chain approach.

NMEP Approach

The MOH developed Zambia's first Health Sector Supply Chain Strategy (HSSCS) in 2013 and implemented the strategy from 2015 to 2017. In 2018, PMI provided TA to the MOH and stakeholders (such as the Procurement and Supply Management TWG) to develop and finalize a revised Health Sector Supply Chain Strategy (HSSCS) 2019–2021. The goal of the HSSCS is to ensure equitable access to medicines, vaccines, and medical supplies for all Zambian citizens. Paraphrasing from the HSSCS, the strategy aims to achieve this goal by focusing on interventions under four functional groups: *Forecasting, Procurement, and Rational Use; Storage and Distribution; Strategic Data; and Finance and Resources.* There is ongoing discussion in-country to revive the Supply Chain TWG and prioritize updating the HSSCS.

The HSSCS has been adopted by the GRZ and will provide guidance to teams to achieve the following:

- Ensure the availability of quality public health commodities and medical supplies through effective and efficient forecasting, procurement, and rational use.
- Establish sufficient pharma-grade storage facilities and a sustainable and efficient distribution system.

- Aim to have 80 percent of trained personnel using an integrated supply chain management system to enhance data integrity by 2021.
- Improve efficiency, equity, and resource mobilization to ensure financial sustainability in the health sector supply chain.

PMI Objective in Support of NMEP

There are seven high-level focus areas for PMI contributions:

1. Forecasting and supply planning TA to the MOH
2. Logistics management information systems capacity-building
3. Data visibility for assessing and monitoring stock status
4. Medical Stores Limited warehousing and distribution capabilities
5. Malaria pre-elimination activities
6. Procurement, distribution, and monitoring of ITNs
7. Procurement of antimalarials, RDTs, and diagnostic commodities

Overall, these focus areas align at a high level with the national supply chain strategy functional areas of forecasting, procurement, and rational use; storage and distribution; strategic data; and finance and resources. However, one key area of divergence with GRZ in terms of supply chain can be found within the National Malaria Elimination Strategic Plan (NMESP) 2017–2021. Under the NMESP, the National Malaria Elimination Programme (NMEP) proposes the use of Mass Drug Administration (MDA) using DHAPQ (dihydroartemisinin + piperaquine). PMI does not support this initiative and therefore does not procure DHAPQ.

PMI-Supported Recent Progress (past ~12 months)

Forecasting and Supply Planning TA to the MOH
Enhanced core team member capacity to promote ownership and coordination of forecasting, quantification, and procurement planning for malaria commodities (with renewed focus on refining standard operating procedures and enhancing active use of standard operating procedures during quantification events). Promoted ownership of procurement and supply planning to institutionalize the exchange of procurement and shipping information among stakeholders. Provided refresher training to the malaria forecasting and quantification core team in the use of Quantimed and PipeLine and taken through forecasting and quantification processes and methodologies (demographic, service statistics, and logistics methods) to develop their skills to be able to spearhead malaria forecasting and quantification processes and functions. Provided technical support to MOH to conduct a five-day malaria forecasting and quantification meeting to assess the 2021–2023 commodity needs and a one-year supply plan for the year 2021 for antimalarial commodities. Held biweekly stakeholders meeting to discuss stock status of key antimalaria commodities and review supply plans and any funding gaps.

Logistics Management Information Systems Capacity-Building
Built capacity in logistics system strengthening through training and supervision in the Essential Medicine Logistics Information Program. Provided ongoing training and support to MOH staff in the use of electronic logistics management information system (eLMIS) to enhance malaria commodity security. Developed a stock redistribution system, which is a geographic information system-based tool that uses color coding and other visual cues to inform supply chain decision-making. Provided onsite TA at 93 sites, to over 280 district health office

(DHO) level staff to improve the quality monitoring and use of logistics data for supervision just before the onset of COVID-19 and government restrictions.

Data Visibility for Assessing and Monitoring Stock Status

Assessed and monitored stock status for antimalarial drugs and RDTs at the provincial, district, and health center levels by using data analytics tools. Improved availability of data for decision-making through End Use Verification (EUV) surveys; however, due to COVID-19 only one EUV was implemented. Shared data with MOH and Zambia Medicines and Medical Supplies Agency (ZAMMSA) in forums, provincial meetings, and district meetings for use in monitoring and decision-making.

ZAMMSA Warehousing and Distribution Capabilities

Provided TA in inventory management procedures, inventory management policies, product security procedures, warehouse management system use, workplace organization processes, and distribution and fleet management. Provided direct supplemental support to ZAMMSA through PEPFAR, whose funding benefits PMI for distribution, infrastructure improvements, and operational support.

Procurement, Distribution, and Monitoring of ITNs

Procured and distributed 1,756,000 ITNs and 372,000 PBO ITNs for the mass distribution campaign and 437,000 PBO ITNs for routine distribution through ANC/EPI, school-based, and community channels. Given the late start of the campaign and manufacturing delays due to COVID-19, the ITNs were delivered during the rainy season causing significant but not insurmountable logistical challenges.

PMI-Supported Planned Activities (next ~12 months with currently available funds)

In FY 2021, PMI is supporting the following activities in Zambia:

- Strengthening logistics information systems to avail critical data for informed supply chain decision-making; includes monitoring and evaluation to include data visibility and analytics initiatives
- Increasing ownership by GRZ to lead quantification and procurement planning processes
- Providing cost-effective, reliable procurement services to GRZ
- Improving effectiveness and efficiency in warehousing and distribution
    o Transportation and distribution
    o Warehousing and inventory management
    o Governance and financing
    o Direct support to supplement in-country storage and distribution
- Increasing innovation for strategic management and planning for improved commodity security

Key Goal

Ensure continual availability of quality products needed for malaria control and elimination (ACTs, RDTs, SP, Art. Inj., and ITNs) at health facilities and community level.

Key Question 1

Has the central level, (or subcentral level, if appropriate) been stocked according to plan for ACTs, RDTs, SP, and Art. Inj. over the last year (2020)? If not, have they been under, over, or stocked out?

In FY 2020, due to disruptions to the international supply chain caused by the COVID-19 pandemic, as well as insufficient buffer stock in-country, the central level experienced low stock levels of AL 6x1, AL 6x2, and AL 6x4 for a significant portion of the year. Although artesunate injectables started the year above maximum stock levels, quantities quickly fell below minimum stock levels by Q3. RDTs also fell below minimum stock levels in Q3 while additional and late procurements of SP pushed the commodity above maximum stock levels in Q3. PMI has been actively engaging with the NMEP and the Global Fund to strengthen malaria commodity forecasting and quantification while advocating for sufficient investment to mitigate the risk of additional stockouts in the future.

Key Question 2

What are the trends in service delivery point stockout rates for ACTs (including ability to treat), RDTs, Art. Inj., and SP over the last year (if tracked)? Is there a seasonal or geographic difference in stockout rates?

The data shows that the stockout rates for ACTs were highest in Q3 and ranged from a stockout rate of just over 40 percent for AL 6x4 to about 75 percent for AL 6x2. The ability to treat with ACTs ranged from over 95 percent in Q1 to 80 percent in Q3. Given malaria seasonality, stockouts have historically increased during Q3 due to a surge in malaria infections during the rainy season. Stockout rates for SP were high in FY 2021 and stockouts of SP were observed in all quarters due to funding gaps from GRZ. PMI has not traditionally procured SP for Zambia. Please see the MIP section for more information on plans to reduce the gap.

Key Question 3

What is the difference between quantities for ACTs consumed and malaria cases, and RDTs consumed and numbers tested? What is driving any differences seen?

RDTs would generally have higher consumption numbers than ACTs, but for the time frame depicted in the graph (especially the March/April/May data points), ACT consumption was higher. Contributing factors likely included last-mile distribution challenges and low central-level stock challenges for RDTs due to global RDT manufacturing issues as a result of the COVID-19 pandemic, which could have contributed to presumptive treatment. However, the NMEC did suspend RCD in high malaria prevalence zones until the malaria RDT supply normalized. At the same time, the most commonly available pack sizes were AL 6x1 and AL 6x2, which were used to treat malaria in adults, resulting in a higher demand for the two-pack sizes than if the appropriate pack sizes had been used per weight band, which could have also impacted the accuracy of the ACT data.

Comparing LMIS data and HMIS data has not yet happened extensively. There have been discussions to look at cross-referencing data sources to compare with commodity data. This may be helpful to verify but would require some technical input to ensure accuracy of the comparison. PMI has also started looking at consumption data and assessing when it fluctuates beyond a "norm," and this has helped program managers assess patterns that seem abnormal. Changes in consumption could be caused by a planned campaign, data inaccuracies, pack size/incorrect units, or seasonal changes, or there could be an unknown reason that needs further review. Reviewing consumption data, and then also comparing it to HMIS data, can be used to help identify or monitor shifts in consumption patterns. This is an area the team will look to explore further.

Key Question 4

To what extent does a functional LMIS provide visibility into timely and quality logistics data from various levels of the system? To what extent is commodity data visibility dependent on surveys or supervisory data rather than routine data reported by an LMIS?

The current LMIS system (eLMIS) provides logistics data to central, district, and provincial level management to assist in decision-making. eLMIS helps program managers determine which facilities are understocked or overstocked, review trends in consumption on a product-by-product basis, identify facilities with potential inventory management problems, and plan deliveries to facilities. The data is available monthly with the assumption that facilities report regularly and accurately (although timeliness and quality of data are often impacted). It should be noted there is a month lag in data availability, which is inherent in the reporting cycle and limits the "real-time" usage of routine LMIS data. The continued rollout of the facility edition eLMIS will help to create more "real-time" access to facility-level commodity data. Surveys and supervisory commodity data may be used to supplement routine eLMIS data but this data is limited.

There have been discussions to look at cross-referencing data sources (such as HMIS data) to compare with commodity data. This may be helpful to verify but would require some technical input to ensure accuracy of the comparison.

Key Question 5

What are the main supply chain TA functions supported by PMI? Are there additional investments that PMI should make (e.g., increasing visibility of demand at health facilities) to ensure continual availability of quality products needed for malaria control and elimination at health facilities and the community level? In areas performing well, is it dependent on PMI/donor funding (e.g., PMI and Global Fund pay for warehousing and distribution)? Should more be done to foster self-reliance in domestic systems and, if so, what approaches should be considered?

The TA activities supported by PMI are as follows:

- Provide supply chain technical leadership for PMI and NMEP activities supported by USAID through a project directorate focused on commodity security and partner engagement for PMI commodities.
- Report availability of malaria commodities to stakeholders.
- Monitor stock status and consumption trends of malaria commodities, and strengthen ITN data capture at the district and facility levels by working with the eLMIS implementing partners and MOH staff to capture data in the system.
- Support for EUV activities.
- Implement the PMI stockout reduction activity by doing root cause analysis and identification of activities that address the most critical barriers/risks to consistent stock performance and developing a comprehensive two-year supply chain investment plan that will guide future PMI supply chain investments with a goal of ensuring Zambia has a clear long-term plan to reduce stockouts in future years and to maintain reductions over time.

PMI should continue to emphasize strengthening data capture to enhance the CHW logistics systems and ensure more accurate stock status and consumption data is captured at the community level. Currently PMI is supporting facility staff and data CHWs to use mobile phones to submit data to the NMEP's DHIS2 MRR system to ensure the timely flow of data. CHW is tracked separately from facility data.

Commodities procured to meet the national need, such as RDTs and ACTs, are absorbed into the national pool and stored by the government at hubs, hospitals, districts, and health facilities; however, there is some support by both the Global Fund and PMI to transport commodities out to the district and health facility level. Global Fund is also providing direct support for construction as well as some operational cost for select hubs. Donor support of commodity distribution should be reserved for emergency situations, but this seems to have shifted given current GRZ funding constraints and the need to ensure commodities move quickly. Continued focus should remain on the importance of GRZ support for commodity distribution.

There have been increased efforts by PMI to strengthen commodity security, which includes working to detect possible theft, diversion, or mismanagement of products within the Zambian public health supply chain and to build host government capacity to detect such issues. Mitigating the risk of PMI commodity loss will remain a top priority in MOP FY 2021 as well as MOP FY 2022.

The FY 2021 stockout reduction strategy has outlined a few priority areas that will require attention to successfully reduce stockouts in Zambia.

1. Facilitate the rollout of eLMIS to additional service delivery points.

    Currently in Zambia, eLMIS is not extended to all service delivery points, making it difficult to ensure the availability and accuracy of data. A U.S. Government project in-country is rolling out eLMIS to additional sites in Zambia, which will include some PMI sites. To ensure successful rollout district staff will be asked to check data accuracy and enter LMIS hard copies into eLMIS-Central Edition. These actions will increase data visibility and accuracy and ultimately support stronger forecasting and supply planning.

2. Support the integration of data management systems into a single platform.

    There are various donors and partners dedicated to malaria control and elimination in Zambia, and in some cases, with their own data management system. PMI supports the need to integrate these systems into one platform accessible by donors and partners alike, which will in turn ensure improved data quality and data for decision-making.

3. Improve last mile distribution of malaria commodities.

    PMI recognizes there are opportunities for improvement when it comes to last mile distribution in Zambia including increased investment from the host country government and donors to support last mile operations. PMI has started supporting some commodity distribution in Zambia, which will help facilitate urgent movement of stocks from the central warehouse to the health facility level.

Are there any other considerations that impact funding allocation in this category? If there is a specific budget line item in Table 2 that is not covered by the above questions, address here.

Conclusions for Supply Chain Investments

With FY 2022 funding, PMI will continue to provide supply chain TA focused on commodity security and partner engagement to the MOH, monitor stock status and consumption trends and report availability of malaria commodities to stakeholders, support EUV activities as feasible, and will continue to implement the PMI stockout reduction activity.

Given competing priorities and a historical pipeline, funding for supply chain activities was slightly reduced from FY 2021. However, all activities typically supported by our supply chain strengthening are expected to continue on track. Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.

3.2. SURVEILLANCE, MONITORING, AND EVALUATION (SM&E)

NMEP Objective

According to the National SM&E Plan for malaria, which was developed to complement the NMESP 2017–2021, SM&E objectives are as follows:

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

It is anticipated that, when the NMESP is revised for the period 2022–2026, the national SM&E plan will also be updated.

NMEP Approach

The 2017–2021 NMESP 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 because it enables the MOH/NMEP and partners to process, present, interpret, and disseminate malaria data from service delivery points to use for 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.

The key strategies from the National Malaria SM&E Plan are as follows:

- Strengthen capacities at 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 to improve malaria program planning, management, and accountability.

- Strengthen and enhance malaria data management systems at community, facility, district, provincial, and national levels and their ability to collect, process, analyze, manage, and use quality malaria-related and key indicator data for programming.
- Strengthen coordination in SME across the NMEP by working with each program area to enhance their capacity to manage and use data for programming.

<u>Routine Health Information Systems</u>

- In Zambia, HMIS and Integrated Disease Surveillance and Response are used by the MOH to report on diseases. In 2014, the HMIS was upgraded to the DHIS2 platform nationwide. All public and mission health facilities (representing 87 percent of all facilities), and some private facilities, report malaria data monthly to the HMIS group within the MOH M&E Unit. The reporting forms for HMIS do not capture community case management data.
- In a subset of HFCAs which have received support from partners such as Gates/MACEPA and PMI, weekly or monthly CHW and HF data are reported by HFs in a parallel malaria surveillance system called Malaria Rapid Reporting (MRR). Facility staff and CHWs use mobile phones to submit data, with the so-called Data CHWs collating data from other CHWs they report for. Scale-up of MRR is linked closely with scale-up of community case management, and thus is best established in Southern, Eastern, and Western provinces.
- Because HMIS reports are time-lagged and do not capture CHW data, the MRR is valued by the NMEC. The MRR is particularly valuable in low-burden areas (Levels 1 and 2) where it allows for an "active response," during which CHWs go out to households of index cases to test and treat household members (reactive case detection).
- The NMEC has developed an "NMEC instance of DHIS2" that allows for combined capture and analysis of the HMIS and MRR data, allowing for a more complete analysis of malaria case incidence by HFCA.
- NMEP supports a range of data improvement activities, including:
  - Monthly district malaria data review meetings and quarterly malaria supervisory visits to districts.
  - Provinces and their respective districts conducting routine data quality audits on a quarterly basis.
  - Monitoring and mentoring visits.
  - Improvements to community-level collection and reporting of routine malaria indicators. Depending on availability of partner resources to support CHW deployment beyond the initial training, CHWs in some districts have received periodic technical supportive supervision including data quality monitoring. From 2021, the NMEP is increasingly prioritizing CHW supervision and support.
  - Strengthening malaria data analysis and use for planning and decision-making.
  Since 2017, central-level NMEC personnel conducted and followed up on data quality audits (DQAs) in all districts and provincial offices, generally on an annual basis.

- HMIS and other surveillance data is reviewed at monthly review meetings at national and provincial level, using a work planning tool and dashboard. Since 2017, monthly dashboards (from Tableau) are sent to stakeholders capturing community surveillance data. There is no current monthly malaria bulletin or newsletter as of 2011.

<u>Evaluation</u>

- The major tools for evaluating outcomes and impact of malaria prevention and control activities in Zambia are the periodic nationally representative surveys, namely the MIS and the DHS. Nationwide MISs were carried out at the end of the rainy seasons in 2006, 2008, 2010, 2012, 2015, and 2018 to provide information on the coverage of the four major malaria interventions, malaria parasite prevalence, and the prevalence of severe anemia. Data collection for the 2021 MIS occurred in April–May 2021, with preliminary results expected in August 2021. The next MIS is planned for 2024.
- The most recent Zambia DHSs were conducted in 2007, 2014, and 2018. Although the DHS does not include malaria biomarkers and in Zambia has not been timed for malaria peak season (unlike MIS), its crucial contribution is determination of all-cause mortality in children under five years of age.
- ANC-based surveillance has been piloted with PMI support in Chadiza District since early 2020. The system captures coverage of control interventions as well as RDT positivity rates, on a monthly basis, in the sentinel population of first-time ANC attendees. If scaled up to additional districts as planned, this approach would provide complementary data for program evaluation in covered geographies.

PMI Objective in Support of NMEP

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, WHO, and the USAID maternal child health and PEPFAR programs, in providing TA and resources for SM&E activities. Zambia exhibits a stronger culture of data tracking and disease mapping at all levels than many comparable, high-burden malaria countries, and PMI aims to further that tendency.

- PMI provides logistical and TA to the SMEO (SM&E and Operations Research) TWG, which meets quarterly to provide national-level coordination and leadership in this area.
- PMI provides support to strengthen routine malaria data collection at the community, health facility, district, provincial, and national levels through the HMIS and MRR, as well as eLMIS. At the national level, TA is provided to the MOH M&E Unit (which runs HMIS and DHIS2) as well as the NMEC SMEO unit.
- PMI will continue to support DQAs as a proven tool for improving system performance.
- In pre-elimination areas, build capacity to confirm every suspected case through timely acquisition of data, efficient logistics management information system and improved staff skills in managing data. As malaria cases decline, data quality becomes increasingly important for making the right decisions that help accelerate the reduction of malaria cases.

PMI-Supported Recent Progress (past ~12–18 months)

<u>Strengthening of Routine Systems</u>

- In the four PMI-focus provinces, PMI has trained 961 (578 male and 383 female) MOH staff to use DHIS2 and HMIS, and has supported DQAs twice per year.
- Surveillance challenges in 2020 stemming from the COVID-19 pandemic included stockout of RDTs, which reduced confirmation rates for malaria case reporting, and increased workloads and travel restrictions, which reduced the availability of healthcare workers to participate in certain trainings, DQAs, and data reviews.

- PMI promoted use of the African Leaders Malaria Alliance/NMEC malaria scorecard and the national Tableau dashboard for data visualization.
- To improve capacity in malaria elimination, PMI provided technical support for establishing a server for malaria case based surveillance. This was piloted in Southern Province, for later adaptation to the pre-elimination program in Eastern Province.
- PMI worked with MOH M&E Unit and the NMEC to improve the interoperability of the HMIS, MRR, and eLMIS systems, including the completeness and consistency of data capture and reporting at both health facility and community levels.
  - Conducted a 2020 rapid assessment at all administrative levels, which was followed by a comparative systems analysis that identified inconsistencies in systems data elements and provided recommendations for harmonizing malaria data reporting.
  - Supported the formation of a malaria data analysis task team to conduct a "deep dive" into the national data analysis and needs of the NMEP. This is planned to feed into the national MPR in 2021.
- In the pre-elimination districts in Eastern Province, PMI continued to support intensified activities focused on data quality improvement. This has included capacity-building through trainings in surveillance and DHIS2 reporting for HF staff and CHWs and the provision of tools for data capturing, analysis, reporting, and utilization for decision-making. It has focused on capacity-building in HMIS/DHIS2-related issues including MRR and RCD reporting.
- In Lusaka District, PMI continued a two-year program to support revival of community surveillance to better characterize the extent of local transmission. Supported activities in 2019–2020 included six rounds of monthly malaria data review meetings with 32 HFs (out of 66 total HFs); six rounds of supportive supervision to 54 HFs; and training data clerks, environmental health technicians, and facility in-charges engaged through data review and supportive supervision activities. Thirty-two health facilities have resumed reporting to the MRR system, 10 of which have revived reactive case detection (RCD). The district was supported to resolve acute RDT shortages that were undermining RCD activities. Base maps for 10 facility catchments were developed and distributed, which supported the Lusaka DHO to implement a "low-tech" approach for mapping locally acquired malaria cases in urban areas through tally sheets on the wall maps.

ANC-based Surveillance

In Q1 of CY 2020, PMI supported the MOH to initiate ANC-based malaria surveillance in Zambia, recognizing its potential value as a cost-effective platform for tracking local trends in prevalence and intervention coverage, especially in moderate and high-burden settings with pronounced seasonality. Chadiza District was selected as the study site due to strong PMI programming presence. (Although Chadiza is one of the pre-elimination districts in Eastern Province, it still has moderate burden, e.g., case incidence >200/1,000/year and peak prevalence >20 percent). In this ongoing pilot activity, all 22 health facilities in the district have been collecting monthly data on malaria prevalence and coverage of malaria control interventions, such as access to LLINs and IRS from women attending their first ANC visit, averaging approximately 300 per month. Health facility staff are aided by specially trained community-based volunteers. Preliminary findings for RDT positivity ratios have tracked appropriately with other surveillance data in the district (Figure A-28) and have exhibited the expected seasonality. Measures of feasibility and acceptability have been favorable to date, with excellent buy-in from NMEC, District Health Office, and health facilities as one component of a package of PMI-supported malaria control activities. There has been

high retention and motivation of community-based volunteers (just 2.4 percent attrition in six months), and refusal by the ANC attendees has been rare (<0.1 percent). In April and May 2021, a cross-section household survey (modified MIS) in Chadiza will serve to validate the use of these data as a means to measure community level prevalence and coverage.

Figure A-28. Comparison of RDT positivity ratios from ANC surveillance (orange line) to community-based passive detection, community-based active detection, and health facility-based passive detection, Chadiza District, Zambia, March 2020–February 2021
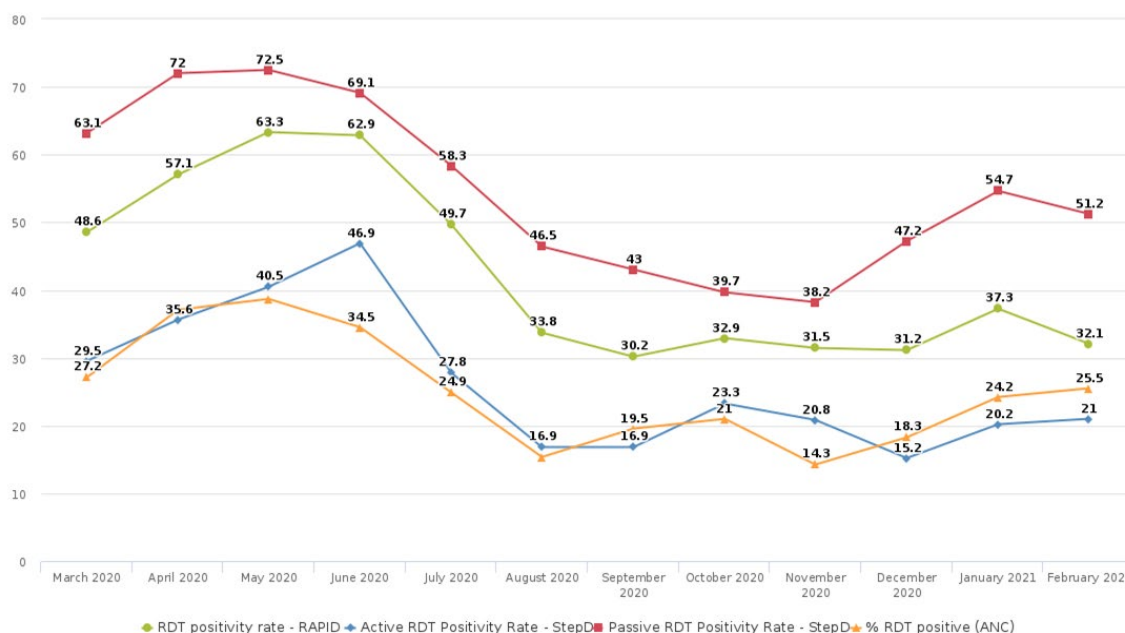
Source: PATH.

Strengthening Routine Systems

- PMI will continue to support the above-mentioned activities to strengthen malaria surveillance through HMIS and MRR. An expected upcoming milestone will be the development and implementation of an agreement between the MOH M&E and malaria directorates on the alignment of malaria data flow.

- PMI will engage the NMEP through the SMEO TWGs to consider linking the implementation of weekly reporting through MRR with RCD. Experience in scaling up MRR from the low-burden areas where it was developed to high-burden areas has encountered resistance from HF staff, who find the weekly reporting requirement burdensome, resulting in reduced timeliness and completeness. In areas most suitable for MRR, PMI will provide android mobile phones and airtime to facility staff, CHWs, and Data CHWs to ensure the timely flow of data.

ANC-based Surveillance

- Formal validation of the pilot in Chadiza District is pending the implementation of a household survey in May–June 2021, which was delayed due to the COVID-19 emergency. Findings and lessons learned from the pilot will be shared at national and international fora.

2021 Malaria Indicator Survey

- PMI, together with the Global Fund and BMGF/MACEPA, is a major partner in the 2021 Malaria Indicator Survey. Data collection is ongoing in May and April, with preliminary results expected by August 2021 and a full report by the end of the year. The MIS findings are expected to provide essential data to inform the Malaria Program Review, which in turn will inform the development of the next five-year National Malaria Elimination Strategic Plan (2022–2026).

Key Goal

To support the NMEP to build their capacity to conduct surveillance as a core malaria intervention using high-quality data from both surveys and routine health information systems.

Key Question 1

Which data sources are available to inform estimates of intervention coverage, service availability and readiness, and morbidity and mortality?

Supporting Data

Table A-22. Available malaria surveillance sources

Source	Data Collection Activity	2019	2020	2021	2022	2023	2024
Household Surveys	Demographic Health Survey (DHS)				P		
Household Surveys	Malaria Indicator Survey (MIS)			X			P
Household Surveys	Multiple Indicator Cluster Survey (MICS)						
Household Surveys	EPI survey			X (Chadiza)		P (Chadiza)	
Health Facility Surveys	Service Provision Assessment (SPA)						
Health Facility Surveys	Service Availability Readiness Assessment (SARA) survey						
Health Facility Surveys	Other Health Facility Survey						
Malaria Surveillance and Routine System Support	Therapeutic Efficacy Studies (TES)	*		*		P	
Malaria Surveillance and Routine System Support	Support to Parallel Malaria Surveillance System						

Source	Data Collection Activity	2019	2020	2021	2022	2023	2024
Malaria Surveillance and Routine System Support	Support to HMIS	X	X	X	P	P	P
Malaria Surveillance and Routine System Support	Support to Integrated Disease Surveillance and Response (IDSR)						
Malaria Surveillance and Routine System Support	Electronic Logistics Management Information System (eLMIS)	X	X	X	P	P	P
Malaria Surveillance and Routine System Support	Malaria Rapid Reporting System						
Other	EUV	X	X	X	P	P	P
Other	School-based Malaria Survey						
Other	Knowledge, Attitudes and Practices Survey, Malaria Behavior Survey			P			
Other	Entomologic Monitoring Surveys						

*Asterisk denotes non-PMI funded activities, X denotes completed activities, and P denotes planned activities.

Zambia has been relatively well endowed in terms of data sources for malaria surveillance. For example, Zambia remains committed to continue conducting an MIS at least every three years, as has been done since 2006. Malaria partners including PMI have provided consistent support to improve HMIS and eLMIS quality measures, including completeness, timelines, and accuracy, while at the same time supporting the MRR system, which improves upon the HMIS in terms of timeliness and consistency of inclusion of CHW data. PMI is supporting interoperability and integration between HMIS and MRR.

Key Question 2

What HMIS activities have been supported? What current priorities will be supported with FY 2022 MOP funding?

Supporting Data

As shown in the table below, Zambia receives support from PMI, the Global Fund, and MACEPA for HMIS system strengthening at all levels. Duplication of support is minimized at the national level through close coordination among partners, and at the provincial and lower levels through coordinated work planning and especially through a geographic partitioning of the country, whereby MACEPA focuses its support on Southern Province; PMI focuses on Luapula, Northern, Muchinga, and Eastern, with enhanced data quality support in the pre-elimination districts in Eastern; and Global Fund through the MOH and CHAZ caters to needs in the other provinces. There is in addition some overlap of malaria SME with USAID-supported SME strengthening for health programming in Copperbelt and Central provinces.

Additional information on PMI-support activities in HMIS system strengthening is provided under the "Recent Progress" section, above. Information on future plans for HMIS support is provided under the "Conclusions" section below.

Table A-23. Sources of support at central, province, district, facility, and community levels

Intervention	PMI-Funded?			Does Global Fund plan to fund this?	Does another donor plan to fund this (MACEPA)?
	FY 19	FY 20	FY 21		
Central Level					
Register, tools (e.g., checklists, indicator glossary), job aids (design, indicators, definition of data elements, data dictionary, system support)	X	X	X		X
Data quality assessments (separate from supervision – funding for travel to lower levels)	X	X	X	X	X
Program monitoring and TA (funding for travel to lower levels)	X	X	X	X	X
Training (funding for central level to conduct training at lower levels, capacity-building, e.g., on-the-job training for central-level staff)	X	X	X	X	X
Human Resources (secondment of person in NMEP for SM&E, office/team for SM&E)	X	X	X		X
Data use (analysis, interpretation, visualization [dashboards, bulletins], dissemination/feedback to lower levels, decision-making)	X	X	X		X
Policy guidelines and coordination (updating policies, guidelines, supporting subcommittee meetings, supporting participation in subcommittee meetings)	X	X	X	X	X
External relations/communications/outreach (support travel to international meetings and publications)	X	X	X		X
Support to annual operational plans for national malaria program	X	X	X	X	
Desk review to catch "logic errors system" (provide TA to catch logic errors)			X		
Admin 1 Level (Province). **PMI supports activities in four provinces while Global Fund supports activities in all provinces.**					
Registers (warehousing, printing, distribution)	X	X	X	X	X
Data quality assessments (separate from supervision – funding for travel to lower levels)	X	X	X	X	X
Program monitoring and TA (funding for travel to lower levels)	X	X	X	X	X

Intervention	PMI-Funded?			Does Global Fund plan to fund this?	Does another donor plan to fund this (MACEPA)?
	FY 19	FY 20	FY 21		
Training (funding for district staff to conduct training at lower levels, capacity-building (e.g., on-the-job training for district- level staff)	X	X	X	X	X
Human resources (secondment of person for malaria SM&E, office/team for SM&E)					
Data use (analysis, interpretation, visualization [dashboards, bulletins], dissemination/feedback to lower levels, decision-making)	X	X	X		X
Adaptation of national policy guidelines and coordination (adapting policies, guidelines, supporting subcommittee meetings, supporting participation in subcommittee meetings)					
Adaptation of checklists and job aids					
Participation in national meetings (support for travel costs)	X	X	X	X	X
Support to Annual Operational Plans for provinces	X	X	X	X	X
Admin 2 Level (District)					
Data entry, summary, and transmission (training, retraining, computers, internet, tools)	X	X	X	X	X
Supervision (training, traveling, supervision tools/checklists, create/design system for organized/methodical supervision)	X	X	X	X	X
Data validation (data validation activities before monthly data submission, organize health facilities)					
Monthly/quarterly data quality review meetings (venue, meeting support)	X	X	X	X	X
Data use (analysis, interpretation, visualization (i.e. dashboards), dissemination/feedback to facilities, decision-making)	X	X	X		X
Human resources (secondment of person for malaria SM&E, office/team for SM&E)					
Annual planning with provinces (support travel)	X	X	X	X	X

Intervention	PMI-Funded?			Does Global Fund plan to fund this?	Does another donor plan to fund this (MACEPA)?
	FY 19	FY 20	FY 21		
Facility Level					
Data collection/entry, summary, and transmission (training, retraining, computers, internet, tools)	X	X	X	X	X
Supervision of CHWs (training, traveling, administering supervision tools/checklists of CHWs)	X	X	X	X	X
Data use (analysis, interpretation, visualization [dashboards], dissemination/feedback to CHWs, decision-making)	X	X	X		X
Monthly/quarterly data quality review meetings(support for travel)	X	X	X	X	X
Community Level					
Data collection/entry and transmission (training, retraining, tools)	X	X	X	X	X
Data use (analysis, interpretation, decision-making)	X	X	X		X
Monthly/quarterly data quality review meetings (support for travel)	X	X	X	X	X

x denotes completed activities, and (x) denotes planned activities.

Key Question 3

Are there specific outcomes of past/current HMIS strengthening efforts that can be identified?

Supporting Data

The data quality audit (DQA) tool promoted by PMI has been used extensively by the NMEC, beginning in Southern Province, and has proved to be effective in supporting malaria data quality improvement. It focuses on eight data elements: (1) total OPD attendance, (2) total clinical malaria cases, (3) total clinical malaria cases in pregnancy, (4) total confirmed malaria cases, (5) total confirmed malaria cases in pregnancy, (6) total malaria cases provided with an antimalarial, (7) total tested cases (RDT), and (8) total tested cases (microscopy).

Figure A-29 summarizes findings from DQAs for the four PMI-focus provinces from 2017 to 2019. During these years, with technical and logistical support from PMI, each province conducted DQAs covering over 220 randomly selected health facilities and representing all districts. The audits were coordinated by the Public Health Offices through their respective Senior Health Information Officers. PMI 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-up on findings and action plans decided.

Reporting rates, completeness, and timeliness were generally high across the three years. However, accuracy remains stubbornly subpar, with HMIS data infrequently matching tallies from the original source records. DQA findings suggested transient improvement in 2018 and 2019, with later reversion in 2020 to the <50 percent accuracy at baseline. Feedback during data review meetings has pointed to several underlying causes, including poor staff familiarity with the interface between the Health Information Aggregation Form 1 (HIA1) and the service delivery registers; new staff in particular often make mistakes when aggregating data from registers to the HIA1. Errors also occur when the District Health Information Officer inputs data from the HIA1 forms into the system. The problems are compounded by inadequate verification and supervision by Health Facility Managers and District Health Officers. COVID-related disruptions to supervisory routines may have contributed to the worsening in 2020. With heightened focus on the accuracy issues, from 2020, PMI in focus provinces is supporting the NMEP and DHO teams to provide increased frequency of data verification, data reviews, and mentorship to health facilities on data management and use.

Figure A-29. Summary of DQA results, 2017–2020, in PMI-focus provinces
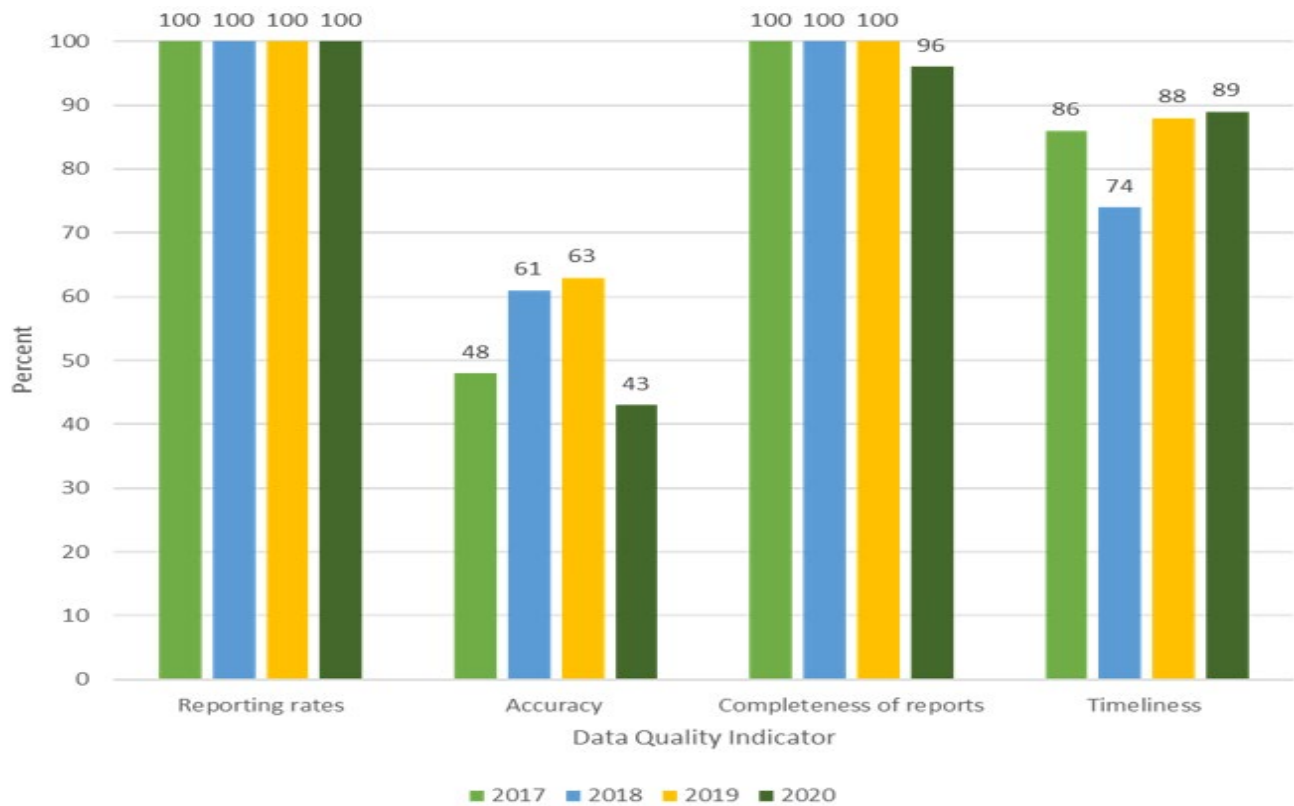
Table A-24. Outcomes of HMIS strengthening efforts

	Indicator	2019	2020
Timeliness	% of reports received on time	100	100
Completeness	"Confirmed malaria cases for children under five years of age" was reported in X [number or percent] of facility-months	100	96
Accuracy	Accuracy of data compared to original source records	63	43

Key Question 4

Are there any other considerations that impact your funding allocation in this category (e.g., strategic information or capacity-building in-country)?
N/A

Supporting Data

N/A

Conclusions for Surveillance, Monitoring, and Evaluation Investments

The monitoring and evaluation of malaria prevention and control activities will rely largely on a combination of routine malaria data through the HMIS and surveys. Funding allocations for SM&E activities in FY 2020 will remain comparable to previous years. PMI will ensure the SM&E activities at the national level and in the four PMI-supported provinces are complementary.

National-level Capacity-building: PMI support at the national level will continue. The SME TWG meets quarterly. Through this TWG and its recently formed Malaria Data Analysis Task Team, PMI will support the NMEP and its partners in ensuring that existing policies and guidelines are in line with current technical standards, collecting and reviewing evidence to inform program implementation, and ensuring that program activities are well-coordinated and implemented. PMI will continue the recently established approach of building capacity at the MOH M&E Unit, in addition to providing ongoing support to the NMEC M&E Unit.

Routine Systems: PMI will continue to support strengthening of Zambia's routine systems for malaria data capture and reporting, including the HMIS, MRR, and (if established) the long-planned Community HMIS, each of which operates on the DHIS2 platform. The focus going forward will be on improving system interoperability and integrity at the national level; on improving quality of data capture and reporting at the community, facility, and district levels, in particular in the area of data accuracy; and on consistent data review and use for decision-making at district and provincial levels. Ideally, CHW data, commodity data, and HMIS data from facilities will be integrated on one platform.

ANC-based Surveillance: Tracking parasitemia and intervention access in a sentinel population of largely asymptomatic ANC attendees has several well-recognized strengths, including its representativeness of the wider local population, its ongoing monthly readouts, and (notionally) its low cost. Following data validation and review of pilot experience, and depending on the conclusions reached in consultation with the NMEC and stakeholders, the prospects may be favorable for scaling up ANC-based surveillance in Zambia. This might begin at a set of sentinel sites in PMI-focus province initially, beginning as early as the second half of CY 2021.

Lusaka Surveillance: PMI support for enhanced community-based Lusaka district surveillance will end in 2021 because this was conceived as a time-limited, two-year effort, and PMI prioritizes high-burden areas overall. PMI has engaged the Lusaka DHO to develop a transition plan for the activities.

2024 MIS: PMI proposes to provide TA and partial financial support for the 2024 MIS. Given the potential reduction in funding from traditional MIS partners, the financial allocation is increased compared with the PMI contributions to the 2018 and 2021 MISs.

Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.

3.3. OPERATIONAL RESEARCH and PROGRAM EVALUATION

NMEP Objective

The NMESP highlights "harnessing innovation through focused research" as a key aspect of health system strengthening. It states that ongoing research on the following topics is needed to ensure that existing tools and approaches are implemented efficiently:

- Therapeutic efficacy of antimalarial treatments
- Insecticide resistance in vector populations
- Uptake of malaria interventions

An objective is to add to the base set of malaria control interventions and novel interventions, in addition to existing tools used in novel ways, to facilitate the process of reaching the elimination goals. The NMESP calls for research in the following areas:

- Information systems
- Drugs and strategies for drug use
- Vector control
- Other interventions, such as vaccines that interrupt malaria transmission

NMEP Approach

The NMEP conducts an annual consultative exercise, supported by the Global Fund and with PMI participation, at which research priorities are updated. The list of priorities generated is extensive. The NMEP SMEO unit and the SMEO TWG vets research proposals, guides research implementation, and provides fora for dissemination of findings. Thematic areas include vector control, case management, malaria in pregnancy, health systems/program management, social and behavior change communication, monitoring and evaluation, elimination, and epidemic response.

PMI Objective in Support of NMEP

In 2017, PMI supported the NMEP to develop a list of priority malaria research topics by thematic area for the 2017–2021 time frame. Each year, PMI supports the review and updating of the research agenda. PMI coordinates with other major sponsors of malaria research, including BMGF/MACEPA and the NIH, to identify areas that would benefit from PMI support. Examples are covered in the following sections.

PMI-Supported Recent Progress (past ~12 months)

1. **The ProACT Study in Chadiza District, Eastern Province**

Overview of the ProACT Study Rationale and Methods

Improving access to and use of health services for prompt and effective case management of malaria has been a persistent challenge. Only about half of febrile children under five years of age are taken to a trained medical provider. As a result, many cases of malaria are undiagnosed and untreated, contributing to ongoing transmission and increased morbidity. iCCM, in which CHWs are trained to offer a menu of basic services focused on maternal and child health, has been introduced in some countries, but is often poorly resourced and underutilized. To improve access to and use of case management services, and to realize the theoretical benefit in terms of transmission reduction that prompt and effective case management offers, a more proactive approach is needed.

The hypothesis is that proactive case detection and treatment by CHWs will lead to a greater reduction in parasite prevalence and case incidence than passive community case management delivered by CHWs.

The study has two primary objectives:

1. Assess whether weekly proactive year-round iCCM with malaria case management for all ages reduces the prevalence of patent (by RDT) and sub-patent (by PCR) parasitemia detected at household level in cross-sectional household surveys more than passive iCCM.
2. Determine whether the confirmed malaria case incidence (detected by CHWs either proactively or passively and at health facilities) decreases more over time in communities with weekly proactive iCCM than routine iCCM by comparing the difference in slope of confirmed malaria incidence in proactive versus routine arms using an interrupted time series analysis.

This study will be a two-arm, cluster-randomized controlled trial to determine whether year-round weekly household visits by CHWs to detect and test people of all ages with fever or history of fever with RDTs (and offer treatment of diarrhea and pneumonia for children under five years of age) and offer treatment with an ACT for those who test positive is associated with a greater reduction in confirmed malaria cases and parasite prevalence over a two-year follow-up period than standard iCCM by CHWs (which includes malaria case management for all ages in Zambia). Randomization will occur at the level of the CHW catchment areas.

Status Update

The ProACT study protocol was finalized and approved in 2019. Initiation was delayed by one year due to the COVID-19 pandemic. The baseline survey data is being collected in April and May 2021, with intent to begin the intervention in June 2021. This household survey in Chadiza District is a modified MIS and has the complementary, cost-saving objectives of serving as a baseline for the ProACT study, validating the ANC

surveillance pilot in Chadiza (described under SM&E, above), and enriching the mapping and modeling activities for the pre-elimination program to better characterize the current and potential future malaria situation.

2. Ongoing Program Evaluation in Nchelenge District

Since 2018, an informal collaboration with the NIH-funded International Center of Excellence in Malaria Research (ICEMR) station in Nchelenge, Luapula Province, has created ongoing opportunities for program evaluation of a package of malaria interventions in that high-burden setting. The ICEMR is led by Johns Hopkins University, and the main local collaborator is the Tropical Disease Research Center based in Ndola. Since 2010, the ICEMR has been awarded two, seven-year NIH grants. The ICEMR collects monthly entomologic and epidemiologic data from a randomized selection of 25 households each month, tracks RDT positivity rates at 11 local health facilities, and conducts special studies on drivers of persistent high transmission, such as mobile populations and unusually challenging local vector dynamics.

The role of the MOH and PMI is to implement, as feasible within available resources, the full standard malaria control package, and to share documentation of what has been implemented, where, and when. To date this has included routine ITN distributions through ANC, EPI, and school channels, and mass campaigns in 2017 and 2020–2021; IRS with increasing population coverage since 2014, maximized in 2020, and supported by Reveal system; scale-up of iCCM, with deployment of CHWs at saturation levels; strengthening of case management and MIP; and strengthening of cross-cutting interventions, including community- and facility-based surveillance, SBC, and supply chain strengthening to minimize stockouts.

A recent workshop confirmed the mutual interest to PMI, the MOH, and the ICEMR of a driving question: "Malaria has been historically uncontrolled in Nchelenge, as documented by the ICEMR since 2014. Given the increasing support for malaria control in recent years, can the MOH and partners demonstrate impact? Is the current standard intervention adequate in this high burden area?"

The mutual goal is to document and analyze changes in coverage of the standard interventions in time and space (IRS, ITNs, case management, iCCM, and SBC) and their association with changes in epidemiologic and entomologic measures of malaria burden. To foster the collaboration in program evaluation, PMI has facilitated data sharing, periodic workshops, joint site visits, and periodic mutual updates, in the spirit of a "learning lab."

To date, the collaboration has already led to course corrections in implementation, especially in IRS. This has included changing from a shorter (pirimiphos-methyl CS) to longer-lasting clothianidin and clothianidin + deltamethrin insecticides (in 2018), and extending IRS coverage to settlements in the swampy interior of the district and to islands (in 2019 and 2020). Recent ICEMR findings suggesting lack of local impact of IRS is summarized in Figure A-30. The ICEMR has documented the population mobility, unimproved housing, dry season surge of *An. funestus* s.l., and other factors that make the malaria ecology of Nchelenge particularly challenging. Their findings have mostly recently prompted consideration of an early transition from IRS to PBO ITNs, as mentioned in the Vector Control section. In case management, ICEMR studies have helped highlight to the MOH and PMI the association of unreliable blood supply with worsened case fatality rate among hospitalized children, and give extra impetus to restoration of iCCM activity following the drop-offs experienced in 2020.

Greater formalization of the collaboration, including joint reports and publications, is envisioned over time.

Figure A-30. Association of IRS implementation with household parasitemia rates, Nchelenge District, Zambia, 2014–2020
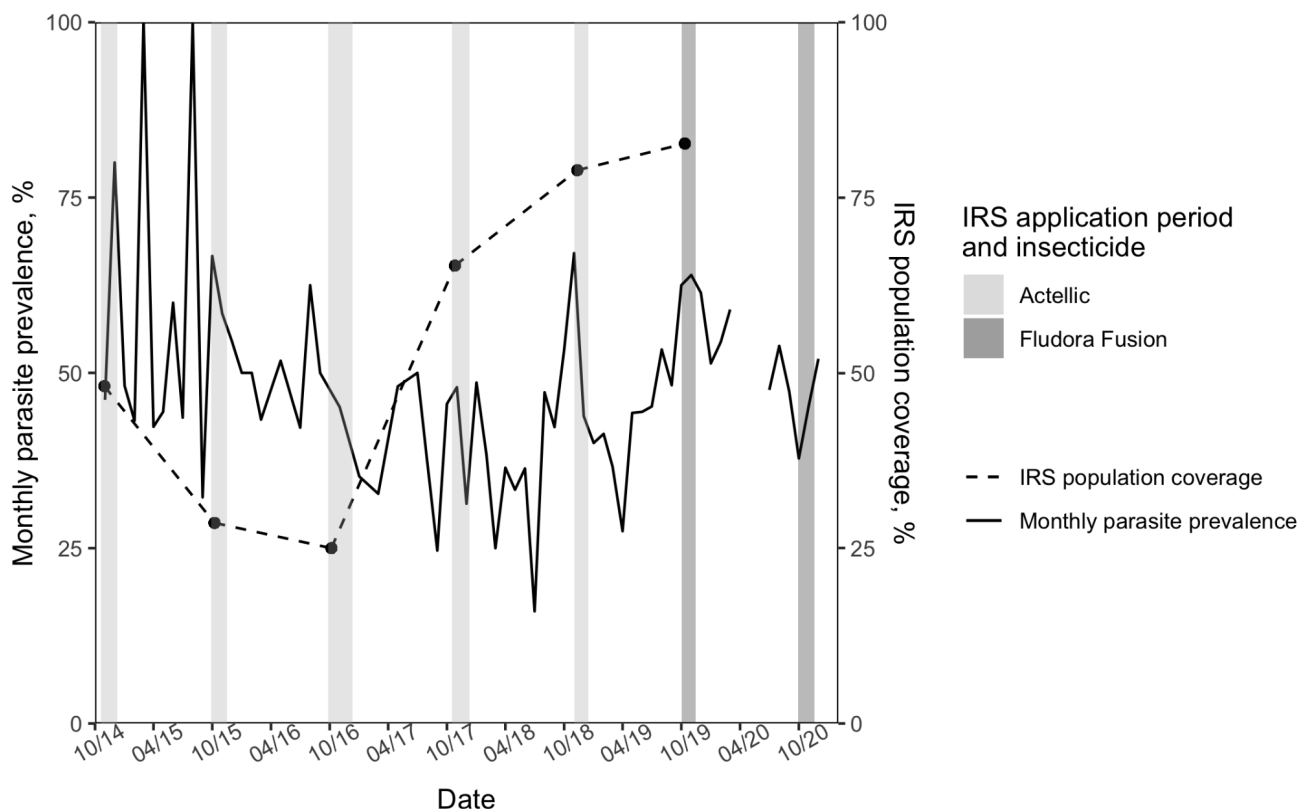
Source: Ellen Ferris, J. Hopkins Univ., unpublished data, ICEMR.

3. Use of Modeling to Inform Pre-Elimination Programming in Eastern Province

The PMI-supported pre-elimination program in Eastern Province will soon complete its first phase, during which investment focused on scale-up and optimization of the standard package of interventions (IRS, ITNs, case management including iCCM, and SBC). During the planned second phase of the program, it is expected that innovation will be needed to further accelerate toward elimination. PMI is engaging with malaria transmission modelers to help inform this process. This builds on the positive experience in Southern Province, where modeling facilitated by BMFG/MACEPA helped to guide program decision-making on a path to pre-elimination status over the course of a decade.

As reported in the FY 2020 MOP, modeling at baseline in 2018 suggested that some areas within the supported area may not reach pre-elimination status within the hoped-for time frame of two to three years. In 2020–2021, the models are being updated.

Modeling is expected to reduce expensive trial-and-error in the evolution of the pre-elimination program, but offering it means to estimate the potential impact of proposed course corrections or innovations. Intervention areas that seem most promising for further exploration may include the following:

1. Replacing IRS with scale-up of PBO or dual active ingredient ITNs in selected geographies

2. Trial of alternative vector control approaches, such as incorporation of attractive targeted sugar baits or improved housing
3. Enhanced roles for community-based management and surveillance, such as deploying CHWs on a proactive basis (as in the ProACT study); and scaling up case-based surveillance in the lowest epidemiologic strata
4. Cross-border measures to reduce reintroduction of malaria
5. Possible addition of mass drug administration through operations research (potentially to be funded by other donors)
6. Others, TBD

In late 2020, PATH created a mathematical model of malaria transmission and intervention scale-up at the district-level in Eastern Province. The model was fitted to 2016–2019 district-level incidence data from HMIS (Figure A-31). Modelers made the following assumptions about intervention scale-up: 75 percent of individuals sleep under LLINs in all districts, IRS coverage has increased since 2018 (using IRS program reports), and access to treatment has increased due to the scale-up of community case management since 2019. The model overall accurately captured the observed reductions in malaria incidence from 2019 to 2020. The model will be interrogated to consider the impact of additional or modified interventions in the region.

Figure A-31. Model of reductions in transmission in three pre-elimination districts in Eastern Province since 2018*
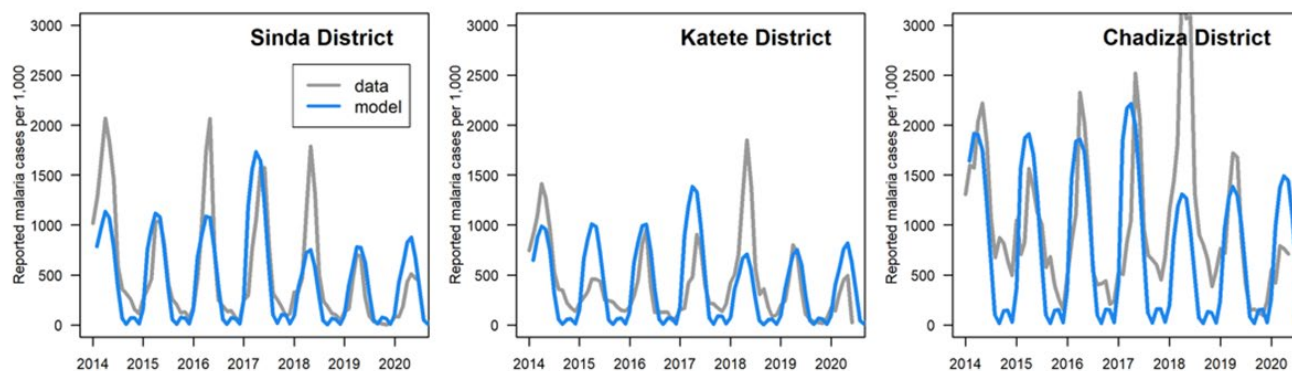
Source: PATH.
* Note: Environmental and other conditions in 2018 were particularly conducive for malaria transmission (as across Zambia and the subregion), which the model was unable to capture.

PMI-Supported Planned Activities (next ~12 months with currently available funds)

Implementation of the ProACT study, the Nchelenge ICEMR collaboration, and the pre-elimination modeling activities will proceed in CY 2021–2022, as outlined in the preceding section.

In addition, PMI will support the launch of a study on ITN misuse and repurposing, as follows:

ITN Misuse and Repurposing Assessment

In 2020 PMI initiated an assessment of ITN repurposing and misuse among nine communities in Luapula, Northern, and Muchinga provinces. The assessment builds on methods developed by PMI/ Malawi. It responds

to long-standing concern in Zambia that ITN misuse in fishing is occurring, causing a diversion of public health resources, and damaging fishing livelihoods through negative impact on fisheries. Results of the assessment will provide PMI, the NMEP, other government agencies including the Ministry of Fisheries and Livestock and implementing partners with an understanding of the scale of ITN repurposing and insights into the drivers of ITN misuse. The results are expected to inform recommendations to improve SBC to promote appropriate ITN use, mitigate the environmental impact of ITN campaigns, protect public health investments in ITNs, and strengthen U.S. Government due diligence in environmental compliance.

The assessment will take a mixed methods approach, triangulating results from complementary activities to generate insights and recommendations for a broad range of public health, fisheries, and livelihoods stakeholders in Zambia. This will be achieved through four core activities: focus group discussions and key informant interviews with members of fishing communities; observations of ITN repurposing and misuse; household surveys to quantify ITN access, use, and reported and observed repurposing and misuse; and a market scan of fishing gear available at local and district markets. Randomization is applied for sampling in the household survey. No intervention is involved at this time. Rather, the results and recommendations will be reviewed before any remediation is applied.

IRB approval was obtained and data collection was scheduled to begin in April 2020, but had to be postponed for at least one year due to the COVID-19 pandemic.

Key Question 1

In consultation with the NMEP, have technical challenges or operational bottlenecks in program interventions been identified that require PE/OR? How have they been prioritized?

Supporting Data

Table A-25. Ongoing program evaluation and operational research (selected)

Funding Source	Implementing Institution	Research Question/ Topic	Status/Timeline
BMGF through IVCC	PATH, Macha Research Trust	Attractive target sugar baits, entomologic validation	Implementation ongoing in Luampa and Kaoma districts, Western Province – planned completion in 2022
BMGF	MACEPA	Impact of CHW deployment on malaria case incidence	Analysis complete, publication pending
BMGF	MACEPA	Comparison of reactive case detection vs. reactive drug administration in malaria elimination areas	"CORE study" – data collected in 2017–2018, data analysis complete, publication pending

Funding Source	Implementing Institution	Research Question/ Topic	Status/Timeline
WHO	MOH	Assess feasibility and impact of window screening vs. ITNs alone on malaria prevalence	Nyimba District, Eastern Province, baseline survey done 8/2019, implementation began 10/2019
PMI	PMI implementing partners, MOH	Assess impact and feasibility of proactive approach to deploying CHWs in community case management	Baseline survey underway in April–May 2021, intervention to be introduced in June 2021 (ProACT Study)
PMI	PMI implementing partners	ITN misuse and repurposing in northeastern provinces	Protocol developed, data collection delayed due to COVID-19 – may begin mid-2021
NIH, PMI	ICEMR, PMI implementing partners, MOH	Longitudinal impact monitoring of malaria control measures in Nchelenge District, and related studies (ICEMR also active in Choma)	Ongoing, monthly sampling of household parasitologic and entomologic indices, complemented by HF caseloads; correlates with measures of malaria control intervention implementation
PMI	PMI implementing partners	Transmission modeling in pre-elimination districts	Periodic data triangulation with updating and interrogation of the model

Key Question 2

Are there specific challenges in any intervention areas that merit further exploration or research with the potential of establishing strategies or interventions applicable in the near future?

The apparent lack of impact of IRS scale-up on malaria burden in certain high-burden settings in northern Zambia, such as Nchelenge in Luapula and Solwezi in North West, poses important questions in vector control.

As previously alluded to (Figure A-30) well-run annual IRS campaigns in Nchelenge District were found by the ICEMR to have had negligible impact on household RDT positivity rates and other measures since 2014. This limited impact was observed even when the insecticide residual efficacy was doubled and the population coverage and geographic reach were maximized. However, ITN use was associated with a 20 percent decrease in parasitemia rates.[5] Drivers of persistent high malaria burden have been noted to include a highly conducive local

[5] Kanyangarara, M., Hamapumbu, H., Mamini, E., et al. Malaria knowledge and bed net use in three transmission settings in southern Africa. Malar J. 2018;17(1):41. Published 2018 Jan 19. doi:10.1186/s12936-018-2178-8; Pinchoff, J., Chaponda, M., Shields, T.M., et al. Individual and household level risk factors associated with malaria in Nchelenge District, a region with

environment (terrain, climate, socioeconomic) with high malaria receptivity and high vectorial capacity, mobile populations; outdoor biting, and a hard-to-control surge of *An. funestus* each dry season.

The Nchelenge setting has high potential for cost-effective program learning with the support of the ICEMR. This opportunity is available till the current ICEMR grant expires in 2024. The following is a proposed two-phased approach, under active review with the NMEC/MOH, the ICEMR, and PMI implementing partners:

- *Proposed Phase 1 – Program Evaluation: Early Transition from IRS to PBO ITNs*
  Starting as early as September 2021, Nchelenge would be supported to be among the first districts nationwide to transition from an IRS-ITN mosaic to full, blanket coverage with PBO ITNs. This would be accompanied by intensified SBC efforts to promote ITN use among all Nchelenge residents, but with special interest in mobile populations. IRS would be partially or fully withdrawn in 2021 and halted by 2022, once high ITN use is ensured. PMI would continue to support expanded access to case management at the health facility and community levels. All interventions would be consistent with the national package currently promoted, and would be allocated according to resource availability and operational feasibility (i.e., intensified program implementation, but not research).
- *Potential Phase 2 – Operations Research: Addition of Innovative/Enhanced Vector Control*
  If gains remain unsatisfactory after PBO ITN deployment, OR would be designed to test further enhancements of vector control interventions in a research setup. One or a combination of several promising measures would be introduced, such as improved housing techniques, attractive targeted sugar baits, larval source management where indicated and feasible, and/or innovative interventions designed for mobile populations.

Key Question 3

Are there any other considerations that impact your funding allocation in this category?

N/A

PMI Goal

PMI will conduct PE/OR that helps to evaluate coverage of the population at risk, intervention quality, or delivery efficiency; study reducing malaria transmission and disease burden; test effectiveness of new or evolved priority interventions and strategies; or explore new metrics and mechanisms to assess intervention impact.

Conclusions for Program Evaluation and Operational Research Investments

Based on consultation with the NMEP and stakeholders, for the coming period, PMI will focus its resources on successful implementation of the above-mentioned activities, namely:

- The ProACT Study (2021–2023)
- Validation of ANC-based surveillance, which is linked to ProACT and described in the SM&E section (2021)
- ITN Misuse and Repurposing Study (2021)

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perennial transmission: A serial cross-sectional study from 2012 to 2015. PLoS One. 2016;11(6):e0156717. Published 2016 Jun 9. doi:10.1371/journal.pone.0156717

- Evaluation of Standard Malaria Control Package in Nchelenge District (ongoing)
- Use of Modeling to Inform Pre-Elimination Programming in Eastern Province (ongoing)

The first three activities listed here have been funded in previous MOPs and are therefore not incorporated into the FY 2022 MOP. However, the ongoing evaluations in Nchelenge and Eastern are open-ended, demonstrate high potential for impact, and will continue to be prioritized.

In Nchelenge, formal operations research may be warranted to address questions around vector control and residual malaria in high burden settings. Although no allocation for such research is proposed in the FY 2022 MOP, as objectives are further defined, the PMI/Zambia team with NMEC and stakeholder may put forward funding proposals in the future, as outlined in the previous section.

Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.

3.4. SOCIAL AND BEHAVIOR CHANGE (SBC)

NMEP Objective

The NMEP's objectives for the National Communication Strategy 2017 to 2021 are to increase knowledge of malaria from the 2015 baseline to 100 percent by 2019; to improve uptake of and correct use of key malaria interventions from baseline to 90 percent by 2019; to arm influencers, health workers, and communities with the communication tools required to achieve elimination; to promote the recognition and celebration of communities that attain malaria-free status; and to provide guidance to communities on the messages and materials needed to maintain malaria-free status and remain vigilant about imported infections and the potential for resurgence.

NMEP Approach

The NMEP launched the National Communication Strategy for Malaria Elimination on World Malaria Day on April 25, 2018. This strategy is in support and alignment with the National Malaria Elimination Strategic Plan 2017–2021 and the National Health Strategic Plan. The strategy envisions a malaria-free Zambia and will begin focusing not only on increased awareness and knowledge of malaria, but also on the additional step of examining what it will take to eliminate malaria from the country.

There is a functioning national malaria SBC coordinating committee, although in the past there have been some challenges with the rotating chairmanship. The MOH has a Directorate of Health Promotions that coordinates general health SBC efforts, clears all health promotion materials, endorses SBC materials on behalf of the MOH, leverages resources to increase coverage and reach of SBC activities, and provides guidance to monitor and evaluate SBC activities. Currently, malaria SBC interventions in Zambia are communication-heavy, both at the community level through interpersonal communication and at the national level through mass media, and often lack behavioral determinants of focus. The primary target audience for these interventions are pregnant women and caregivers of young children.

All malaria partners in Zambia are expected to align program activities with the National Communication Strategy for Malaria Elimination. The largest donors include PMI and the Global Fund. The Global Fund supports the implementation of community-level SBC activities through CHAZ. This includes implementation of champion communities and engagement with traditional and religious leaders.

The National Communication Strategy for Malaria Elimination 2017–2021 has increased the MOH's capacity to more effectively plan and oversee all SBC activities in-country. Currently, all institutions working in malaria (public and private organizations, NGOs, the Global Fund, and PMI) are required to follow the national strategy. A new communication strategy post-2021 has yet to be developed, but it is hoped this new strategy will have a broader SBC focus while still highlighting key communication components.

The communication and behavioral objectives of the current national malaria communication strategy are as follows:

Table A-26. Behavioral and communication objectives

Vector Control: IRS/ITNs
Behavioral Objectives
- All pregnant women have LLINs and use them every night year-round.   - All household members including adolescents have access to LLINs and use them appropriately, allow their households to be sprayed, and clear stagnant water in surrounding areas.   - Migrant populations carry LLINs wherever they go and have a responsibility to allow their homes to be sprayed.
Communication Objectives
- Increase knowledge of malaria/the mosquito.   - Increase understanding of LLINs/IRS/LSM activities and increase the awareness of the benefits of vector control.   - Communicate the community benefit of vector control.
Case Management and MIP
Behavioral Objectives
- Increase the number of women taking at least four doses of IPTp during pregnancy.   - Increase the number of men/husbands supporting their spouses during ANC.   - Increase the number of symptomatic people who seek care within 24 hours.   - Improve the quality of care and prevent misdiagnosis.
Communication Objectives
- Increase the number of pregnant women and women of child-bearing age with knowledge of the importance of IPTp and early ANC.   - Increase the number of men who understand the importance of ANC.   - Increase the number of people with knowledge of the common symptoms of malaria.   - Increase the number of people who know how to seek malaria testing and treatment.   - Stress the importance of conducting a malaria diagnostic test before prescribing medication.

Health Services
Behavioral Objectives
● Record every case into the register, and 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 a blood test before receiving any malaria treatment. ● If you test positive, adhere to the complete treatment course.
Communication Objectives
● Increase the number of districts adopting Component B strategies. ● Increase trust in health service delivery by clinicians. ● Increase understanding of the importance and use of data. ● Increase understanding of malaria services available. ● Increase understanding on malaria treatment.
Community Clearance of Malaria Parasites
Behavioral Objectives
● Increase the percentage of people participating in MDA, in particular those who move for fishing and farming (seasonal migration) and adolescents. ● Increase the percentage of people adhering to the three-day regimen. ● Increase the number of religious leaders actively promoting MDA from their pulpits. ● Increase the number of community leaders publicly testifying on the benefits of MDA.
Communication Objectives
● Increase the understanding of symptomatic vs. asymptomatic malaria. ● Increase the understanding of MDA drugs (currently dihydroartemisinin-piperaquine, DHAPQ). ● Increase awareness of the community benefits of MDA participation, and demonstrate safety by having CHWs and leaders take their first dose during a village meeting. ● Inspire community leaders to become "malaria champions."

Detect and Investigate Individual Cases
Behavioral Objectives
- 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 (in the context of RCD).   - Increase the number of communities providing incentives to their CHWs.   - Ensure that CHWs report timely and accurate data.   - Ensure that CHWs administer quality care.   - 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.   - Be armed with durable and appropriate materials for engaging homes.   - Communicate how CHW work is part of a larger effort to end malaria.
Eliminating Malaria
Behavioral Objectives
- 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 the 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.

PMI Objective in Support of NMEP

In alignment with the country's national malaria control/elimination communication strategy, PMI utilizes targeted SBC interventions that supports the adoption and maintenance of select key malaria prevention and treatment-seeking behaviors, thereby improving the overall quality of malaria control efforts that will contribute to reductions in malaria morbidity and mortality.

One of the most notable strengths of the malaria SBC efforts in Zambia is the wide breadth of stakeholders who recognize the importance of SBC in achieving reductions in malaria-related morbidity and mortality. From government to private sector to civil society stakeholders, there is widespread acknowledgement that SBC has a critical role to play in achieving the goal of a malaria-free Zambia. Unfortunately, at present, the efforts of these committed and informed stakeholders are not well coordinated. In some areas of the country where there is geographic overlap between partners engaged in malaria SBC, there is duplication of effort with several partners facilitating the same or similar activities within the same districts, sometimes with limited awareness of one another's activities and approaches with a need for increased sharing or general resources.

PMI-Supported Recent Progress (past ~12 months)

In the past 12 months PMI has provided TA to the NMEP at the central level and has worked through implementing partners to conduct quality SBC interventions at the health facility and community levels.

Champion Communities

PMI continued supporting the Champion Communities Initiative (CCI) which was adopted into the national malaria strategy in 2020 as a sustainable model for successfully mobilizing communities against malaria. Trained CCI volunteers help fellow community members identify barriers to accessing and utilizing malaria services, develop action plans, and set targets for the adoption and maintenance of key behaviors. Communities that achieved their own set performance targets were recognized and celebrated as champion communities. In the past 12 months, PMI trained 960 change champions as well as 94 DHO and health facility staff in Muchinga, Northern, Luapula, and Eastern provinces.

Community dialogues

To help address malaria knowledge gaps as identified in the 2018 MIS, and to increase awareness and uptake of malaria interventions and services, PMI supported District Health Officers and health facility staff to conduct community dialogues. During community dialogues, facilitators prompted discussions on malaria, barriers to utilization of malaria services, consequences of the disease, and ways to prevent it. PMI conducted 83 community dialogues in eight districts reaching a total of 1,183 people. PMI had planned to conduct an additional 766 community dialogues, but these could not be done because of the MOH guidance on prevention measures against COVID-19.

Mass media

By utilizing mass media, PMI sought to engage a wider audience than could be reached through the targeted community approach. In addition to facts about malaria and malaria prevention, the programs addressed differences between malaria and COVID-19 signs and symptoms, prevention of COVID-19 transmission, and the effects of the pandemic on the malaria program. Mass media messaging focused on increasing knowledge and awareness on proven malaria interventions including correct and consistent ITNs use, promoting early treatment-seeking behavior, and early commencement of IPTp. PMI also procured megaphones to further support mass media efforts.

PMI recorded and aired adolescent malaria myth-buster radio programs in the pre-elimination districts. PMI engaged 10 (five male and five female) students selected from two secondary schools and two boarding schools

in Chipata District. With technical support from trained journalists, these students conducted interviews with peers in their schools. Recordings were used in the final production of four radio programs hosted by the students, while technical experts from MOH dispelled myths raised by the students.

Prior to the pandemic, PMI organized a media mission in Chadiza to capture successes and challenges of the pre-elimination program, provide media personnel with new information on the malaria elimination effort, and encourage positive and consistent reporting of malaria through TV, radio, and print media. Fourteen journalists participated from seven media houses: Zambia National Information Service, Prime TV, Breeze FM, Mphangwe Community Radio, Feel Free, Radio Maria, and the Zambia Daily Mail.

PMI-Supported Planned Activities (next ~12 Months with currently available funds)

All upcoming PMI-supported SBC activities aim to promote and maintain one or more the following behaviors by addressing local barriers and leveraging appropriate motivators:

Insecticide-Treated Net Use: Pregnant women sleep under insecticide-treated nets (ITNs) every night, every season year-round; children under five years of age sleep under an ITN every night, every season year-round.

Early Care-Seeking for Malaria: Caregivers and mothers of children under five years of age take their children for malaria testing within 24 hours of the onset of fever.

Early ANC (IPTp use): Pregnant women enroll for ANC early and take intermittent preventive treatment during pregnancy (IPTp) from their 12th week of pregnancy until delivery to prevent malaria.

IRS Acceptance: Heads of household allow their houses to be sprayed with insecticide (IRS) to prevent malaria.

In the next 12 months, PMI will support the following SBC activities:

Mass and community-oriented media approaches

PMI will support mass and community-oriented media approaches to target individual and community-level barriers and promote the adoption of key malaria behaviors in Eastern, Luapula, Muchinga, and Northern provinces of Zambia. This activity will support increased access, acceptance, and utilization of all malaria behaviors and associated interventions including correct and consistent use of ITNs, prompt care-seeking, and early ANC booking and uptake of IPTp for pregnant women. In addition, PMI will support acceptance of IRS among household heads. Utilizing radio as the key mass media approach, radio discussion programs and myth-buster spots targeting adolescents will be the key activities in this area. It is expected that PMI will broadcast 1,800 radio spots and 100 radio programs with malaria messages.

Interpersonal communication approaches

PMI will support normative behavioral shifts through interpersonal communication approaches to influence the adoption and maintenance of key malaria behaviors as well as to facilitate community-led problem-solving to overcome barriers to correct and consistent ITN usage, acceptance of IRS, prompt care-seeking, early ANC booking and uptake of IPTp in Eastern, Luapula, Muchinga, and Northern provinces of Zambia. To achieve this, PMI will support training of DHO and health facility staff, community change agents (CCAs) and other community peer leaders such as CHWs and Safe Motherhood Action Groups (SMAGs) in counseling and peer education to

engage, discuss, and influence the practice of healthy behaviors among pregnant women, mothers, household heads, and community leaders. It is expected that 120 DHO staff and 1,020 CCAs will be oriented in interpersonal communication.

Community dialogues

PMI will conduct community meetings to engage, educate, and mobilize communities to facilitate the shifts in social norms, ultimately promoting correct and consistent use of ITNs, acceptance of IRS, prompt care-seeking, and early ANC booking and uptake of IPTp in Eastern, Luapula, Muchinga, and Northern provinces of Zambia. To achieve this PMI will support the orientation of community leaders including village head persons, chiefs, and any other persons nominated by their community and selected CCAs in facilitating community dialogues that will galvanize communities to foster collective responsibility for malaria prevention, maintenance, and treatment interventions. It is expected that PMI will conduct 240 community dialogues.

Mobilization of faith leaders

PMI will mobilize and engage faith leaders to influence social norms and promote household and individual behavior change within their communities by serving as models, influencers, catalysts, facilitators, and health promoters to promote correct and consistent use of ITNs, acceptance of IRS, prompt care-seeking, early ANC booking and uptake of IPTp in Eastern, Luapula, Muchinga, and Northern provinces of Zambia. To achieve this PMI will support the building of an effective partnership with a local faith network to carry out activities among Christian, Muslim, Baha'i, and Hindu faith leaders.

Mobilization of youth and educational leaders through the school system

PMI will mobilize schools to improve local barriers to malaria prevention and prompt care-seeking behavior, including methods to overcome them. To achieve this, PMI will support the engagement of public primary schools to mobilize both teachers and learners to undertake interactive malaria prevention and treatment activities. It is expected that PMI will mobilize 360 youth and teachers.

District community SBC engagement plans

PMI will support the DHOs to develop SBC engagement plans to enable districts to focus and support their SBC interventions at both the health facility and community levels. The ultimate aim is for districts to promote correct and consistent use of ITNs, acceptance of IRS, prompt care-seeking, and early ANC booking and uptake of IPTp in Eastern, Luapula, Muchinga, and Northern provinces of Zambia. In the next 12 months, 40 district community engagement plans will be developed.

Training of healthcare workers to improve quality of care

PMI recognizes that service providers have variable and often inadequate technical capacities and interpersonal skills to deliver comprehensive and high-quality malaria care. When healthcare workers lack supplies, commodities, communication skills, or training, they deliver incomplete or inconsistent services. Coupled with this is provider mistrust of RDTs or specific treatments, which leads to nonadherence to treatment resulting in compromised service provision to clients. PMI will orient 120 healthcare providers in interpersonal

communication strategies and approaches to ultimately improve provider–client relationship and evidence about priority gaps and deficits influencing service provision and the provider–client relationship in eight focus districts.

Information communication technology to disseminate SBC messages

PMI will explore the use of information communication technology for the delivery of key malaria messages where appropriate, especially with the outbreak of the COVID-19 pandemic, which is increasingly limiting coverage of certain community mobilization interventions. PMI will engage providers of the three mobile phone networks (MTN, ZAMTEL, and AIRTEL) to disseminate messages to promote correct and consistent use of ITNs, acceptance of IRS, prompt care-seeking, and early ANC booking and uptake of IPTp in Eastern, Luapula, Muchinga, and Northern provinces of Zambia. Further PMI will craft strategic and targeted messages that will be recorded and packaged on flash drives, which will be mounted on megaphones for use by CCAs during community outreach. In addition, PMI will support innovations to introduce two electronic teaching aids for CHWs or healthcare workers to provide detailed instructions on how to use and hang an ITN and the benefits of IPTp. The teaching aids will be used to facilitate effective health talks during ANC and EPI sessions. It is expected that PMI will engage three mobile phone companies to disseminate messages, and produce two teaching aids for use in clinics.

Advocacy at subnational level

PMI recognizes that malaria elimination requires the support of political leadership and resources to ensure the availability of malaria commodities and services. Such support is necessary to complement the promotion of health-seeking attitudes, norms, and behaviors. To achieve this, PMI will advocate through indabas, meetings, and other initiatives by national and provincial decision-makers, district malaria elimination councils, local authorities, chiefs' councils, and village headmen. The focus for these advocacy initiatives is to support local leadership to mobilize resources by engaging the private sector, coordinating with local health initiatives to integrate malaria goals and activities, organizing campaigns, and strengthening malaria reporting and supervisory systems. It is expected that PMI will conduct five advocacy indabas at the four levels of the health system (national, provincial, district, and community).

SBC coordination, monitoring, and supervision at subnational levels

PMI will coordinate shared learning of SBC insights, activities, and lessons learned across provinces. To achieve this, PMI will support quarterly SBC TWG meetings and the orientation of provincial and district teams to be able to coordinate, monitor, supervise, and review the implementation of malaria SBC activities. It is expected that PMI will conduct four SBC partner coordination meetings, and four supervisory, monitoring, and mentoring visits to each province.

Capacity for SBC data review and use through the national advisor role

PMI will place a Social and Behavior Change Advisor at the NMEP to work closely with the national SBC team and play a key role in analyzing data from the MOH-led and PMI-supported MIS and the qualitative barrier analysis. This role will help to strengthen national decision-making and shape SBC policy based on current evidence to inform the development of strategic documents such as the National SBC Strategy (see below) and the integration of behavioral indicators into the national DHIS2 platform. PMI will further collaborate with key partners to integrate SBC data into the HMIS/DHIS2 to ensure a national tracking system of the impact of SBC

activities and to generate data that can inform decision-making within the program to further improve SBC nationally.

Development of a national SBC strategy

PMI recognizes that Zambia's current national malaria elimination communication strategy was based on the National Malaria Elimination Strategic Plan (NMESP) 2017–2021, which ends in 2021. PMI will advocate for the development of the next strategy with a focus on social and behavior change, with communications activities constituting as one of many strategies to fulfill the overall SBC vision. PMI will contribute limited financial support for meetings to develop the National SBC Strategy, as well as technical input from the SBC Advisor and Lusaka- and U.S.-based staff.

Leveraging annual malaria events

PMI will support Zambia's commemoration of key malaria events such as World Malaria Day (WMD), National Health Week, and the Southern African Development Community (SADC) Malaria Week. PMI will develop relevant materials for the WMD. PMI will also support district and community-level activities to commemorate WMD events.

Providing strategic support for SBC interventions and materials

PMI will develop, print, and disseminate carefully crafted and selected materials to support SBC interventions. This will include procurement, materials development, and pretesting processes for 15,600 communication materials and enablers comprising 750 flip charts, 750 job aids, 1,500 T-shirts, 5,000 wristbands, 5,000 stickers, 750 chitenges, 10 banners, 300 bicycles, 750 gum boots, and 750 bags to be distributed in Eastern, Luapula, Muchinga, and Northern provinces of Zambia. These materials are intended to promote visibility and facilitate the work of the CCAs when they conduct household visits.

Strengthening capacity through sub-agreements to national civil society organizations

PMI recognizes the need to increase reach of all SBC interventions and to ensure continuous implementation of community-level activities. To achieve this, PMI will issue sub-agreements to local and national CSOs to promote correct and consistent use of ITNs, acceptance of IRS, prompt care-seeking, early ANC booking and uptake of IPTp in Eastern, Luapula, Muchinga, and Northern provinces. To ensure quality SBC activities through CSOs, PMI will train relevant CSO staff in effective community engagement approaches. It is expected that PMI will engage 14 CSOs.

Measuring SBC activities

SBC interventions will be measured through a selected number of behavioral indicators. These have been defined in the Monitoring, Evaluation, and Learning plan and will be tracked monthly to see the progress the project is making in reaching its goal and intermediate results. PMI will support a robust monitoring and evaluation of all SBC interventions.

Formative barrier analysis to ground SBC interventions in evidence

To ensure SBC activities at different levels are informed by evidence, PMI will support the analysis of data from existing sources (e.g., formative research carried out in 2018, MIS, and DHS) and the 2019 stakeholder assessment conducted in Eastern Province. This is to identify gaps in the current use of treatment and prevention interventions broken down by region, social economic status, and gender, and to identify behavioral barriers and motivators to appropriately target social behavior change interventions. Recognizing the geographic and quantitative limitations of the MIS and DHS, PMI will support NMEP to conduct a mixed methods rapid barrier analysis to complement the formative research and to probe more deeply on determinants that drive or prevent the uptake of malaria prevention and treatment behaviors at a granular level.

Key Goal

Through the use of SBC interventions and in alignment with a country's national malaria control/ elimination communication strategy, PMI supports the adoption and maintenance of key malaria prevention and treatment-seeking behaviors, thereby improving the overall quality of malaria control efforts that will contribute to reductions in malaria.

Key Question 1

What behaviors is PMI proposing to prioritize through its SBC programming? What data support this prioritization? Will support be geographically targeted or national?

Supporting Data

Table A-27. Prioritized behaviors with FY 2022 funds

Behavior	Target Population	Geographic Focus	Justification
Prompt care-seeking for fever	Caretakers of children under five years of age	Subnational: Luapula, Muchinga, Northern, Eastern	In the 2018 MIS, prompt care-seeking for children with fever was low, as only 19.7% sought treatment from a health facility/provider on the same day or next day. Promptness of treatment seeking was moderately higher in urban (24.1%) than in rural areas (16.4%). Therefore, additional SBC interventions are needed to help increase prompt care-seeking for fever.
ITN use and care	All members of the target population with special emphasis on pregnant women and caregivers of children under five years of age with an increased emphasis in districts where IRS is being withdrawn	Subnational: Luapula, Muchinga, Northern, Eastern	In the 2018 MIS, ITN coverage in rural areas rose to 87% from 64% in 2008. Therefore, SBC activities must focus on both ITN use and care as a means to increase overall ITN coverage of target populations.
Early ANC attendance	Pregnant women	Subnational: Luapula,	In the 2018 MIS only about 5% of pregnant women received four doses of IPTp. Seven percent of rural

Behavior	Target Population	Geographic Focus	Justification
		Muchinga, Northern, Eastern	women received four doses of IPTp, compared with only 2% of urban women. From 2015 to 2018, the percentage of women reporting taking a fourth dose of IPTp stayed the same at 5%. This suggests an urgent need to increase SBC activities promoting early ANC attendance and IPTp uptake.

Key Question 2a

For prompt care-seeking for fever, what gaps exist in understanding the barriers to the adoption and maintenance of malaria prevention and treatment behaviors?

Supporting Data

According to the 2018 MIS, prompt care-seeking for children with fever was low, with only 20 percent of respondents reporting they sought treatment from a health facility/provider on the same day or next day. However, this was slightly higher in urban areas (24 percent) compared to rural areas (16 percent). Findings from the SBC formative assessment supported by PMI in 2019 also reported some barriers associated with prompt care-seeking, including specifically distance to the health facility, the perception that there are no commodities available at facilities, use of self-administered local herbs to treat malaria (potentially related to lack of access and commodities), and a lack of knowledge about CHWs. Based on these data, there may be opportunities to explore behavioral factors further to identify additional barriers and motivators that may influence the uptake of prompt care-seeking behavior. Further, as lack of knowledge is a large category more research to determine specific knowledge gaps among key audiences may be required.

Key Question 2b

For ITN use and care, what gaps exist in understanding the barriers to the adoption and maintenance of malaria prevention and treatment behaviors?

Supporting Data

From 2007 to 2018 there has been a positive trend in both increased access to ITNs and the number of people who slept under an ITN the night before the survey. Interestingly, there is stronger net use behavior in Luapula Province, which has one of the highest malaria transmission rates among Zambian provinces. The ITN use:access ratio is from 0.8 to 1.0 in the provinces of Eastern, Muchinga, Northern, and Western, and 0.6 to 0.8 in the provinces of Central, Copperbelt, North-Western, and Southern. Lusaka has the lowest ITN use:access ratio ranging from 0.4 to 0.6. Thus, in addition to encouraging people to sleep under a net every night, every season, all year round, emphasis should also be placed on maintaining consistent net use behaviors and promoting proper net care. Further research on better understanding why the access rates are higher in Luapula than in other provinces may be helpful in determining how to improve this barrier in other provinces. Furthermore, research is needed to show whether increased access leads to increased use within these communities as well as which barriers may be impeding correct and consistent use and maintenance of nets for households that currently have access to them.

Key Question 2c

For early ANC attendance, what gaps exist in understanding the barriers to the adoption and maintenance of malaria prevention and treatment behaviors?

Supporting Data

In 2018, 64 percent of pregnant women completed four ANC visits, while 24 percent attended ANC during the first trimester (2013–2014 DHS). This presents missed opportunities for IPTp uptake as only about 5 percent of pregnant women received four doses of IPTp in 2018. However, 7 percent of women in rural areas received four doses of IPTp compared with 2 percent of women in urban areas. The SBC formative assessment supported by PMI in 2019 indicated cultural norms, distance to the health facility, and lack of knowledge that their local facility offers IPTp services as key barriers to ANC attendance and IPTp uptake. More details on the aforementioned and additional unidentified barriers would be helpful in informing SBC activities.

Key Question 3

What is the country's capacity to design, implement, and monitor SBC interventions at the national and subnational level?

Supporting Data

In theory, there is strong support within the GRZ for malaria SBC activities. Both the NMESP and National Communication Strategy for Malaria Elimination 2017–2021 highlight health promotion and SBC activities as critical to achieving the goal of a malaria-free Zambia, with the NMESP noting that SBC activities are "imperative" and "high on its agenda." However, in practice, the support needed for operationalization of malaria SBC activities, including partner coordination both at the central and district levels, better targeting of SCB activities to key target audiences, and using behavioral data for decision areas needs to be strengthened. Engagement of provincial and district-level staff is varied across PMI-supported areas. Specifically, some of these provincial and district level staff are closely engaged in implementing partner activities (e.g., training of health facility staff and community champions), while others have minimal engagement in coordination and implementation of activities. One of the gaps is the lack of a formal SBC position within the NMEC's organogram. Given multiple high-priority areas at the NMEC and among donors, there is not sufficient SBC support to cover the country's needs.

Conclusions for SBC Investments

PMI will support the MOH and local communities to implement evidenced-based, targeted SBC interventions in all four provinces. Evidence to date on SBC program effectiveness supports the use of high-impact approaches including promoting and reinforcing specific health behaviors by strategically addressing local and context-specific behavioral barriers and motivators. PMI plans to utilize both community change agents and multiple communication channels to facilitate and support individual and community behaviors and shifts in social norms. PMI will integrate SBC in other public health programming and platforms such as EPI and ANC.

No specific formative assessments, program evaluations, or operations research is currently being planned with FY 2022 funds, but the need will be reevaluated after results from the analysis being supported with FY 2020 funds and the Malaria Behavior Survey supported with FY 2021 funds are analyzed.

PMI will place an SBC Advisor at the NMEP to work closely with the national SBC team and play a key role in analyzing data from the MOH-led and IP-supported MIS and the qualitative barrier analysis. This role will help to strengthen national decision-making and shape SBC policy based on current evidence to inform the development of strategic documents such as the National SBC strategy. Continued support for this position is anticipated with FY 2022 MOP funds. PMI will also continue supporting the SBC TWG and will advocate for the development of the next strategy with a focus on SBC, with communications activities constituting as one of many strategies to fulfill the overall SBC vision.

SBC funding levels in FY 2022 will be similar to previous FY 2021 allocations; however, in FY 2022 some funds have been designated to specifically support SBC activities during the 2023 ITN mass distribution campaign, given this was an area of weakness in the FY 2020 mass distribution campaign. Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.

3.5. OTHER HEALTH SYSTEMS STRENGTHENING

NMEP Objective

- Zambia's National Malaria Elimination Strategic Plan 2017–2021 calls for the following:
  - o Strengthening national, provincial, and district-level capacity to plan, manage, and implement malaria activities.
  - o Addressing human resource needs.
  - o Ensuring that there is an established planning and forecasting framework for projecting funding needs and tracking health expenditures.
  - o Developing capacity at all levels of the health system to manage the storage and distribution of malaria commodities.
  - o Reinforcing coordination among partners
- Mobilize an additional $100 million, in addition to projected donations by long-standing malaria partners, to close the country's identified funding gap. Although the NMEP's original goal of elimination has been deferred to 2030, the country estimated its malaria resource requirements at just over $694 million for the five-year period from 2017 to 2021.

NMEP Approach

In March 2019 Zambia launched its first End Malaria Council (EMC). The EMC is designed to increase resource mobilization to achieve and sustain malaria elimination. Zambia's EMC convenes senior-level, multi-sectoral stakeholders (government, business, and community leaders) to complement Zambia's National Malaria Elimination Programme. The EMC is country-led and country-owned, and is focused on three priority areas: (1) ensuring the national strategic plan is implemented by driving action and holding stakeholders accountable, (2) pursuing traditional and innovative financing to mobilize domestic resources to close the existing funding gap, (3) and advocating for malaria elimination to remain high on public and private sector agendas.

In June 2019 the EMC established the End Malaria Fund (EMF). The EMF is a public-private partnership to spearhead efforts toward mobilizing the country's estimated $100 million funding gap necessary to fill in order to

end malaria by 2021. The EMF's Board is now functional and operates as a subcommittee of the EMC and supports the Council in meeting its key strategic priorities.

To achieve operational capacity, the NMEP is targeting health facility catchment areas and aiming to support them with specific intervention packages. As part of this decentralization, the GRZ implements a community health assistant program to bridge the gap between the community and formal health services.

PMI Objective in Support of NMEP

PMI aims to support capacity strengthening and malaria health system improvements at the provincial, district, facility, and community levels, including data-driven decision-making at the national and subnational levels.

In alignment with NMEP's 2030 goals, PMI advocates further saturation of proven interventions and for increased focus and funding toward malaria by the Zambian government. PMI will complement these efforts by advocating for increased integration of non-governmental cooperating partners.

PMI-Supported Recent Progress (past ~12 months)

In 2020 PMI provided support for the Field Epidemiology Training Program (FETP) and the Peace Corps Stomp Out Malaria Initiative as well as support to strengthen the NMEP staff capacity through professional development activities.

PMI also more than doubled the number of districts in the integrated program for malaria elimination and expanded OTSS activities to cover all health facilities in Chadiza, Katete, and Sinda districts. OTSS continued to expand between 2019 and 2020 to include 2,741 trainees/mentorships, including 57 OTSS supervisors, 42 MOH staff trained in HMIS, and 1,253 facility staff. This also includes 1,389 CHWs who treated 338,452 patients with confirmed malaria.

PMI-Supported Planned Activities (next ~12 months with currently available funds)

In 2021, PMI will continue to provide support for two Zambian nationals to participate in FETP, either at the intermediate or advanced level.

PMI will continue to support Peace Corps activities in malaria control, including through small project assistance grants. PMI will also support a third-year Peace Corps volunteer position to assist CHWs in improving the quality of services and surveillance data for the PMI-supported pre-elimination program.

PMI will continue to provide support to strengthen NMEP staff capacity through development activities such as training workshops and participation in regional/global meetings.

Key Goal

Key Question 1

Upon identifying specific goals, objectives and actions for health systems strengthening focused on reducing malaria infection, morbidity and mortality, can you outline these and consider relevant support?

Because there is not a specific predefined goal and objective for this section on other health systems strengthening, this is an open question that is included by the in-country MOP team. Possible examples to consider include support to address emergencies (Ebola outbreak, cyclones, etc.), support that engages capacity strengthening such as FETP or Peace Corps programs, or support to extend access to care via community health outreach.

Addressed in previous sections.

Supporting Data

N/A

Conclusions for Additional Health Systems Strengthening Investments

Do you propose expanding, contracting, or changing any previously supported HSS activities? If so, why and what data did you use to arrive at that conclusion? Please provide a brief summary of changes from FY 2020 approved activities.

Proposed support for HSS activities largely reflects investments in Peace Corps and capacity-building for the NMEP as in previous years. Please see FY 2022 PMI budget tables for a detailed list of proposed activities with FY 2022 funding.