

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



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U.S. PRESIDENT'S MALARIA INITIATIVE



PRESIDENT'S MALARIA INITIATIVE

RWANDA

Malaria Operational Plan FY 2017

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ABBREVIATIONS and ACRONYMS

ACT	Artemisinin-based combination therapy
ANC	Antenatal clinic
AL	Artemether-lumefantrine
ASM	<i>Agents de Santé Maternelle</i> (specialized maternal community health workers)
CBHI	Community-Based Health Insurance
CDC	Centers for Disease Control and Prevention
CHW	Community health worker
DfID	U.K. Department for International Development
DHS	Demographic and Health Survey
DQA	Data quality audits
eLMIS	Electronic logistics management information system
EPI	Expanded Program for Immunization
ESR	Epidemic surveillance and response
FANC	Focused antenatal care
FY	Fiscal year
GHI	Global Health Initiative
GHSA	Global Health Security Agenda
Global Fund	Global Fund to Fight AIDS, Tuberculosis, and Malaria
GOR	Government of Rwanda
HBM	Home-based management (of malaria)
HCC	Health Communication Center
HMIS	Health management information system
HSSP	Health Sector Strategic Plan
iCCM	Integrated community case management
IDSR	Integrated Disease Surveillance and Response
IPTp	Intermittent preventive treatment of malaria for pregnant women
IRS	Indoor residual spraying
IST	Intermittent screening and treatment
ITN	Insecticide-treated mosquito net
IVM	Integrated vector management
KAP	Knowledge, attitudes, and practices
LLIN	Long-lasting insecticide-treated net
LMIS	Logistics management information system
LMO	Logistics management office
MCH	Maternal and child health
MDG	Millennium Development Goals
MERG	Monitoring and Evaluation Reference Group
MIP	Malaria in pregnancy
MIS	Malaria Indicator Survey
MOH	Ministry of Health
MOP	Malaria operational plan
MOPDD	Malaria and Other Parasitic Diseases Division
MPPD	Medical Procurement and Production Division
MSP	Malaria Strategic Plan
NFM	New Funding Model
NMCP	National Malaria Control Program (called the Malaria and Other Parasitic Diseases Division in Rwanda)

NPO	National program officer
NRL	National Reference Laboratory
OP	Organophosphate
PCV	Peace Corps Volunteer
PEPFAR	President's Emergency Plan for AIDS Relief
PMI	President's Malaria Initiative
PBF	Performance-based financing
QA/QC	Quality assurance/quality control
RBC	Rwanda Biomedical Center
RBF	Results-based financing
RBM	Roll Back Malaria
RDT	Rapid diagnostic test
SBCC	Social and behavior change communication
SIS-COM	<i>Système Informatique de Santé Communautaire</i> (community information system)
SP	Sulfadoxine-pyrimethamine
SPR	Slide positivity rate
STOMP	Stomping out Malaria in Africa
UNICEF	United Nations Children's Fund
USAID	U. S. Agency for International Development
USG	United States Government
WHO	World Health Organization

I. EXECUTIVE SUMMARY

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

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

Rwanda was selected as a PMI focus country in FY 2007.

This FY 2017 Malaria Operational Plan presents a detailed implementation plan for Rwanda, based on the strategies of PMI and the Malaria and Other Parasitic Diseases Division (MOPDD) MOPDD. It was developed in consultation with the MOPDD and with the participation of national and international partners involved in malaria prevention and control in the country. The activities that PMI is proposing to support fit in well with the National Malaria Control strategy and plan and build on investments made by PMI and other partners to improve and expand malaria-related services, including the Global Fund to Fight AIDS, Tuberculosis, and Malaria (Global Fund) malaria grants. This document briefly reviews the current status of malaria control policies and interventions in Rwanda, describes progress to date, identifies challenges and unmet needs to achieving the targets of the MOPDD and PMI, and provides a description of activities that are planned with FY 2017 funding

The proposed FY 2017 PMI budget for Rwanda is \$18 million. PMI will support the following intervention areas with these funds:

Entomologic monitoring and insecticide resistance management:

The current 2013–2018 Malaria Strategic Plan recognizes two objectives related to vector control. First, to control malaria in the 'highest burden' districts via IRS or use of ITNs, and second to mitigate malaria vector pyrethroid insecticide resistance. PMI has supported entomologic monitoring in Rwanda since

2007, including vector species composition and density, seasonality, and insecticide resistance monitoring. Over time, 12 entomologic monitoring sites have been established in Rwanda and now provide the necessary longitudinal data for optimizing Rwanda's vector control interventions.

With FY 2017 funds, PMI will continue to support entomologic monitoring at 12 sites across Rwanda. Monthly data collection will be conducted in IRS districts and include adult mosquito collections, such as human landing catches, to assess vector species distribution and density, seasonality, and behavior. WHO cone bioassays will be conducted to assess the quality of IRS operations and to determine insecticide decay rates; insecticide resistance monitoring will be carried out at four sites.

Insecticide-treated nets (ITNs):

Rwanda achieved universal coverage of insecticide-treated mosquito nets (ITNs) in 2011 for all age groups. Since then, PMI has collaborated with the MOPDD and the Global Fund (GF) to continue the procurement and distribution of ITNs. PMI procures ITNs for routine distribution. These ITNs are distributed through antenatal clinics (ANCs), expanded program for immunization clinics (EPI) and boarding schools. In 2015, PMI procured 1,000,000 ITNs to support a rolling mass distribution campaign planned for 2016. It is expected that in 2016 over six million ITNs will be distributed as part of a planned mass campaign with Global Fund and PMI support.

With FY 2017 resources, PMI will procure about one million ITNs, some of which will be distributed through EPI and ANC. PMI will continue net durability and insecticide resistance monitoring as well as promote social and behavior change communication (SBCC) activities at national and community levels to ensure correct and consistent net use.

Indoor residual spraying (IRS):

Rwanda's strategy to reduce malaria transmission is aligned with PMI guidance and is achieved in part through indoor residual spraying (IRS) of targeted high-burden districts and communities identified using data from the Ministry of Health's (MOH) health management information system (HMIS). In 2014, two spray rounds (February/March and September/October) were conducted and protected approximately 1 million residents in three districts bordering malaria-endemic neighbors. The coverage rate was more than 98% of the 242,589 targeted structures. A spray round in February–April 2015, which was implemented in collaboration with the Global Fund, protected 99% of the targeted population and covered 250,000 structures. A spray round occurred in September–October 2015 using a carbamate insecticide and a second round began in February 2016.

With FY 2017 funds, PMI will deploy IRS for approximately 576,000 structures in high-burden districts identified by HMIS malaria surveillance and the Government of Rwanda (GOR) has committed additional financial support to cover these districts with IRS. PMI will continue to support insecticide resistance monitoring to guide the selection of the most appropriate IRS insecticide.

Malaria in pregnancy (MIP):

Rwanda supports two out of the three prongs of WHO-recommended strategy to reduce malaria in pregnancy (MIP). The MOPDD discontinued intermittent preventive treatment of malaria for pregnant women (IPTp) in 2008 due to significant parasite resistance to sulfadoxine-pyrimethamine. PMI continues to support other interventions to prevent and encourage early detection and treatment of malaria in pregnant women, including procurement of ITNs and distribution to pregnant women at ANCs, training of health care workers on focused antenatal care (FANC), and support to a cadre of maternal health community health workers (*Agents de Santé Maternelle* [ASMs]) who monitor pregnant women in their village and encourage them to attend their ANC appointments. The Maternal Child Health (MCH) Program, in coordination with the MOPDD, the Community Health Program, and the

EPI, with support from PMI and other partners, has developed an integrated approach to deliver quality health care for pregnant women; FANC is now available nationwide. The MOPDD also works with MCH to deliver folate/iron to improve pregnancy outcomes.

PMI is supporting the MOPDD to implement and evaluate a pilot program of intermittent screen and treat (IST) for pregnant women in two high transmission districts to mitigate the risk of malaria for pregnant women. Results of the pilot will help guide Rwanda's future MIP program.

With FY 2017 funding, the MOPDD, PMI, and partners will continue to support early diagnosis and treatment of MIP and ITN procurement and distribution to pregnant women. PMI, in coordination with the United States Government's MCH programs and the MOH, will also continue to facilitate supervision of ASMs by health center supervisors, contribute to their training, evaluate performance of community outreach to pregnant women, and strengthen linkages between ASMs and health facilities to promote ITN use, ANC attendance, and early detection and treatment of malaria in pregnant women.

Case management:

In 2006, the MOPDD adopted artemether-lumefantrine (AL) as the first-line treatment for uncomplicated malaria and in 2009 adopted the WHO recommendation to require diagnostic confirmation of all fever cases. Historically, the Global Fund procured the majority of ACT and RDT needs for Rwanda with PMI and the GOR supplementing commodities as necessary. However there are concerns about future funding levels from the Global Fund since given Rwanda's economic growth and status as a pre-elimination country for malaria.

PMI has prioritized capacity building at the community level and together with the GOR supports the integrated community case management (iCCM) approach. Partnering with the MCH program, Rwanda ensures children under five years of age have access to treatment of malaria, diarrhea, and pneumonia through community health workers (CHWs) and health facility staff. According to 2015 data, iCCM by CHWs accounted for an estimated 10% of all malaria treatment in Rwanda. Despite the recent increase in malaria in the country, the majority of the cases have been in children over five years and adults according to an internal analysis done by the NMCP. In response to the increase in cases, Rwanda has recently and temporarily opened community-based treatment to children over five years of age and adults.

With FY 2017 funds, PMI has committed to supplying all RDTs for use at the community level and a portion of the national needs for ACTs. The GOR will supplement with Global Fund and national resources as necessary. Additionally, PMI procures parenteral artesunate for severe malaria treatment. PMI will continue to support iCCM in seven districts and fund SBCC activities to promote timely treatment seeking and proper use of ACTs. Ongoing support for first- and second-line antimalarials therapeutic drug efficacy monitoring will ensure medicines are potent and monitor for parasite resistance. At the health facility level, PMI will concentrate on strengthening capacity in laboratory diagnostics, supply chain management, and the MOPDD's supervisory role to monitor and reinforce the correct use of ACTs, especially by CHWs. At the national and district levels, PMI will strengthen quality assurance/quality control (QA/QC) systems for accurate malaria diagnosis.

Health systems strengthening and capacity building:

Rwanda has a strong commitment to improve health through a wide range of health systems strengthening efforts. PMI contributes to health system strengthening by MOPDD capacity building through participation of staff in international meetings, support of seconded staff; continued strengthening of the National Reference Laboratory, and Logistics Management Information System;

and the integration of service delivery within other programs, such as MCH and EPI. PMI also works with the Peace Corps to help strengthen capacity of Peace Corps Volunteers and local communities to understand and prevent malaria via educational programs and activities. In addition, PMI supports a Field Epidemiology and Laboratory Training Program (FELTP), where MOH trainees have malaria specific training and participate in malaria control efforts. During the two-year program, trainees can be posted with the MOPDD to work daily on malaria control policy and participate in malaria field investigations.

With FY 2017 funds, PMI will work with the MOPDD and other malaria stakeholders to consolidate gains made in malaria control and help the MOPDD to continue the scale-up of malaria control interventions and also enhance surveillance, monitoring, and evaluation and early epidemic detection and response. PMI will continue to support capacity strengthening at all levels but more specifically at the entomological laboratory, commodity procurement systems, and data analysis to inform policy and interventions. PMI will also continue to support malaria focused programs with Peace Corps Volunteers and the FELTP.

Social and behavior change communication (SBCC):

PMI funds Rwanda's national malaria communications strategy which strives to ensure 95% of the population has correct knowledge of malaria prevention and control by 2018. All behavior change communication activities are directed by the Rwanda Center for Health Communication within the MOH. This center coordinates, integrates, and harmonizes health messages across the individual MOH programs. PMI has been supporting the MOPDD to develop a new SBCC communication strategy. It was anticipated that the strategy would be completed in 2015 but there have been delays in the process and the strategy is expected to be completed in 2016. PMI supports numerous health messages across various channels such as interpersonal communication, radio, print, billboards, and video screenings.

With FY 2017 funds, PMI will support nationwide SSBCC activities at the Health Communication Center and MOPDD through a partner to implement their SBCC strategy upon completion. PMI will also support community-level SBCC focusing on community mobilization and engagement using interpersonal communication, mass media through community radio, and mobile cinema and dramas. Rwanda will continue SBCC messaging focusing on messaging encouraging people to sleep under ITNs and visiting the health facility or community health worker for fever diagnostics and treatment.

Surveillance, monitoring, and evaluation (SM&E):

PMI, the President's Emergency Plan for AIDS Relief (PEPFAR), and other USAID health activities have all contributed to strengthening Rwanda's SM&E systems resulting in one of the strongest, most comprehensive SM&E systems in Africa. HMIS data are complete, accurate, and timely for routine program monitoring, including malaria. MOPDD staff analyze and use these data to make evidence-based programmatic decisions and produce geospatial illustrations of malaria distribution and trends over time. PMI, Global Fund, and the MOPDD in collaboration with the HMIS Unit in the Rwanda Biomedical Center (RBC) also conduct annual data quality audits (DQAs) nationwide to validate HMIS data. Malaria data from health centers, referral hospitals, and the private sector are integrated in the HMIS whereas data from CHWs implementing iCCM are entered in the Community Information System (SIS-COM) which then is aggregated and integrated within the HMIS.

After experiencing a large decline in malaria cases from 2005 to 2011, Rwanda is currently experiencing an increase in reported malaria cases, from a low of 200,000 malaria cases reported in 2011, to over 2.6 million cases reported in 2015. According to preliminary analysis conducted by the MOPDD, the vast majority of this increase is among persons over five years of age; a population with increasing access to malaria diagnosis and effective treatment. Rwanda is taking actions to address this upsurge. According

to the Rwanda Demographic and Health Survey (DHS) 2014-2015 only 43% of the population has one net for every two people. Likewise, IRS is currently being implemented in only five districts since the change from focal to blanket spraying this year. Both of these issues will be addressed through more aggressive programming this year, with a mass distribution of 6 million ITNs planned for 2016-2017 and a shift to the more effective insecticide pirimiphos-methyl. The MOPDD's own analysis of the situation indicated that the majority of the cases were in older children and adults, so they have opened up the CHW system to provide services to patients of all ages for the time being. The exact causes of this increase are not well characterized and the MOPDD, PMI, and other malaria stakeholders are currently investigating the drivers of this increase to respond appropriately.

With FY 2017 funding, PMI will continue to support the MOPDD to strengthen evidence-based decision-making throughout the health system and strengthen surveillance, especially at the decentralized district levels. The GOR has prioritized decentralization and with the goal of achieving malaria pre-elimination by 2018, thus it is pivotal to build the ability of districts to analyze and respond to upsurges in malaria. Therefore, PMI will support the MOPDD in strengthening decentralized M&E capacity. PMI will also continue to work with the MOPDD to implement and evaluate, "reactive case detection" where index cases at health centers in epidemic-prone districts are investigated at the household level by a team from the district. PMI will also contribute funding for DHS household surveys in 2017-2018.

Operational research (OR):

In previous fiscal years, PMI supported a three-year prospective net durability monitoring activity to examine the physical durability and insecticide residual efficacy of ITNs, although this was not formally considered OR. The results showed that over 50% of both polyester and polyethylene ITNs failed due to holes or lack in durability between 18 and 24 months in the field. Results from these studies directly impact Rwanda's current programming for maintaining universal coverage (see MIP and ITN sections).

Additionally, PMI supported a study to determine the prevalence of malaria among pregnant women. This cross-sectional study included six rural health centers with varying malaria transmission intensity and included malaria testing via microscopy, RDT, and polymerase chain reaction (PCR). The results show a low national malaria burden among pregnant women (microscopy: 1.6%, RDT: 2.5%, and PCR: 5.7%). This year, using FY 2015 funds, PMI plans to support the MOPDD to implement an intermittent screen and treat (IST) pilot program in two high transmission districts for pregnant women. Results of the pilot will help guide Rwanda's future MIP programming. No FY 2017 resources are being requested for OR.

II. STRATEGY

1. Introduction

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

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

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2. Malaria situation in Rwanda

Rwanda is a small (26,338 km²), land-locked country in the Great Lakes region of Eastern Africa, bordered by Uganda, Burundi, the Democratic Republic of the Congo, and Tanzania. It has a population of approximately 12 million people (projection from 2012 census results), making it the most densely

populated country in continental Africa. Administratively, the country is made up of 30 districts, which are divided into sectors, cells (*cellules*), and 14,953 *umudugudus* (villages of 50–100 households). The entire population is at risk for malaria, including an estimated 1.8 million children under five years of age (14.6% of the population) and 443,000 pregnant women/year (30.2% standardized birth rate; projections based on 2012 census results).

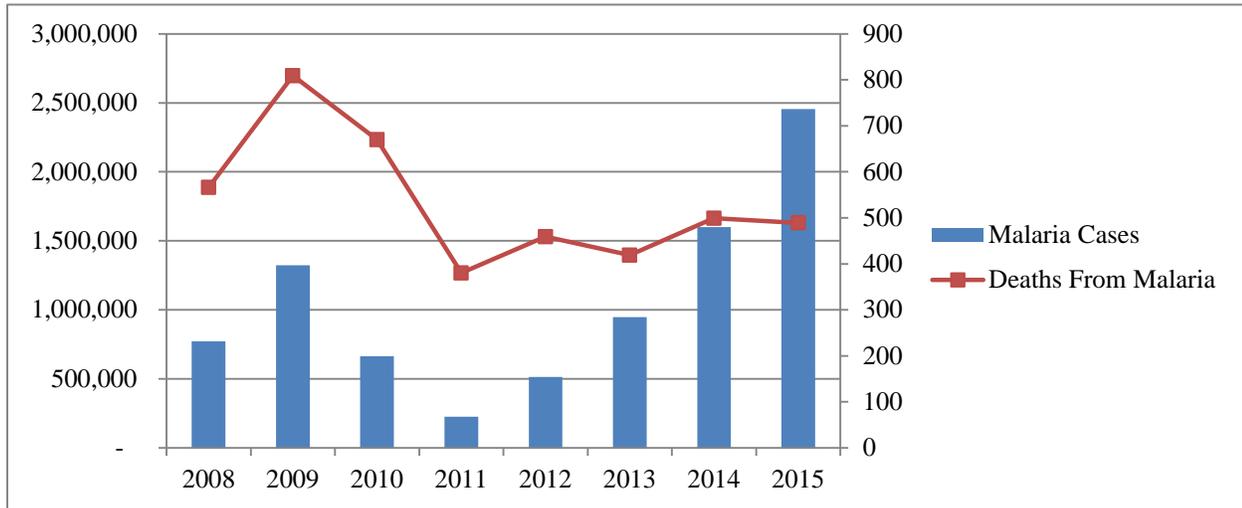
According to MOPDD's health management information system (HMIS) data from June 2015, the MOPDD has classified 19 of the country's 30 districts as high-burden with 11 of these districts accounting for over 76% of malaria disease. Of these, five high-burden districts, Bugesera, Gisagara, Gatsabo, Kirehe, and Nyagatare, were sprayed in February-March 2016 with PMI, Government of Rwanda (GOR), and Global Fund resources. The MOPDD has also targeted eight districts for pre-elimination activities: Burera, Gakenke, Gisagara, Musanze, Ngororero, Nyabihu, Nyagatare, and Rubavu. However, given the recent increase in malaria throughout the country, the MOPDD will review the suitability of the ongoing pre-elimination activities. Malaria transmission occurs year-round with two peaks from May to June and from November to December in the endemic zones following distinct rainy seasons. In addition to climate and altitude, other factors that influence malaria in the country include high human concentration near vector habitats (e.g., boarding schools in proximity to marshlands); population movement (especially from areas of low to high transmission); irrigation schemes (especially in the eastern and southern parts of the country); and cross-border movement of people (especially in the eastern and southeastern parts of the country).

From 2005 to 2011, Rwanda achieved significant reductions in the burden of malaria through the successful implementation and scale-up of malaria control interventions. In a survey conducted in 2005, Malaria was the number one etiology for morbidity of children under age five. In 2008, malaria dropped to the number three cause of morbidity, and by 2012 dropped further to number four for children under age five. According to data provided by the Rwanda Health Management Information System (HMIS), overall malaria incidence declined 86% between 2005 and 2011; outpatient malaria cases declined 87%; inpatient malaria deaths declined 74%; and malaria test positivity rate (TPR) declined 71%. According to the 2010 Rwanda Demographic and Health Survey (DHS), malaria prevalence decreased from 2.6% in 2008 to 1.4% in 2010 in children under five years of age. Over 95% of total reported malaria cases are laboratory-confirmed.

Since 2011, Rwanda has seen an 11-fold increase in reported malaria cases, from 225,176 cases reported in 2011 to 2,662,706 in 2015. According to the MOPDD's HMIS data, the number of malaria cases reported in 2015 was greater than the number reported in 2014 in all 30 districts. Of these, 11 districts, primarily in the Eastern and Southern regions, had a large increase in malaria cases (Figure 1). According to preliminary analysis conducted by the MOPDD¹, the vast majority of this increase is among persons over five years of age.

¹ Data were not shared with PMI for inclusion in the MOP.

Figure 1. Malaria deaths and malaria cases reported to the Rwanda HMIS, 2008–2015



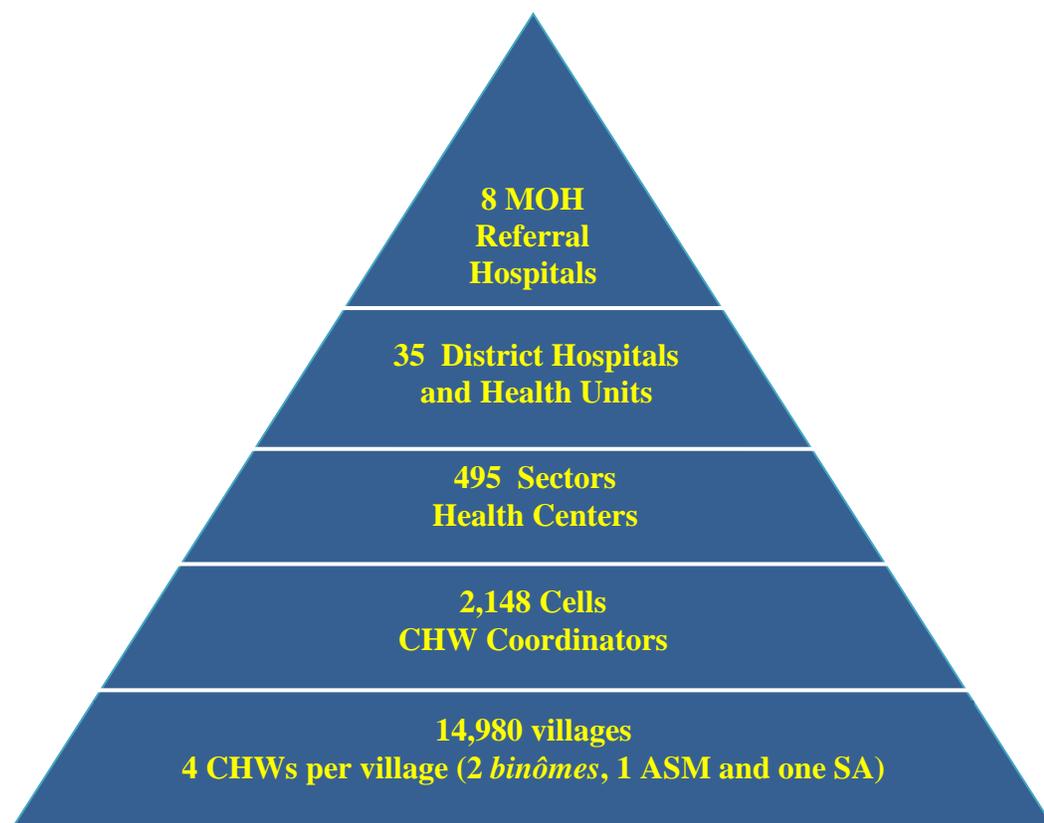
There is a need to conduct further analysis, however the MOPDD attributes the increase in cases to a number of factors including the increase of total number of patients seeking health care in health facilities, increased rainfall and agricultural environmental modification, significant drop in ITN coverage (43% coverage of one ITN for every two people)², mosquitoes’ resistance to pyrethroid insecticide, increased number of health facilities reporting into the system, and increased availability of RDTs and ACTs among other causes. It also important to note that malaria has been increasing in the eastern African region, thus it will be challenging for Rwanda to control malaria while trans-border exchanges are intense.

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

The Rwanda health system has five tiers and is led by the MOH (Figure 2). The MOH supports, coordinates, and regulates all interventions whose primary objective is to improve the health of the population. The mission statement of the MOH is “to provide leadership of the health sector to ensure universal access to affordable preventive, curative, and rehabilitative health services of the highest attainable quality.”

² Rwanda DHS 2014-2015.

Figure 2. Current Rwanda health system overview



CHW: community health worker; *binôme*: two community health workers (male and female) in a village who implement iCCM; ASM: *Agent de santé maternelle*; SA: social affairs community worker

Services are provided at different levels of the health care system (community health, health posts, health centers, district hospitals, and referral hospitals) and by a variety of providers, including public, faith-based, private-for-profit, and non-governmental organizations.

Health facilities

Public health facilities represent about 65% of the total number of health facilities in Rwanda; an estimated 21% are private dispensaries, 11% are private medical clinics, 2% are community-owned, and 1% are managed by parastatal organizations. The number of public health facilities in Rwanda at the end of 2015 was 655, which includes 495 health centers and 35 district hospitals. There are an estimated 302 private facilities. All these facilities report data into the HMIS. Figure 3 graphically represents the proportions of different Rwandan health facilities and these are well distributed throughout the country as shown in Figure 4.

Figure 3. Distribution of health facilities — Rwanda, 2015³

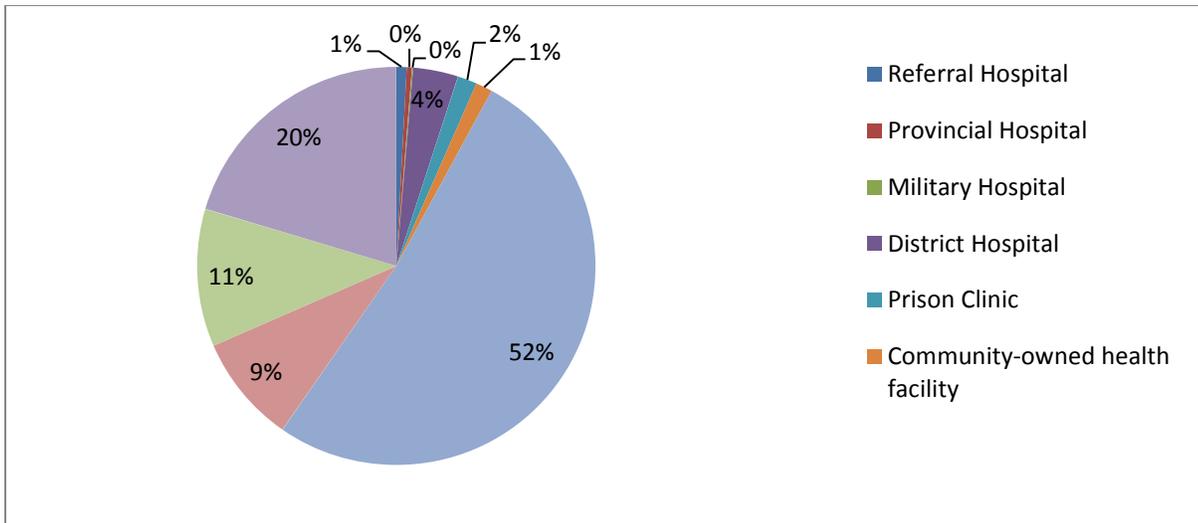
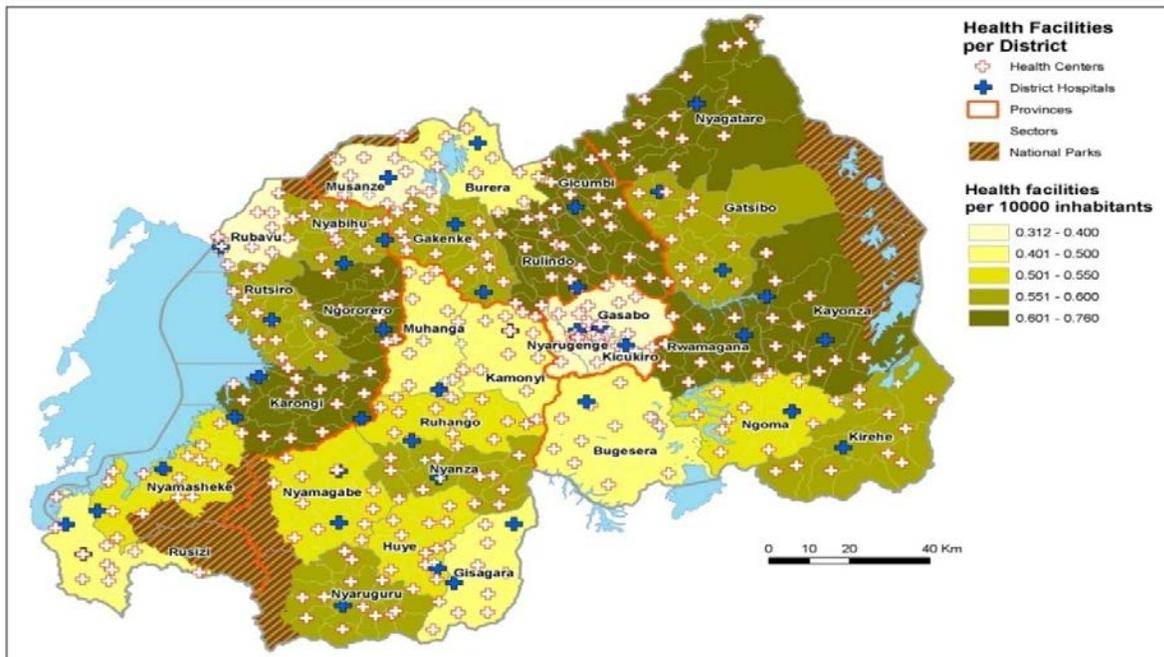


Figure 4. Geographical distribution of Rwandan health facilities per district



³ Source: Facilities registered in RHMIS; data provided by MSH.

Referral system

An extensive network of public sector health centers exists to meet the health needs of Rwanda's population. This network is structured as a pyramid with eight referral hospitals at the apex supported by four provincial hospitals and 495 health centers. Health centers use a network of 45,000 volunteer community health workers (CHWs): 30,000 *binômes* (two community health workers, one male and one female) who implement community case management and 15,000 *agents de santé maternelle* (ASM); as well as other community-based associations for community outreach activities. Referral hospitals also serve as teaching institutions for doctors and pharmacists.

All health centers and facilities have at least one functional microscope and reagents needed for the diagnosis of malaria and CHWs use RDTs. The referral system is anchored by the provision of an average of four ambulances per district as well as the CHWs' access to cell phones. Table A summarizes the services provided at each type of health facility.

Table A. Minimum package of services in different types of health facilities

Health Facilities	Minimum Package of Services Provided
National Referral Hospital	Advanced inpatient/outpatient services, surgery, laboratory, gynecology, obstetrics, and radiology; specialized services including ophthalmology, dermatology, ear nose and throat, stomatology, and physiotherapy
District Hospitals	Inpatient/outpatient services, surgery, laboratory, gynecology, obstetrics, and radiology
Health Centers	Prevention activities, primary health care, inpatient, referral, and maternity
Dispensaries	Primary health care, outpatient, and referral
Health Posts	Outreach activities (i.e., immunization, family planning, growth monitoring, ANC)

Administratively, Rwanda consists of four provinces and Kigali City, 30 districts, 416 sectors, 2,148 cells, and 14,980 villages. The 2014-2015 DHS showed that insurance coverage has remained stable since the 2010 DHS and that 79% of the households have at least one family member with health insurance and that among those insured 97% have community health insurance (*mutuelles*). Each district has at least one district hospital and an average of one health center per 20,000 people.

4. National malaria control strategy

The MOPDD, in collaboration with Roll Back Malaria (RBM), WHO, the Global Fund, PMI, and other partners, wrote the 2013–2018 Malaria Strategic Plan (MSP). It addresses challenges and gaps identified in a Malaria Program Review, which was completed in March 2011, incorporates recommendations from a malaria pre-elimination forum that took place in September 2012, includes four gap analysis workshops carried out by the MOPDD in collaboration with all stakeholders, and has been reviewed and validated both through a Roll Back Malaria MSP process as well as a Joint Assessment of National Health Strategies review.

Under the 2013–2018 MSP, the MOPDD assumes the lead coordination role and takes responsibility for the decentralization of malaria control and prevention activities throughout the country. The MOPDD coordinates the contributions of all health partners, donors, and private sector stakeholders.

The vision of Rwanda’s 2013–2018 MSP is to be free from malaria as a way to contribute to socio-economic development. It has targeted new goals to achieve malaria pre-elimination nationwide and near zero malaria deaths by 2018, by reducing malaria morbidity to pre-elimination levels of less than 5% test positivity rate among febrile patients and by lowering mortality by 50% from the 2011 baseline level.

The Rwanda MSP 2013–2018 goal is:

- To achieve near zero deaths from malaria and reduce malaria burden to achieve a slide positivity rate (SPR) less than 5% in fever cases by 2018.

To achieve this goal, six specific objectives have been set out:

- Objective 1: By 2018, at least 90% of population at risk will be effectively protected with locally appropriate vector control interventions.
- Objective 2: By 2018, all malaria cases will be tested with a quality assured diagnostic method and promptly treated in line with the national guidelines.
- Objective 3: By 2018, malaria morbidity measured by slide positivity rate will be less than 5%, with six initial districts achieving this by 2016.
- Objective 4: By 2018, all health units will report timely, completely, and accurately on key malaria indicators.
- Objective 5: By 2018, effective program management and coordination will be expanded to all levels including multi-sectorial and regional partnerships.
- Objective 6: By 2018, 95% of the population will have correct knowledge of malaria prevention and control.

The strategy’s goals and objectives are aligned with three of the GOR’s primary strategic documents: Vision 2020, the overarching strategy used to guide long-term development in Rwanda; the Economic Development and Poverty Reduction Strategy (EDPRS) for 2013–2018; and Rwanda’s mid-term development plan, which in turn serves as the framework for the national Health Sector Strategic Plan III (HSSP) for 2012–2018 (Figure 5).

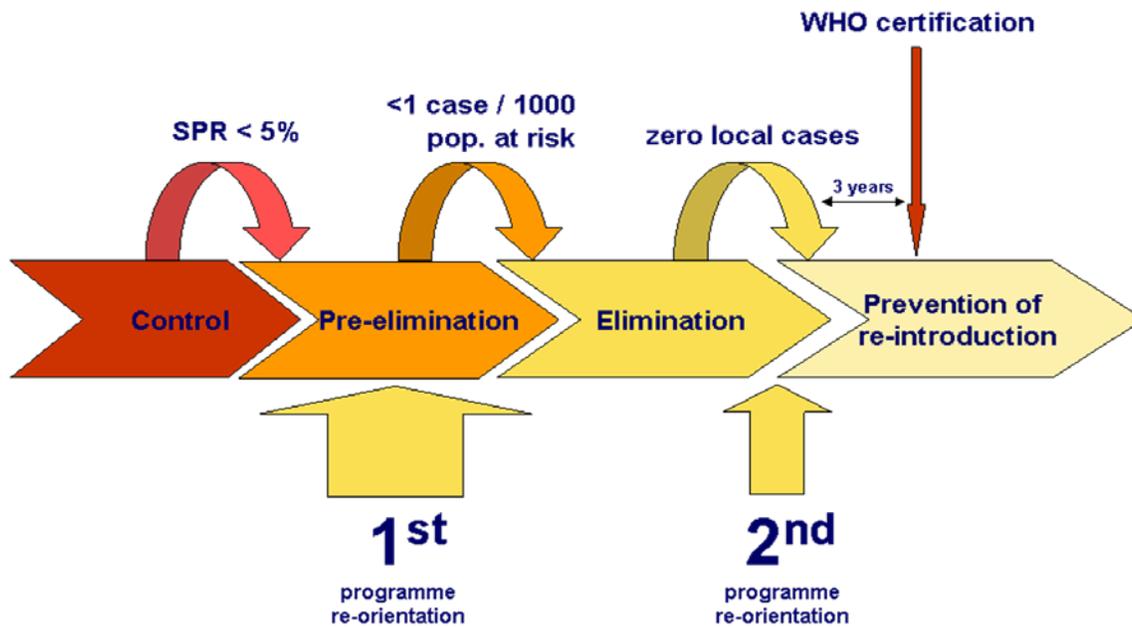
Figure 5. Rwanda’s current development and health strategic framework



EDPRS, Economic Development and Poverty Reduction Strategy
 NSP, National Strategic Plan
 HSS, Health System Strengthening

The MSP focuses on shifting the paradigm from malaria control to enhanced surveillance, investigation, and response (Figure 6), addresses gaps observed in the implementation of Rwanda’s previous strategies, and provides detailed approaches for achieving malaria-related results and targets. This plan aims to sustain progress, consolidate gains, and transition from the scale-up of malaria control and prevention activities to a targeted identification and response paradigm where enhanced malaria surveillance identifies, investigates, and responds to cases to stop transmission and shrink the malaria map in Rwanda.

Figure 6. WHO stages in malaria control



5. Updates in the strategy section

Since the last MOP:

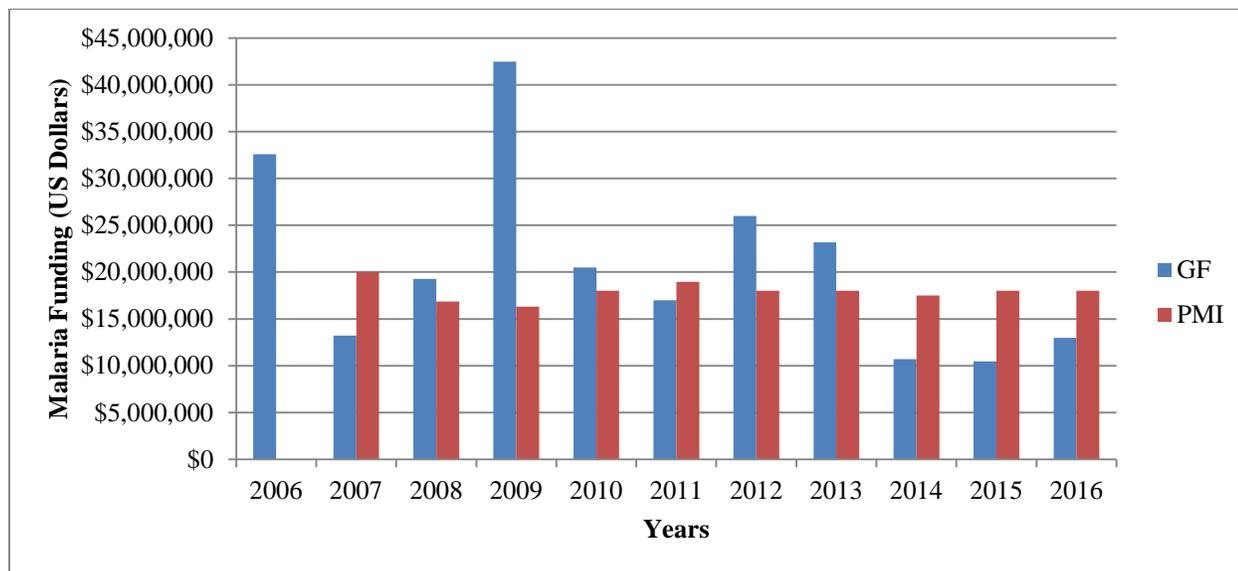
- The GOR implemented the 2014–2015 DHS which includes key malaria indicators, parasite prevalence, and anemia. The final report was launched in May 2016 and the data are now available. The report can be accessed at: www.dhsprogram.com
- The MOPDD has developed a concept note for a mid-term review of the Malaria Strategic Plan (MSP). It is expected that the review will be undertaken in 2016 (May-October). The purpose of this assessment is to review the implementation of the Rwanda MSP, assess the malaria program's performance and make recommendations for improvement for the remaining period of the strategic plan.
- To address the increase in malaria cases over the past few years, the MOPDD prepared a Malaria Contingency Plan (released in February 2016) to complement the Malaria Strategic Plan 2013-2018. The plan emphasizes continuing with the proven and effective interventions laid out in the MSP, including use of ITNs, IRS, prompt case management, iCCM, and SBCC. The plan highlights the use of proven interventions as well as a few new interventions namely:
 - Urgently increasing effective LLIN coverage by ensuring availability of LLINs (i.e. procurement) and their effective distribution through campaigns (next universal coverage campaign: August-December 2016), and routine services at health centers (ANC, EPI)
 - Scaling up home-based management of malaria for adults countrywide
 - Indoor residual spraying with insecticides in eight districts
 - Emphasizing the involvement of other GOR agencies and resources to help in the fight against malaria.

6. Integration, collaboration, and coordination

Funding and integration with key development partners

PMI and the Global Fund provide the majority of malaria funding to Rwanda (Figure 7). Other development assistance for malaria comes from RBM and WHO. The Global Fund malaria grants support the expansion of community case management with RDTs, antimalarials for treatment at health facilities and in the community, procurement of ITNs, the strengthening of monitoring and evaluation systems, and resources for health communications, health systems strengthening (HSS), HMIS, and program management operating costs. The MOPDD had one Global Fund malaria grant from July 2011 through June 2014, and then received a \$6 million Global Fund interim funding grant to cover July 2014 to December 2014 to ensure continuity of operations until the full roll-out of the NFM in January 2015. The new Global Fund support is for the start of results-based financing (RBF), which covers the 2015–2017 allocation period and is set at \$40 million.

Figure 7. Global Fund and PMI support to Rwanda, 2006–2016⁴



Sources: www.theglobalfund.org; www.pmi.gov

Collaboration within the Global Health Initiative and other USG programs

PMI functions within the GHI strategy and contributes to strengthening health systems for delivery of GHI programs of maternal, neonatal and child health, and reproductive health. At community level, malaria community-based interventions such as net distribution, hang-up campaigns, and house spraying use health workers that deliver a package of other GHI initiatives, such as community-based drug distribution for malaria, pneumonia and diarrhea, and behavior change communication for positive health behaviors.

PMI works in collaboration with the President’s Emergency Plan for AIDS Relief (PEPFAR) on cross-cutting programmatic issues related to HIV/AIDS and malaria interventions. This has included support to the Medical Procurement and Distribution Division (MPDD) of the Ministry of Health and co-funding, since 2012, the Field Epidemiology & Laboratory Training Program (FELTP). In addition, PMI supports Peace Corps Volunteers (PCVs) through the PMI/Peace Corps Stomping out Malaria in Africa (STOMP) initiative to support malaria prevention and control activities. These include the promotion of behavior change communication activities aimed at improving use of ITNs and promotion of early health-seeking behavior.

Preliminary planning for Global Health Security Agenda (GHSA) was initiated in May 2016. A three-day workshop brought together multi-sectoral professionals to assess where Rwanda is standing on issues that help attaining a world safe and secure from global health threats posed by infectious diseases. GHSA aims to address global health security risks and assure global preparedness vis-a-vis emergence and spread of new microbes, rapid spread of diseases across borders due to geographic-based integrations, free movement of people, migration patterns of animals and accidental release or theft/illicit use of dangerous microbes. At this time, no USG funds are committed to GHSA activities in Rwanda.

⁴ Figures are planned amounts per fiscal year.

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

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

1. Reduce malaria mortality by one-third from 2015 levels in PMI-supported countries, achieving a greater than 80% reduction from PMI’s original 2000 baseline levels.
2. Reduce malaria morbidity in PMI-supported countries by 40% from 2015 levels.
3. Assist at least five PMI-supported countries to meet the WHO’s criteria for national or sub-national pre-elimination.⁵

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

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

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

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

8. Progress on coverage/impact indicators to date

Health Management Information System (HMIS)

The primary sources of information used to track trends in malaria prevalence and coverage indicators are aggregated case reports from health facilities and national household surveys. The HMIS collects monthly data on the number of reported cases (presumed and confirmed) of malaria and deaths

⁵ http://whqlibdoc.who.int/publications/2007/9789241596084_eng.pdf

attributed to malaria by age group from over 640 health centers and district hospitals. Rwanda has a community information system (SIS-COM) which collects data from community health workers and integrates the data into HMIS. Performance-based financing and monthly data quality audits (DQAs) are conducted, showing concordance between HMIS reports and clinic registers and encouraging reporting completeness. Based on HMIS data, Rwanda saw 84% fewer malaria cases from 1.5 million in 2005 to an unprecedented low of 225,176 in 2011, representing a profound reduction in transmission. However over the last four years, Rwanda observed a larger number of reported malaria cases but a relatively unchanged malaria case fatality rate.

Fluctuations in numbers of reported malaria cases are seen in the HMIS data (see Table B). From 2009 to 2011, there was a steep decline in total malaria cases reported, a 45% decline in the number of malaria deaths, and a 75% decrease in the test positivity rates. Since 2011, the number of cases has increased 11-fold. At least part of the increase in reported cases may be related to a surveillance phenomenon: with increased access to health care, more patients are being seen although transmission is not increasing; and reporting rates to the HMIS have increased as more health facilities report into the system (private facilities started reporting into the system in 2014). Non-surveillance factors may include: changing weather with more rainfall and changes in ambient temperature which is likely to have affected the density of mosquitoes during this time frame; increased importation of malaria cases leading to increased transmission (all of Rwanda’s neighboring countries have high rates of malaria). Increasing resistance of mosquitoes to insecticides (pyrethroids) or the use of nets distributed in 2012-2013 that had to be replaced may also have contributed to the increase. In addition, in 2015 media campaigns encouraged malaria testing for everybody.

In 2015, 2,662,706 cases were reported; 99% were confirmed, with a test positivity rate of 37%. According to the HMIS data, the 11 endemic districts accounted for 76% of all malaria cases reported. Despite the increased number of reported cases, the case fatality rate (malaria deaths / malaria admissions) has continued to remain relatively unchanged (see Table B).

Table B. Summary of malaria data reported through the HMIS, 2009–2015

Indicator	2009	2010	2011	2012	2013	2014	2015
Total cases reported	1,322,622	663,785	225,176	487,150	949,966	1,598,055	2,662,706
Reported number of deaths	809	670	380	459	419	499	489
% confirmed ¹	51%	94%	99%	99%	99%	99.9%	99.9%
% morbidity ²	15.2%	7.8%	3%	5.9%	8.5%	14.8%	17%
Test positivity rate ³	54.3%	24%	13.1%	15.6%	29.2%	29.2%	37%
Case fatality rate ⁴	2.3%	2.5%	3.5%	2.5%	1.8%	Still analyzing	Still analyzing

¹ Proportion of suspect cases that received laboratory confirmation by microscopy or RDT.

² Until 2010, % morbidity relates to % of fever cases with malaria. In 2011, the denominator changed from fever cases to all outpatient cases. It represents confirmed malaria new cases as a percentage of all outpatient new cases.

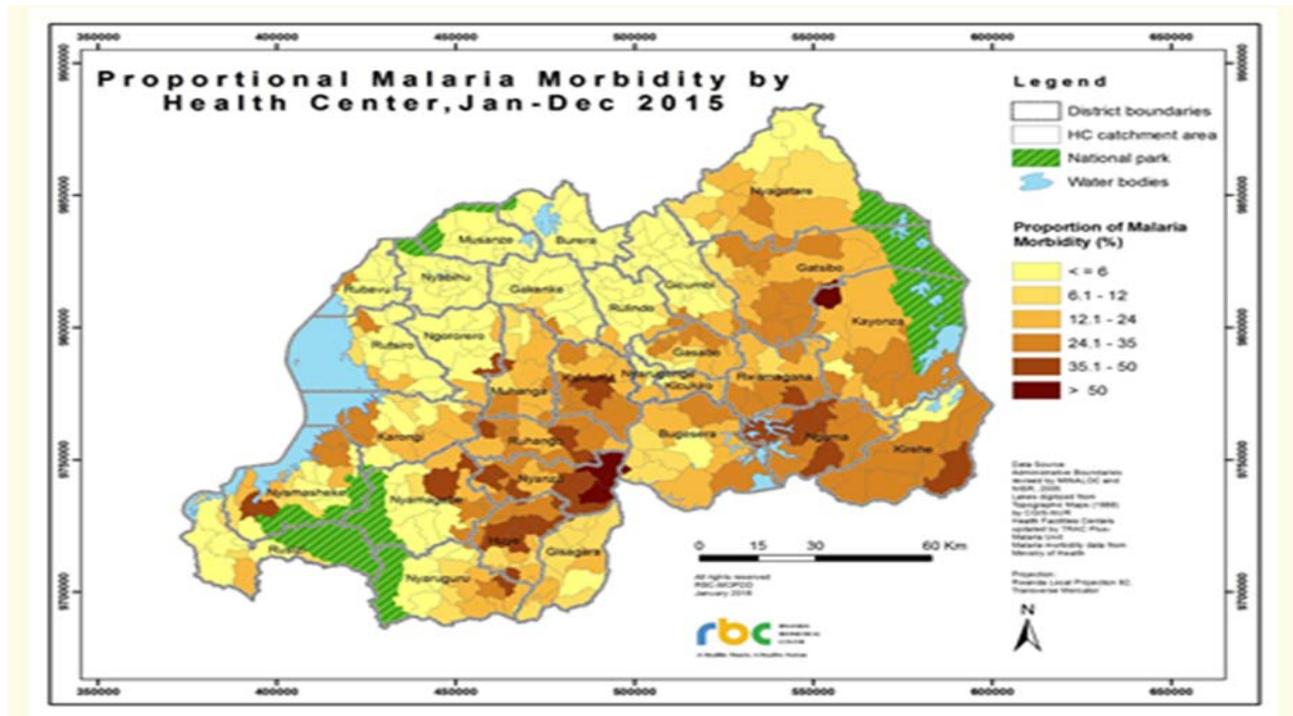
³ Test positivity rate: malaria positive tests divided by total tests of suspect cases.

⁴ Defined as $\frac{(\text{malaria deaths})}{(\text{malaria admissions})}$; MOPDD is still analyzing 2015 data

Figure 8 depicts the increased malaria burden in 2015, as measured by test positivity rates from health centers throughout the country. Given its high diagnostic testing rates, the MOPDD uses these facility-

based test positivity rates instead of household-level parasite prevalence to stratify malaria burden by district and to monitor the impact of interventions.

Figure 8. Malaria test positivity rates by health center — Rwanda, 2015



National household surveys

The most recent household survey was the 2014-2015 standard DHS. The MOPDD also conducted an interim survey in late 2007 to early 2008, and a full DHS in 2010. The MOPDD also conducted a national Malaria Indicator Survey (MIS) in 2007–2008 and in 2013. These surveys show improvements in key prevention indicators, as summarized in Table C. It is important to note that 2.5 million ITNs were distributed after the 2010 DHS data collection, and therefore the 2013 MIS was conducted to update ITN ownership and use rates in Rwanda. These gains in bed net ownership and use parallel the reductions in malaria parasitemia observed in children under five over the same period: from 2.6% in 2007-2008 to 1.4% in the 2010 DHS. Due to the anticipated low parasitemia prevalence and large sample size required to obtain valid prevalence estimates, parasitemia measurements were not obtained in the 2013 MIS.

Table C: Evolution of key malaria indicators in Rwanda from 2005 to 2015

Indicator	2005 DHS	2007/8 DHS	2010 DHS	2013 MIS	2014/5 DHS
% Households with at least one ITN	15%	57%	82%	83%	81%
% Households with at least one ITN for every two people	N/A	N/A	N/A	N/A	43%
% Children under five who slept under an ITN the previous night	13%	58%	70%	77%	68%
% Pregnant women who slept under an ITN the previous night	17%	62%	72%	76%	73%
% Households in targeted districts protected by IRS*	N/A	94%	99%	99%	99%
% Children under five years old with fever in the last two weeks for whom advice or treatment was sought	26%	21%	16%	68%	57%
% Children under five with fever in the last two weeks who had a finger or heel stick	N/A	N/A	21%	30%	36%
% Children receiving an ACT among children under five years old with fever in the last two weeks who received any antimalarial drugs	N/A	5%	11%	11%	11%
% Women who received two or more doses of IPTp during their last pregnancy in the last two years	6%	17%	N/A**	N/A	N/A

* Percentage of households in targeted districts protected by IRS; data are from HMIS and MOPDD sources not DHS.

** Rwanda discontinued IPTp in 2008

9. Other relevant evidence on progress

In 2014, Rwanda conducted an impact evaluation of its malaria program over the preceding decade. This report documented the significant scale-up of malaria control programming, as seen in the indicators above. A ‘decomposition analysis’ was conducted to examine the determinants of change in under-five mortality. The results of this analysis showed that the observed increase in household bed net ownership, from 8% to 94% could explain as much as 45% of the observed decline in under-five mortality between 2000 and 2010, equivalent to a reduction of 37 deaths per 1,000 live births. In addition, the increasing percentage of mothers reporting ITN use between 2000 and 2010 could explain an additional 4.2% of overall mortality reduction.

10. Challenges and opportunities

Globally, Rwanda is recognized for the gains made in the health care sector in ensuring increased access to health care.⁶ The country has put systems in place ensuring increased health care access, especially for vulnerable populations. Key among these are community-based health insurance (CBHI) and performance-based financing (PBF) which offer a foundation for implementation of various health programs. However, one of the challenges facing the country is that the majority of PBF and CBHI funding is dependent on external sources. According to the HSSP III 2012–2018, one of the vulnerabilities is ensuring financial and institutional sustainability of these initiatives. The GOR remains committed to ensuring the achievement of Vision 2020 through reducing population growth, improving maternal health, and reducing the burden of malaria. Undoubtedly, a strong health care system will be essential to transition from malaria control to malaria pre-elimination.

The HSSP III articulates the health sector priorities over the next five years, which include sustaining the high levels of coverage with the various interventions and achievements already made against infectious diseases, improving access to health services, and institutional strengthening. The Rwanda 2014-2015 DHS showed high coverage of ITNs with at least 81% of households owning one mosquito net. According to the 2013 MIS a large proportion of the population has correct knowledge on causes and prevention of malaria and over 95% of all suspected cases are tested appropriately according to the HMIS. These achievements are important predictors to ensure that Rwanda achieves its 2018 goals and targets.

Rwanda has a strong community-based health care system with a large cadre of CHWs and a well-articulated and implemented strategy on iCCM of childhood diseases. CHWs play a pivotal role in the diagnosis and treatment of malaria at the village level. This is an invaluable opportunity that ensures utilization, accessibility, and appropriate and prompt treatment of malaria. Additionally, through the SIS-COM, CHWs are able to report timely data which informs and allows the MOPDD to quickly respond to community-level needs. Rwanda also has a strong HMIS with high reporting rates with additional health facilities reporting each year. These are building opportunities to strengthen surveillance in line with the MSP as the country seeks to achieve pre-elimination. The importance of accurate and timely data, subsequent analysis, and rational response as the malaria burden declines are paramount.

Rwanda's 2013–2018 MSP outlines the resources and key interventions needed to achieve malaria pre-elimination by 2018. However, the prospects of achieving pre-elimination are under threat given declining global resources and the reported increase in malaria cases throughout the country. Without the necessary resources to sustain the gains already made (both financially and programmatically), it will be difficult to reach the pre-elimination goal. It is critical that both domestic and global resources are mobilized and available to ensure that the targets and goals set in the MSP are achievable. For Rwanda's fiscal year July 1, 2014-June 30, 2015, 86% of the malaria-specific budget came from external donors⁷, with PMI contributing 59% of the budget (Table D). However, the GOR has shown commitment to malaria interventions via their financial and operational support for IRS and malaria SBCC messaging in 2015.

⁶ Lu Chunling, *et al.* Towards universal health coverage: An evaluation of Rwandan Mutuelles in its first eight years, PLOS June 18, 2012.

⁷ Rwanda National Malaria Annual Report, 2014-2015, Ministry of Health, Rwanda Biomedical Center.

Table D*⁸: Rwanda malaria funding sources, FY 2014-2015

Funding	Budget Planned (USD)	Share as % of budget
GLOBAL FUND SSF MALARIA	4,014,473	13%
GLOBAL FUND RBF MALARIA	4,065,806	14%
PMI	17,500,000	59%
GOR	4,248,633	14%
Grand Total	29,828,912	100%

The changing burden of malaria in Rwanda is also a challenge. While the country has seen a decline in malaria cases from 2005 to 2011, increases in the past four years (2012–2015) show that sustaining low malaria rates is a continuing multifactorial struggle. The MOPDD recognizes the importance of identifying the causes and implementing solutions, however like many countries, Rwanda has limited resources and thus the MOPDD must be strategic about its interventions, especially IRS. PMI and other partners have been working closely with the MOPDD to identify the causes of the increase in malaria cases and ensure appropriate responses. In 2016, the GOR released a Malaria Contingency Plan (see Section 5 Updates in Strategy), indicating the government’s recognition of the problem and a willingness to address gaps in malaria prevention. Continuing to evaluate, characterize, and respond to the recent increase in malaria cases, whether due to increased reporting or underlying malaria transmission, remains a high priority for the MOPDD.

The political stability of the region also poses a challenge. In spring and summer 2015, due to political instability in neighboring Burundi, over 100,000 refugees fled into Rwanda and remain there; many of whom have malaria and other tropical infectious diseases. The MOPDD has worked in collaboration with other partners to evaluate this evolving situation and ensure malaria prevention and treatment interventions are available for both the refugee camp and surrounding communities.

⁸ Rwanda National Malaria Annual Report, 2014-2015, Ministry of Health, Rwanda Biomedical Center

III. OPERATIONAL PLAN

The overall PMI strategy for Rwanda is aligned, complementary, and supportive of both Rwanda's 2013–2018 national MSP and the newly introduced Malaria Contingency Plan, with goals to address the uptick in malaria cases over the past several years, while still supporting some districts that are ready to embrace pre-elimination strategies. To accomplish this, PMI will make strategic investments that leverage resources from the GOR, development partners, and technical agencies. PMI's national-level support includes health system strengthening, support to the HMIS and SIS-COM, improvement of pharmaceutical and commodity supply chain management, and enhancement of SBCC activities. PMI will also continue to support integrated prevention and treatment interventions, including provision of antimalarial commodities and diagnostics in health facilities and communities, integrated community case management (iCCM), malaria in pregnancy, and surveillance, monitoring, and evaluation.

Rwanda has prioritized decentralization and PMI will support this effort by building and transitioning capacity and supporting programs in the districts, health centers, and community. Several USAID funding streams including those for HIV/AIDS, maternal and child health, and family planning will be combined with PMI resources to support this goal.

The proposed FY 2017 PMI budget for Rwanda is \$18 million. PMI will support the following interventions with these funds.

1. Vector monitoring and control

MOPDD/PMI objectives

The current 2013–2018 MSP recognizes two objectives related to vector control. First, to control malaria in the 'highest burden' districts, and second to mitigate malaria vector pyrethroid insecticide resistance. The MSP also emphasizes maintaining universal coverage of ITNs and implementation of IRS in line with WHO guidance and policies. Due to the high cost of blanket spraying, the MOPDD's strategy prior to 2016 was to focus on focal spraying in high-burden malaria districts. The MOPDD uses real-time HMIS data to determine where to target IRS. Based on HMIS data from September-October 2015 that showed minimal reduction of malaria in districts with focal spraying, the MOPDD changed its approach to blanket spraying starting in February-March 2016; districts with the highest burden of malaria will be targeted.

In February 2016, the MOPDD drafted a Malaria Contingency Plan which addresses the ongoing causes of the increase in malaria since 2012 and proposes strategies to be implemented to contain malaria upsurges in the short, mid, and long-term including blanket spraying.

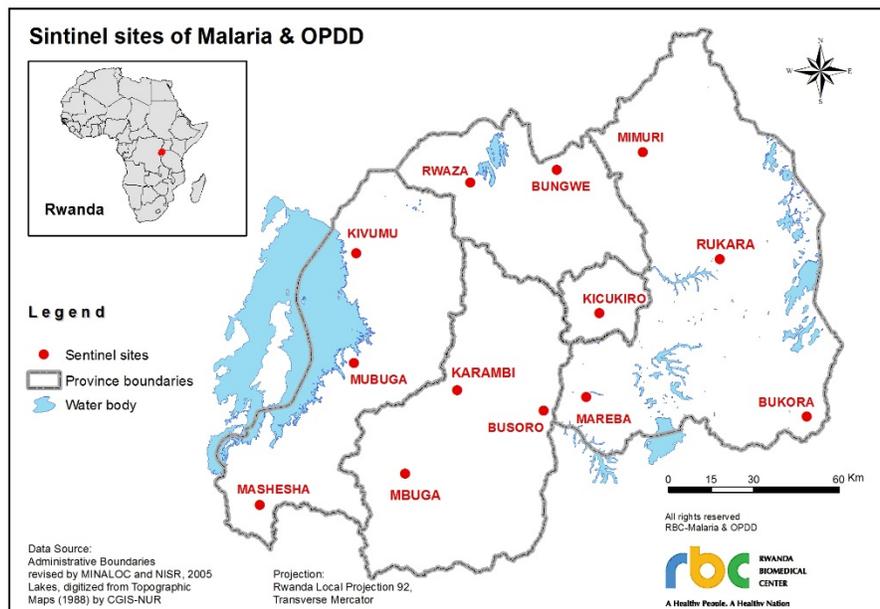
In addition to IRS operations, PMI resources support procurement of personal protective equipment, environmental compliance assessments, and entomological monitoring which evaluates both IRS impact and vector susceptibility to a range of insecticides. Twelve sites across the country monitor vector insecticide susceptibility and provide the necessary data to target programs (see Figure 9). The sites specifically monitor vector pyrethroid resistance, which threatens ITN performance, as well as pre- and post-IRS impact-related entomological indicators (i.e., vector density, taxonomy, and parity rates).

a. Entomologic monitoring and insecticide resistance management

Progress since PMI was launched

PMI has supported entomologic monitoring in Rwanda since 2007, including vector species composition and density, seasonality, and behavior, net durability monitoring, and insecticide resistance monitoring. Over time, 12 entomologic monitoring sites (a thirteenth site, Mbuga, collects meteorological data) have been established in Rwanda and now provide the necessary longitudinal data for optimizing Rwanda's vector control interventions. Evidence of vector resistance to pyrethroids in early 2013 prompted a rotation to carbamate-class insecticide. In 2013-2014, insecticide resistance monitoring detected emerging carbamate resistance, but in 2014-2015, tests showed susceptibility to carbamates. The latest results of insecticide resistance testing are presented below (see Table E). IRS impact assessments inform program decisions, based on entomological monitoring in target and comparison areas. Vector density, parity, and behavior are estimated and reported⁹ to verify impact and inform programs for future decisions. For example, 2013 residual insecticidal effect data indicated that carbamate IRS treatments last for three to four months, which prompted the decision to use two rounds of IRS per year (specifically in February–March and September–October covering the two peak malaria transmission periods). In December 2015, a decision was made to transition from carbamates to the organophosphate, pirimiphos-methyl. The first application of this insecticide is scheduled for September 2016 in two districts.

Figure 9. Entomological monitoring sites supported by PMI — Rwanda, 2016^{10*}



Progress during the last 12-18 months

In September 2015, a spray campaign was conducted in four districts (Bugesera, Gisagara, Kirehe, and Nyagatare). Within a week of spraying, bioassays were conducted on three wall surfaces. In all tests,

⁹ PMI / Africa (AIRS) Indoor Residual Spraying (IRS2) Task Order Six. February 2016. Rwanda End of Spray Report, Bethesda, MD. Abt Associates Inc.

¹⁰ Sentinel sites for monthly entomology monitoring are: Bukora, Bungwe, Busoro, Karambi, Kicukiro, Kivumu, Mareba Mashasha, Mimuli, Mubuga, Rukara, and Rwaza.

100% mortality of susceptible *An. gambiae s.s.* was recorded. After three months post-spray, bendiocarb 80WP[®] demonstrated to be effective for three months with an 80% mosquito mortality on the three wall surface types tested.

In total, 14,917 adult female *Anopheles* mosquitoes were collected from October 2014 to October 2015 using pyrethrum spray catches and human landing catches. *Anopheles gambiae s.l.* comprised 98% of the capture (14,563 specimens), followed by *An. funestus*, *An. pharoensis*, *An. ziemmani*, *An. coustani* and *An. maculipalpis*. *An. gambiae s. l.* densities in all four districts (including the control district) were highest in February and March, decreased in April and increased again in September. In April 2016, molecular testing (using PCR) was conducted on all *An. gambiae s. l.* samples to determine members of the complex. Approximately 63% were determined to be *An. arabiensis* and additional analysis is still ongoing.

Vector density was lower in the Gisagara and Bugesera districts compared to the control district (Kirehe). The mean *An. gambiae s.l./house/day* was highest in Kirehe from October 2014 to October 2015 during the reporting period even before IRS was initiated.

Of the 14,917 *Anopheles* spp. collected, 13,711 were collected using human landing catches. An analysis of this collection showed a statistical difference between indoor and outdoor collections in all the districts. *An. gambiae s.l.* demonstrated more exophagic than endophagic behavior tendency in all districts, including the control district. While IRS is highly effective at controlling *An. gambiae s.s.* and *An. funestus* due to their endophagic behavior, *An. arabiensis* is currently considered the main vector for outdoor transmission.

Table E. *An. gambiae s.l.* insecticide susceptibility¹ in Rwandan IRS districts (2014–2015)

IRS District	Insecticide (Class)					
	% mortality 24 hours post exposure*					
	deltamethrin (pyrethroid)	permethrin (pyrethroid)	γ -cyhalothrin (pyrethroid)	bendiocarb (carbamate)	pirimiphos-methyl (organo-phosphate)	fenitrothion (organo-phosphate)
Nyagatare	81	91.9	80.4	100	100	100
Gisagara	90	95	92	100	100	100
Gisagara	90	84	66	100	100	100
Bugesera	67	63	43	100	100	100
Bugesera	58	41	46	100	100	100
Bugesera	97	89	86	100	100	100

¹WHO insecticide susceptibility test method thresholds: >98% mortality: susceptible; < 98% mortality: evidence of resistance, further investigation needed; 90–97% mortality: possible resistance, if confirmed; <90% mortality: resistance, if ≥ 100 females tested.

Plans and justification

PMI will continue to support entomologic monitoring at 12 sites across Rwanda. Monthly data collection will be conducted in IRS districts and include adult mosquito collections using pyrethrum spray catches and human landing catches to assess vector species distribution and density, seasonality,

and behavior. WHO cone bioassays will be conducted to assess the quality of IRS operations and to determine insecticide decay rates. Insecticide resistance monitoring will be carried out at four sites and include susceptibility testing for deltamethrin, permethrin, lambda-cyhalothrin, bendiocarb, pirimiphos-methyl, and fenitrothion. In addition to the entomological monitoring, the MOPDD collects monthly meteorological data and annual insecticide resistance data from the site in Mbuga (see Figure 9).

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

- *Entomologic monitoring activities.* Entomologic monitoring in 12 sites will continue to guide decision-making on IRS and ITNs. (\$300,000)

b. Insecticide-treated nets

MOPDD/PMI objectives

Long-lasting insecticide-treated nets (LLINs), abbreviated as ITNs throughout this MOP, remain a key tool in the fight against malaria. Rwanda's national ITN objective elucidated in the 2013–2018 MSP is to maintain universal coverage and achieve over 90% ownership and use through:

- Continuous distribution channels: ANC, EPI, and public boarding schools;
- Universal coverage mass campaigns: next campaign is planned for 2016; and
- Quarterly surveys conducted by CHWs to quantify ITN needs by household.

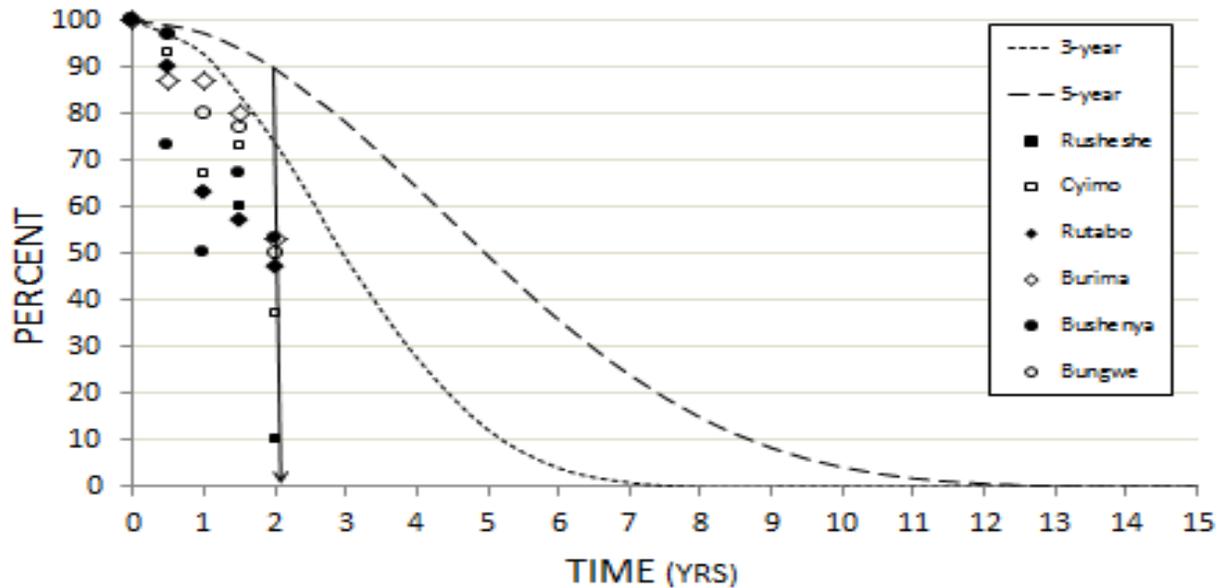
As per RBM guidance, the MOPDD defines universal coverage as one net for every two people. The MOPDD uses the RBM tool for ITN procurement quantification and follows the Roll Back Malaria Harmonization Working Group recommendations to achieve universal coverage (a procurement ratio of 1.8 persons per net). To maintain universal coverage, the MOPDD's policy calls for replacement of old, expired ITNs every two years through phased rolling mass campaigns, which differs from WHO's recommendation of a three-year mass campaign schedule.

Progress since PMI was launched

A 2009 universal coverage campaign was planned to expand the coverage achieved during the campaign implemented in 2006 (which targeted children under five years of age). However, the ITNs for this 2009 campaign were delayed and not distributed until 2010–2011. Following this campaign, Rwanda documented reductions in malaria cases in 2010 and 2011. Malaria cases started increasing in 2012, which corroborate net durability and efficacy data showing over 50% of ITNs losing efficacy within two years (see Figure 10). The MOPDD responded in 2013 with a targeted universal campaign to high-burden districts, but unlike the decreasing malaria trends after past distributions of ITNs, the HMIS data showed an overall increase in malaria cases in the following months. As part of routine net longevity studies, the MOPDD analyzed a sample of ITNs at different time points and laboratory evaluation revealed inadequate ITN insecticide concentration in 42.5% (17 of 40) of samples.¹¹ Additional distribution campaigns in March 2015 replaced some of these ITNs. Other drivers of net survivorship, such as cultural and behavioral practices, must also be considered.

¹¹ Hakizimana *et al.* Monitoring long-lasting insecticidal net (LLIN) durability to validate net serviceable life assumptions, in Rwanda. *Malaria Journal*, 2014, 13:344.

Figure 10: ITN percentage survivorship at six Rwandan sites¹². The graph depicts fabric integrity plotted against time with data collected at six month intervals from testing sites. For reference, the short dashed line is an expected ITN survivorship curve assuming a life span of three years and the long dash line is an expected ITN survivorship curve assuming a life span of five years.



Progress during the last 12-18 months

In March 2015, the MOPDD received 1,400,000 ITNs procured by PMI which were distributed in 13 high-burden districts targeting pregnant women, children under five years of age, and households identified by CHWs as in critical need of ITN replacement.¹³ In addition, 375,000 ITNs were distributed in November 2015 targeting women and children.

PMI provided external technical assistance to the MOPDD to identify, quantify, and forecast viable continuous distribution channels in Rwanda with the RBM tool, which assists in ITN quantification and forecasting. The MOPDD, PMI, and other stakeholders agreed to implement a mass distribution campaign in 2016 with over 6 million ITNs. The rolling mass distribution campaign is expected to start in September 2016 and be completed by around December 2016. In addition, the MOPDD plans to target new cohorts through continuous distribution at ANC and EPI in addition to targeted community-based distribution. Rwanda will monitor and document the impact of the mass distribution and continuous ITN distribution channels on the malaria burden via HMIS.

In 2013, PMI supported technical assistance and data management for a Malaria Indicator Survey (MIS) to obtain current ITN ownership and coverage data. The results from the MIS also inform the MOPDD of preferred ITN specifications (i.e., conical vs. rectangular and preferred colors) to increase acceptance

¹² Hakizimana *et al.* Monitoring long-lasting insecticidal net (LLIN) durability to validate net serviceable life assumptions, in Rwanda. *Malaria Journal*, 2014, 13:344.

¹³ CHWs do not distribute routine ITNs to communities but are involved in mass distribution campaigns.

and adherence, but further investigation needs to be conducted to determine if these preferences reinforce good ITN behavioral practices. As evidenced by the association of ITN distribution and subsequent decreases in malaria cases, if high levels (one ITN for every two persons) of effective ITN ownership are not maintained, which includes SBCC reinforcement on consistently sleeping under an ITN each night, malaria upsurges can be expected. Thus, universal ITN ownership and use is critical for Rwanda's reduction of malaria burden. PMI supports the MOPDD's work with local civil society organizations using CHWs nationwide for interpersonal communication sessions, community mobilization, and sensitization ensuring net use and care to prolong net longevity. A knowledge, attitudes, and practices (KAP) survey is planned to be undertaken in 2016.

Commodity gap analysis

In 2015, in light of increases in malaria cases, the MOPDD used malaria incidence trends to target high burden districts for replacing nets and ensuring continued use of routine distribution channels. The MOPDD is in the process of procuring one million ITNs with PMI funds and approximately 5.2 million ITNs with Global Fund resources in support of the 2016 mass campaign, which will cover the entire country and ensure universal coverage before the end of 2016. At the time of writing, the Global Fund funding enveloped for 2018 was not yet known.

Table F. Rwanda ITN gap analysis¹

Calendar Year	2016	2017	2018
Total targeted population	11,553,192	11,839,419	12,132,544
Continuous Distribution Needs			
Channel #1: ANC	231,064	236,788	242,651
Channel #2: EPI	473,681	485,416	497,434
Channel #3: Public and private boarding schools, others	295,255	-	330,928
<i>Estimated Total Need for Continuous</i>	1,000,000	722,204	1,071,013
Mass Distribution Needs			
Mass distribution campaign	-	-	6,740,302
<i>Estimated Total Need for Campaigns</i>	-	-	6,740,302
Total Calculated Need: Routine and Campaign	1,000,000	722,204	7,811,315
<i>Partner contributions</i>			
ITNs carried over from previous year	-	-	277,796
ITNs from MOH	-	-	-
ITNs from Global Fund Round RBF ²	-	-	-
ITNs planned with PMI funding	1,000,000	1,000,000	-
Total ITNs Available	1,000,000	1,000,000	277,796
Total ITN Surplus (Gap)	-	277,796³	(7,533,519)⁴

¹Rwanda develops its gap analysis according to its own fiscal calendar running from July-June. The gap analysis is conducted every year prior to the start of the new fiscal year.

²The RBF grant is ending in December 2017. Global Fund will support the mass campaign in 2016 with 5,201,501 ITNs.

³Given the mass distribution planned in 2016, there is no anticipated gap in 2017. The expected surplus in FY 2017 will be used in 2018 for ANC.

⁴In 2014, Rwanda signed an RBF grant with the Global Fund covering the period January 2015 to December 2017 with a significant reduction in funding. As part of this agreement, much of the Global Fund resources were invested in ITN procurement. These ITNs will be a major part of the rolling mass campaign that will take place in 2016. At the time of writing, the Global Fund resource envelope for 2018 was not yet known.

Plans and justification

The primary challenge in Rwanda is to maintain universal coverage of ITNs. To increase current coverage of nets, the MOPDD plans to distribute over 6 million ITNs as part of a rolling mass campaign in 2016. Continuous distribution of nets will continue to new cohorts of children under five years of age, pregnant women, communities, and through future mass campaigns, which requires adequate financing, forecasting, surveillance, and distribution.

Major threats facing malaria control and ITNs in Rwanda are established pyrethroid resistance in the Eastern and Southern Provinces and reduced durability of ITNs in the field compared to the three-year expected life-span. At the moment, the only insecticides recommended for ITNs are pyrethroids, primarily permethrin, alpha-cypermethrin, and deltamethrin. Vector-insecticide resistance monitoring

(described under IRS/entomology monitoring activity) confirmed vector-pyrethroid (cyano and non-cyano group) resistance. Mosquitoes exposed to standardized lethal levels of permethrin and deltamethrin only experienced 18% and 24% mortality, respectively. Evidence of low mortality following pyrethroid insecticide exposure informs IRS strategies to mitigate vector resistance, thereby conserving pyrethroids only for ITN impregnation. Districts within Eastern and Southern Provinces achieved universal ITN coverage and the MOPDD and PMI are implementing IRS with non-pyrethroid insecticides in two high-burden districts to mitigate pyrethroid resistance and conserve ITN efficacy.

Proposed activities with FY 2017 funding: (\$5,328,250)

PMI will support the MOPDD's maintenance of universal ITNs coverage by procuring and distributing ITNs through continuous distribution channels and continue net durability monitoring using MOPDD entomological capacity built during the three-year prospective studies. PMI will focus SBCC efforts at national and community levels to promote correct and consistent usage (described under the SBCC section) and explore net care and repair strategies to promote durability given the reduction in resources especially through the PMI-Peace Corps collaboration. Specific activities for FY 2017 funding include:

- *Procure and distribute ITNs:* Support the procurement and distribution of free ITNs through routine channels – ANC, EPI, and boarding schools. PMI proposes to procure about 1,000,000 ITNs that will be used for routine distribution. The final number of ITNs will depend on the actual costs of the nets. (*\$4,500,000*)
- *MPPD management fee for ITNs:* The MPPD charges a management fee for ITNs procured with donor funds; the fee covers import and storage. (*\$193,500*)
- *Distribution of ITNs:* Distribution of ITNs from the medical stores to health centers for routine distribution; \$0.50 per ITN is included to provide transportation to the health center. (*\$500,000*)
- *Net durability and insecticide resistance monitoring:* Prospective ITN durability, longevity, and efficacy monitoring of routine versus new net products. (*\$134,750*)

c. Indoor residual spraying

MOPDD/PMI objectives

The current 2013–2018 MSP recognizes two objectives related to vector control. The first objective is to control malaria in the 'highest burden' districts and the second is to mitigate malaria vector pyrethroid insecticide resistance. HMIS data (2013–2014) indicate that IRS with carbamate-class insecticides is associated with a significant reduction in malaria morbidity in Rwanda's highest burden districts.

In addition to IRS operations, PMI resources support procurement of personal protective equipment, environmental compliance assessments, and entomological monitoring which evaluates both IRS impact and vector susceptibility to a range of insecticides. As previously mentioned, twelve sites across the country monitor vector insecticide susceptibility and provide the necessary data to target programs (see Figure 9). The sites specifically monitor vector pyrethroid resistance, which threatens ITN performance, as well as pre- and post-IRS impact-related entomological indicators (i.e., vector density, taxonomy, and parity rates).

Progress since PMI was launched

The table below lists PMI-supported IRS rounds by date, target district, number of structures, and class of insecticide used (and proposed IRS for 2017 and 2018).

Table G. PMI-supported IRS in Rwanda, by district, 2013–2018

Round	Date	Districts Sprayed	Structures sprayed (% targeted)**	Insecticide	Population Protected
10	Sep-Oct 2013	Bugesera, Nyagatare, Gisagara	224,708 (98%)	Pyrethroid Carbamate	957,027
11	Feb-Mar 2014	Bugesera, Nyagatare, Gisagara	123,919 (99%)	Carbamate	512,789
12	Sep-Oct 2014	Bugesera, Nyagatare, Gisagara,	173,086 (99%)	Carbamate	705,048
13	Feb-Mar 2015	Nyagatare, Gisagara	127,150 (99%)	Carbamate	517,194
14	Sep-Oct 2015	Bugesera, Nyagatare, Gisagara, Kirehe	215,981 (98%)	Carbamate	889,326
15	Feb-Mar 2016	Nyagatare, Kirehe	147,947 (98%)	Carbamate	774,778
16	Sep-Oct 2016*	Nyagatare, Kirehe	188,000	Organo-phosphate	774,778
17	2017*	Up to 4 high-burden districts	320,000	Organo-phosphate	1,412,503
18	2018*	Up to 4 high-burden districts	320,000	Organo-phosphate	1,412,502

* Represents targets based on the 2016 IRS work plan, and/or projected targets based on national strategic plan and/or discussions with MOPDD

Due to vector resistance to pyrethroids, Rwanda has performed IRS exclusively using non-pyrethroids since 2014. Implementation of IRS with higher cost insecticides (non-pyrethroids are significantly more expensive than pyrethroids) necessitated a new approach to selecting IRS areas (deploying a mix of blanket and focal spraying) and caused a reduction in the population protected.

Progress during the last 12-18 months

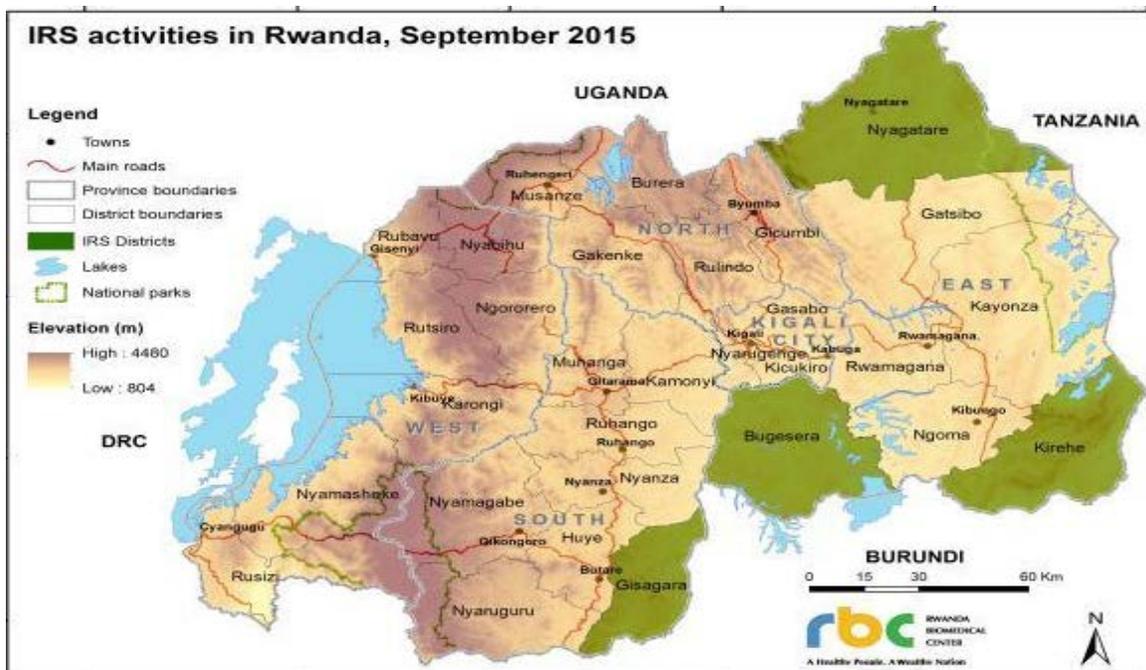
Figure 11 shows districts where PMI-supported IRS activities occurred in 2015 (depicted in green). Specifically, in 2015, PMI supported training of 2,005 spray personnel to implement IRS in more than 300,000 structures, which protected more than 1.2 million people across four districts (Bugesera, Gisagara, Kirehe, and Nyagatare). PMI also supported a capacity building assessment, which highlighted the MOPDD’s strengths in planning, entomological monitoring, implementation, and environmental compliance.

Fortunately, in 2015, Global Fund resources were used in part to support IRS because of the GOR’s demonstrated capacity, built by PMI since 2007 and evidenced by the capacity building assessment, to effectively develop an IRS strategy and implement IRS operations. Resources from the Global Fund, which were used to procure insecticides, were combined with GOR resources and PMI support for

equipment and supervision. This joint venture was led to increased spray coverage in Bugesera and Nyagatare.

In 2016, the MOPDD and PMI successfully advocated for the GOR to continue strong support for IRS. Under MOPDD direction, GOR, PMI and Global Fund contributions were coordinated in the February–March 2016 spray season. During this spray round, PMI supported blanket spraying in two districts (Kirehe and Nyagatare) covering 147,947 structures (98% coverage) and protecting 618,696 persons. The upcoming spray operation in September-October 2016 will target 188,000 structures and protect an estimated 775,000 persons.

Figure 11. Map of recent IRS activities in Rwanda, September 2015



Plans and justification

Currently, over 70% of Rwanda’s reported malaria cases stem from 10 of 30 districts. PMI will continue to deploy IRS based on evidence from epidemiological and entomological surveillance in an effort to target the highest burden districts. The districts to be sprayed in 2017 will be determined in consultation with the MOPDD. There will be emphasis on MOPDD engagement for IRS and capacity building in anticipation of greater GOR support. In addition, Rwanda has been confirmed as a country for the UNITAID-funded NgenIRS Project in 2016. This market intervention project includes a short term co-payment to accelerate price reductions for long-lasting IRS insecticides. The price reduction will enable Rwanda to expand coverage of long-lasting IRS from baseline levels, and participation in the NgenIRS Project confirms Rwanda’s commitment to do so. While the IRS targets for FY 2017 funding are subject to change, it is envisaged that IRS will be provided for up to 320,000 structures.

Given GOR support, the MOPDD will assume greater responsibilities for IRS activity implementation, including payment of IRS spray staff, transport, staff services, warehouse and site management, and SBCC mobilization activities. PMI will harmonize the MOPDD IRS implementation to find efficiencies and operational cost savings. Ideally by 2017, a transition to the GOR for implementation will occur with insecticide procurement by PMI and technical support from the PMI implementing partner. Other

activities such as logistics, warehousing, and payment of spray operators and community mobilizers will be moved to the local government systems for additional cost savings. Currently the high-burden districts include: Bugesera, Gatsibo, Gisagara, Huye, Kayonza, Kirehe, Ngoma, Nyangatare, and Nyanza. The proposal for PMI to procure insecticide while the MOPDD/GOR undertakes the logistics in the IRS implementation is still under discussion and no agreement has been reached yet. The planned implementation of IRS in 2017-2018 as articulated in this malaria operational plan assumes that PMI will procure insecticide and implement the operations (see Table H).

Table H: Proposed PMI IRS in Rwanda for 2017–2018

Date (spray round)	Districts sprayed (PMI)	Insecticide	Structures Sprayed (est.)	Population Protected (est.)
September–October 2017 (18)	Up to 4 districts	Organo-phosphate	320,000	880,674
September–October 2018 (20)	Up to 4 districts	Organo-phosphate	320,000	TBD

Notes: The GOR proposed to contribute funds to support IRS in 2017-2018. Coordination between partners is expected to result in IRS activities covering up to four districts. The proposal is for PMI to provide insecticide, training, equipment, and supervision for all IRS areas while GOR resources will support operational costs and commodities. This is still under discussion.

Proposed activities with FY 2017 funding: (\$5,514,500)

- *Implementation of IRS in high-burden districts.* Support PMI-GOR spraying of approximately 320,000 structures in high-burden districts as determined by HMIS data. Selected districts will include those accounting for approximately 40% of all malaria cases reported in Rwanda. Organophosphates will likely be used following five previous rounds of carbamate insecticide. Operational costs are based on previous expenditure analyses provided by the IRS implementing partner. Funds going to the PMI IRS implementing partner will be used to provide commodities, operational and logistical support in addition to technical assistance. (\$5,500,000)
- *Technical assistance for IRS.* CDC staff will conduct one technical assistance visit to assist with IRS planning and implementation and entomological monitoring. (\$14,500)

2. Malaria in pregnancy

MOPDD/PMI objectives

Rwanda’s MIP activities include several WHO recommended interventions to prevent, promptly detect, and treat malaria in pregnant women. This includes providing ITNs to pregnant women on their first ANC visit, iron/low-dose folate, and case management of febrile pregnant women with parasitological diagnosis by microscopy or RDTs. Rwanda stopped supporting IPTp in 2008 due to increasing parasite resistance to sulfadoxine-pyrimethamine and decreasing malaria prevalence nationwide; however, the MOPDD is now planning to implement an intermittent screen and treat (IST) approach to prevent and control malaria in pregnancy in high transmission districts. For cases of malaria in pregnancy, the

national policy calls for oral quinine in the first trimester, and AL in the second and third trimester for uncomplicated cases.

Progress since PMI was launched

Maternal mortality in Rwanda fell from 750 deaths (2005 DHS) to 210 deaths (2014-2015 DHS key findings) per 100,000 live births, a 72% decline. Most (98%) pregnant women visit an ANC at least once during their term although the median gestational age at first visit is late at six months; however, 44% of women make four or more ANC visits. Net usage among pregnant women has continued to rise from 17% (2005 DHS) to 72% (2010 DHS) to 73% (2014-2015 DHS).

The Rwandan Maternal Child Health (MCH) Program, in coordination with the MOPDD, the Community Health Program, and the EPI, with support from PMI and other partners, has developed an integrated approach to deliver quality health care for pregnant women. The services provided by these units, in addition to fetal growth monitoring and birth preparation, make up the focused antenatal care package (FANC), which is now available nationwide. CHWs who focus on maternal health (*Agents de Santé Maternelle* [ASMs]) identify pregnant women in their villages, distribute iron, low-dose folic acid, and mebendazole for anemia prevention, promote ITN use and encourage women to go early and regularly (at least four visits) for their scheduled ANC visits. Early ANC attendance is also encouraged by providing targeted SBCC, combined with innovative community- and facility-level PBF and high enrollment in community health insurance schemes (*mutuelles*).

The MOH, with the support of partners has worked to improve the quality of FANC services at health facilities through training and capacity building efforts at national and district levels. Rwanda has adopted the updated WHO guidance in treating malaria cases in pregnant women and quinine is available for treatment in the first trimester. Health workers have been trained on the updated recommendations in the case management of MIP.

In 2013, PMI supported a CHW sensitization meeting in the Ngoma District to uncover the causes that lead to infant and maternal mortality and to integrate these results into facility and district level interventions. The meeting served as a platform for CHWs to discuss the challenges they faced encouraging pregnant women in communities to adhere to four standard ANC visits and to have their first visit before 14 weeks of gestation. The discussions also touched on the linkages between home deliveries and maternal and child health outcomes. The results of the meeting helped to identify strategies to overcome identified problems.

Progress during the last 12-18 months

After discontinuing IPTp in 2008, the MOPDD is readdressing their MIP approach in the context of pre-elimination. Results of the 2011–2012 rapid assessment showed a low nationwide malaria prevalence of 2% in pregnant women by microscopy, which supports the significant decline in the number of malaria cases observed in this time frame. However, the study also revealed the malaria burden for pregnant women in high malaria transmission districts is disproportionately elevated relative to other districts (up to 6.3% by microscopy), which exacerbates poor birth and maternal outcomes in these focal areas.

The MOPDD, working with PMI and partners, is piloting an intermittent screen and treat (IST) approach for pregnant women in targeted high-burden districts using RDTs during all ANC visits. The MOPDD will use data from the monitoring and evaluation activities of the pilot to design their future MIP

national strategy. Their hope is that the pilot demonstrates the suspected positive impact of this approach in reducing negative effects of malaria on mothers and neonates in Rwanda. It is anticipated that implementation of this pilot will start by summer 2016.

Commodity gap analysis

Rwanda does not procure SP for IPTp, therefore this is not applicable.

Plans and justification

With FY 2017 funding, the MOPDD will continue to distribute ITNs to all women at their first ANC visit (see ITN section). PMI will also provide technical assistance for the development of the MIP strategy, including a review of the results of the IST monitoring. PMI will continue to coordinate with USG MCH programs and the MOH to ensure a harmonized approach to ANC implementation. Finally, PMI will strengthen communication efforts through SBCC for early detection and treatment of malaria in pregnancy, consistent ITN use, and early and regular ANC attendance by pregnant women. This will be coordinated with the Maternal Community and Child Health (MCCH) Division which implements activities aimed at ensuring that women attend ANC early and can benefit by receiving ITNs in line with the national policy.

Proposed activities with FY 2017 funding: (\$100,000)

- *Implementation of MIP strategy:* PMI will support and strengthen Rwanda's MIP strategy technically by developing a national strategy and guidelines, which will be implemented with PMI support. This will include capacity enhancement, training CHWs, and guidelines in the context of focused ANC. (\$100,000)

3. Case management

a. Diagnosis and treatment

MOPDD/PMI objectives

Rwanda's national malaria treatment policy states that all suspect cases of malaria should be laboratory confirmed by either microscopy or RDT prior to treatment with an ACT. The policy applies to all age groups and health facilities, communities, and the private sector. The diagnostic policy advocates the use of microscopy in health facilities and limits the role of RDTs to communities and in health facilities during emergency situations (e.g. at times when laboratory technicians are not available). RDTs are used by CHWs for parasitological confirmation of malaria cases.

All health facilities use artemether-lumefantrine (AL) as the first-line treatment for uncomplicated malaria. Oral quinine is recommended when AL is contraindicated, such as in children weighing less than 5 kilograms and pregnant women in their first trimester, and as the second-line treatment for cases of uncomplicated malaria when AL is not well tolerated or available. In 2011, Rwanda changed its treatment policy for the first-line treatment of severe malaria from parenteral quinine to parenteral artesunate; parenteral quinine and parenteral artemether remain as second-line alternatives. Intramuscular artesunate is recommended as pre-referral treatment for the management of severe malaria in health facilities only.

At the community level, trained CHWs provide treatment (after positive diagnosis with RDT) to children under five years of age with prepackaged ACTs that have been specifically packaged with pictorial dosing information and SBCC information in the local language (Kinyarwanda) to ensure proper dosing. In response to the recent upsurge in cases of malaria, CHWs have been permitted to treat cases in older age groups as of 2016. There is currently no policy for pre-referral management and treatment of severe malaria at the community level although discussions are ongoing within the Ministry of Health.

Progress since PMI was launched

Rwanda has a well-established community-based health system for the management of malaria, diarrhea, and pneumonia. The MOPDD supports iCCM in collaboration with the MOH Child Health Desk. The iCCM package includes the prevention, correct diagnosis, treatment, appropriate follow-up, and if needed referral process for malaria, pneumonia, diarrhea, and other components such as nutrition, family planning, hygiene, and palliative care. The trained CHWs responsible for implementing the package use RDTs to diagnose malaria and specially packaged ACTs for treatment at the community level. Currently, approximately 30,000 CHWs implement the iCCM package throughout the country's 30 districts. PMI Rwanda jointly implements iCCM with the Global Fund. Currently, PMI supports iCCM in seven districts (6,255 CHWs) and the Global Fund supports the other districts. Financing of community-based health care is provided through the community insurance scheme, small fees collected for medications, and community performance-based financing.

Antimalarials for health facilities are co-funded by PMI and Global Fund grants. However, because deliveries of Global Fund-procured ACTs were delayed, PMI supported the MOPDD request for emergency procurement using FY 2013 funds, for a total of 555,630 ACTs of which 30,000 were included in the FY 2013 MOP.

Progress during the last 12-18 months

Diagnostic capacity is a critical element of malaria case management, and Rwanda has prioritized diagnostic quality control as part of its national strategy. Rwanda has made remarkable progress to ensure appropriate malaria diagnosis before treatment with ACTs. With PMI and Global Fund support, Rwanda achieved greater than 95% microscopic laboratory confirmation of malaria cases at health facilities and RDTs at the community level according to Rwanda's routine health information system. Ongoing efforts to improve diagnostic quality over the past year included the training of 147 laboratory technicians on microscopy, including parasite density and species identification (the latter only for pre-elimination areas).

Rwanda's MOH has continued to evaluate provider behaviors after incorporating universal diagnostic testing into routine practice and these activities are supported by donor agencies. Monthly supervisory visits from district health staff to health centers have been conducted in seven PMI-supported districts. With FY 2015 funds, PMI implementing partners supported the production and distribution of iCCM tools and kits in the seven PMI-supported districts. The MOPDD also trained 10 Master Trainers in iCCM, and an additional 278 trainers who will work with the CHWs. Additionally, implementing partners conducted quarterly DQAs and meetings in 11 districts (total of 165 health centers) to validate 2015 malaria data from HMIS to registers.

At the national level, PMI provided support for the national review of the treatment guidelines, organization of a technical meeting for managers of hospitals and health centers in the six pre-elimination districts, and administered grant support for the 2015 ACT drug efficacy study. The use of IV artesunate was adopted in 2012 and scaled up in 2013 for severe malaria treatment. In 2014, PMI supported a field investigation among health facilities that reported severe malaria to analyze trends. A total of 5,887 patients were admitted with malaria diagnosis. Eighty-seven percent met the WHO criteria for severe *falciparum* malaria. Of these, 44% were children under five years of age. Using the findings from this study, and the revised national treatment guidelines, PMI supported MOPDD staff to conduct supervisory visits focused on the management of severe cases, to ensure that best practices were applied nationally. As shown in Table B of the Strategy section, hospital-based case fatality rates have remained low and even declined in recent years, indicating good quality of care for severe cases admitted to hospital.

Since 2011, Rwanda has experienced a surge in cases, from a low of 200,000 cases, to over 2.6 million cases in 2015. This surge in cases has motivated a stronger focus on good case management practices, especially in the over-five age groups where most of the cases are appearing. In February 2016, the MOPDD developed a Malaria Contingency Plan which identifies a number of activities aimed at turning around the current surge in cases. In addition to many preventive approaches, the plan includes scaling up home-based management (HBM) of malaria for adults and children over five years of age.

The HBM for adults plan is to increase the testing and treating of adults in the community thus preventing severe malaria cases and death and also cutting the malaria transmission as early as possible. The plan is to roll out HBM in adults to all 30 districts. HBM in adults is already being implemented in 12 districts accounting for 60% of all malaria cases recorded in country with GOR and Global Fund support. PMI supports this effort through commodity procurement. The decision to use CHWs for HBM in adults is based on the fact that the recent increase in malaria cases was in children over five years and adults. Rwanda has an estimated 30,000 CHWs trained to manage malaria in children less than five years of age. However, in 2015, CHWs only tested and treated an estimated 9% of fever/malaria cases due to the shift in disease burden. It is expected that the proportion of cases managed at the community will increase from about 9% to 55% which accounts for the increase in RDTs.

Commodity gap analysis

The MOPDD led a joint quantification exercise in April 2016, to forecast national commodity needs and make procurement allocation decisions. Participants included staff from the Medical Procurement and Production Division, the Logistics Management Office (LMO), district pharmacists, PMI implementing partners, and USAID. As a result, established estimates of malaria commodity needs were established in the final report. As detailed in the Pharmaceutical Management section below, Rwanda has an excellent logistics management information system, which allows timely data on stock availability to be used for quantification exercises and procurements. Figures from Table I show a consumption-based forecast estimates the team agreed to use.

Table I: RDT gap analysis

Calendar Year	2016	2017	2018
RDT Needs			
Number of RDT tests performed in routine testing at health facilities and in communities ¹	576,408	489,946	4,095,175 ⁵
Number of RDTs performed for active case detection	686,973	686,973	686,973
Number of RDTs for IST ²	36,000	36,000	36,000
Total RDT estimated consumption ³	1,299,381	1,212,919	4,818,148 ⁶
Total RDTs needed based on supply plan⁴	1,914,720	2,362,491	4,974,240
Partner Contributions			
RDTs from MOH	381,447	–	–
RDTs from Global Fund	1,533,273	1,199,065	–
RDTs from other donors	–	–	–
RDTs planned with PMI funding	1,000,000	–	1,000,000 ⁷
Carry over from previous year	163,426	1,163,426	0
Total RDTs Available	3,078,146	2,362,491	1,000,000
Total RDT Surplus (Gap)	1,163,426	0	(3,974,240)⁸

¹ RDT needs are based on a consumption-based forecast conducted and agreed upon in the quantification workshop and not exclusively on demographic estimates.

² There are 120,000 expected pregnant women and it is assumed 30% will be in locations with IST services.

³ Estimated total RDT consumption is a figure produced from the forecast and only represents an estimated amount of product that end users will need.

⁴ RDT estimated needs represents the quantity of RDTs that should be procured; this figure is based on the supply plan, which takes into account stock on hand, shipments on order, and buffer stock to maintain stocked-to-plan at all facilities. It is important to note that RDTs are used primarily at the community level in iCCM and HBM programs, and for IST and reactive case surveillance. Diagnosis at the health facility level is generally done by microscopy.

⁵ This is the estimate at community level without the RDTs estimated for active case detection and ISTp (if implemented).

⁶ The number of RDTs in 2018 is estimated based on the home-based management (HBM) of malaria among adults introduced by the GOR in 2015 in 11 districts and will be scaled up. As a result, it is expected to increase the proportion of cases tested with RDTs from 10% to 55%.

⁷ For FY 2017, PMI will cover a portion of the RDT needs at the community level, while the GOR and Global Fund cover the remaining gap.

⁸ The Global Fund and GOR commitments are not known as of this MOP writing, however it is expected that they will procure RDTs to address this gap.

Data source: Rwanda eLMIS, HMIS and quantification of 2016-2018

Table J: ACT gap analysis

Calendar Year	2016	2017	2018
ACT Needs¹			
Target population at risk for malaria ²	11,500,000	11,800,000	12,100,000
Total projected ACT need based on supply plan³	2,785,657	5,012,107	6,006,968^{5,6}
Partner Contributions			
ACTs from MOH	–	1,124,889	–
ACTs from Global Fund	1,516,394	655,208	–
ACTs from other donors	–	–	–
ACTs planned with PMI funding	350,000	879,000	1,741,852
Additional ACTs procured by PMI	1,222,540	149,000	–
Carry over from previous year	1,881,338	2,184,615	–
Total ACTs Available	4,970,272	4,992,712	1,741,852
Total ACT Surplus (Gap)⁴	2,184,615	(19,395)	(4,265,116)

¹This includes all six presentations of ACTs: 6x1, 6x2, 6x3, 6x4, Primo Rouge, Primo Jaune and is a consumption-based forecast utilizing logistics data

²Based upon the Rwanda 2012 Census we used medium estimates of population growth.

³Estimated total ACT consumption is a figure produced from the forecast and only represents an estimated amount of product that end users will need. ACT estimated needs represents the quantity of ACTs that should be procured; this figure is based on the supply plan, which takes into account stock on hand, shipments on order, and buffer stock to maintain stocked-to-plan at all facilities. The carry-over amounts are fact checked as part of the quantification.

⁴The GOR is aware of this projected ACT gap and will seek resources as appropriate to fill the gap.

⁵This is the projected consumption based on an estimated 5,061,098 malaria cases in 2018 forecasted based on current increasing trends. This number may go down with new malaria prevention strategies such as mass distribution of ITNs in 2016.

⁶It is important to note that RDTs are used primarily at the community level in iCCM and HBM programs, and for IST and reactive case surveillance. Diagnosis at the health facility level is generally done by microscopy. Thus the projected need for ACTs does not correlate directly with the projected need for RDTs.

Data source: Rwanda eLMIS, HMIS and quantification of 2016-2018

Therapeutic Efficacy Studies

Rwanda has been implementing drug efficacy studies in six sites. This is a routine activity conducted annually where antimalarial drugs used to treat children are evaluated for clinical response to determine evidence of parasite drug resistance. These investigations are developed in accordance with WHO standard antimalarial drug efficacy protocols and approved by the Rwanda Ethics Committee. The initial sites for the drug efficacy tests in 2012 were: Kibirizi, Muganza, Nyarurema, and Rukara, with two additional sites added in 2013 (Masaka and Ruhuha). One site was initially supported with PMI funds, but with this MOP, PMI will support three sites and Global Fund will support three. Each site is expected to recruit an estimated 120 participants. Preliminary findings for the 2012-2015 period from the four sites conducting the artemether-lumefantrine drug efficacy study are shown below (see Table K). CHWs were used to ensure patient attendance and there were no losses to follow-up. The initial results are undergoing additional PCR analysis with WHO to confirm clinical results particularly for treatment failures which can be due to either re-infection or recrudescence.

Table K. Preliminary therapeutic efficacy study findings for artemether-lumefantrine, in the four initial sites, Rwanda, 2012–2015

<i>Sites</i>	Expected	Recruited	Adequate Clinical and Parasitological Response	Early treatment failure	Late treatment failure
<i>Nyarurema</i>	110	68	52	1	15
<i>Kibirizi</i>	110	103	85	1	17
<i>Rukara</i>	110	110	93	1	17
<i>Muganza</i>	110	100	83	1	16

The drug efficacy study has faced challenges and delays mainly due to the low parasitemia among the study population and impact of different control activities such as IRS which has dramatically decreased malaria incidence in some of the formally high-burden target districts, specifically Nyagatare (Nyarurema site) and Gisagara (Kibirizi site). The MOPDD is preparing for the 2016 study. There will be no arm looking at the efficacy of oral quinine. It is expected that with FY 2017 funds, PMI will support three districts with additional support from other donors as necessary.

Plans and justification

Rwanda’s 2013–2018 Malaria Strategic Plan to “ensure all malaria cases are tested with a quality diagnosis,” continues to be supported by PMI mainly through well planned and now web-based and cloud-hosted logistics systems to procure RDTs for health facilities and communities. The pivotal end-user of these commodities, the Rwanda CHW force, will have routine knowledge refresher instruction with iCCM trainings upgrading knowledge on biologic assays, equipment, and reporting tools. To ensure quality of these tools, PMI continues to fund and support quality control programs for microscopy and/or RDTs for district hospitals, health centers, and communities.

As part of its pre-elimination strategy, the MOPDD has begun reactive case detection (see M&E section for more details) in certain regions of the country per the 2013–2018 MSP. Once a patient tests positive with malaria, all members of the household are then tested and treated if positive for malaria. Additionally, Rwanda’s 2013–2018 MSP states that “all malaria cases are promptly treated in line with national guidelines.” To accomplish this, PMI supports effective malaria case management through procurement of ACTs for CHWs use and parenteral artesunate for severe malaria treatment in health facilities. In addition to supporting some pre-elimination activities, PMI is committed to supporting the MOPDD to address the increase in cases throughout the country. This includes supporting laboratory trainings, covering all RDT needs at community level, and a portion of ACT needs. Gaps in both commodities will be filled through Global Fund and GOR procurements.

Proposed activities with FY 2017 funding: (\$4,056,585)

- *Capacity building for malaria diagnostics:* The program is planning to train approximately 400 laboratory technicians to improve their capacity in malaria testing. This training will strengthen malaria diagnosis as the country is facing changes in malaria epidemiology. (\$58,465)
- *Procure ACTs and parenteral artesunate:* The program is currently using malaria treatment guidelines elaborated with WHO’s support. PMI funds will procure about 1.7 million ACT treatments and 100,000 vials of parenteral artesunate for severe malaria. PMI also supports a

unique social marketing program (though ACTs remain free-of-charge), which involves repackaging ACTs for community-level use with pictorial aids and information in Kinyarwanda. This component is described and funded in the SBCC section. (\$2,176,037)

- *Procure RDTs*: PMI will support the procurement of approximately 1 million RDTs for use at the community level. (\$600,000)
- *MPPD management fee*: Fee for MPPD to store and distribute medications. (\$222,083)
- *Support for integrated community case management implementation*: PMI will continue to support implementation of the iCCM package in seven districts (Gatsabo, Kayonza, Kicukiro, Kirehe, Ngoma, Nyarugege, and Ruhango). Global Fund supports iCCM in the other districts. The support will include original and refresher trainings at district levels, supportive supervision, training in appropriate RDT use, evaluating CHW performance with RDTs, monitoring activities, and provision of CHW materials and supplies. PMI will support CHWs to provide appropriate health communications messages to encourage understanding and adherence to the current treatment algorithms. PMI, with leveraged funds from other USG MCH programs, will support the complete package of iCCM interventions, which includes malaria, pneumonia, diarrhea, malnutrition, and family planning, in currently supported districts or other districts depending on priorities of the MOH. (\$900,000)
- *Therapeutic drug efficacy monitoring*: PMI will support routine monitoring of the treatment efficacy of first- and second-line antimalarials at three sites. (\$100,000)

b. Pharmaceutical Management

MOPDD/PMI objectives

The MOH, through the MOPDD and the MPPD, conducts annual quantifications for malaria medicines and RDTs, to meet the need of the public sector facilities in the country. The USAID commodities partner provides technical assistance in quantification exercises. Rwanda's malaria supply chain is part of an integrated system with a harmonized LMIS. The supply chain has four levels: central (MPPD), districts, health facilities, and the community level. One of the priorities of the GOR is to strengthen district pharmacies to manage commodity distribution systems. The logistics system is a pull system. Each facility estimates its needs and places orders. The MPPD delivers commodities to the district pharmacies. Districts supply health centers in their catchment area are using their own vehicles. Resupply is done on a monthly basis. Facility staff utilize the electronic logistics management information system to capture stock-on-hand data, issue orders to the district pharmacies, and produce reports for decision-making. These reports include consumption and stock-on-hand data, as well as any days out of stock.

Progress since PMI was launched

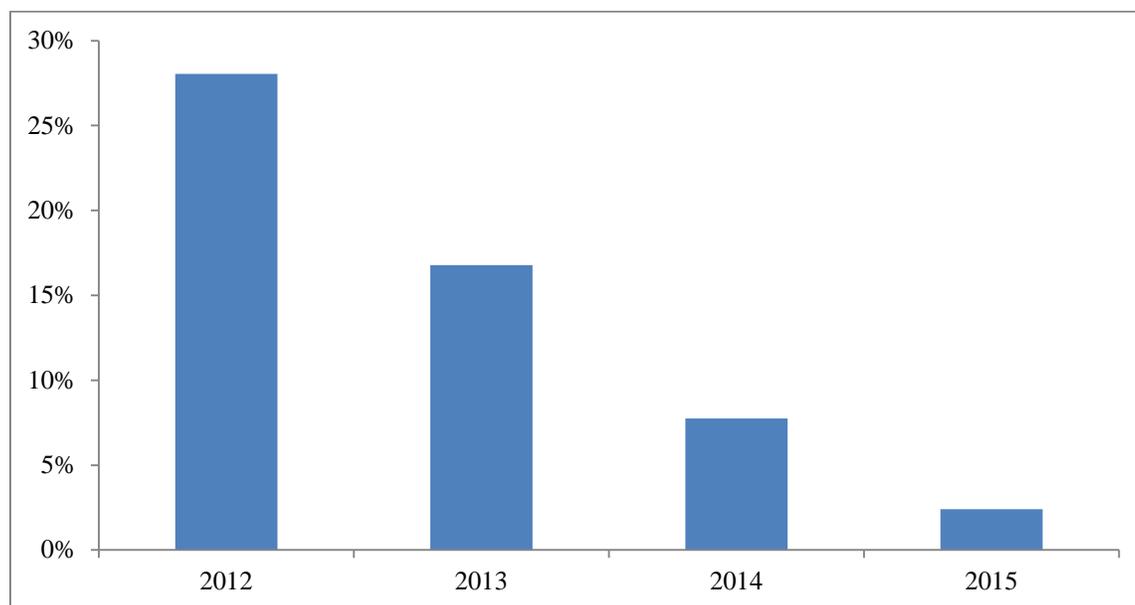
Procurement and management of antimalarials and other commodities is through the MPPD, part of the Rwanda Biomedical Center (RBC). The MOPDD directs Global Fund financing for commodities and MPPD procures and manages the supplies. The MOH's LMO provides central coordination and

technical assistance in logistics management. As part of the National Supply Chain Strategic Plan, malaria commodities are envisioned to be managed primarily through this coordinating body and integrated into the coordinated procurement and distribution system (CPDS) with family planning, HIV, and other health commodities.

In August 2014, the MOPDD, with the LMO, MPPD, and PMI commodities partner, hosted its first joint quantification workshop, followed by an update exercise, which produced the first joint malaria commodities forecast and supply plan. This quantification and supply planning body continues to meet for annual quantification exercises and quarterly supply plan meetings. Newly available data from the electronic logistics management information system (eLMIS) were utilized for better transparency into commodity consumption. Improved data availability and improved stakeholder coordination and flexibility and planning is contributing to the response to the increase in malaria incidence, ensuring that lifesaving drugs are available at service delivery points, and avoiding emergency orders at the national level.

A paper-based logistics management information system (LMIS) for all program-related commodities was launched in 2011, and the eLMIS was rolled out in 2014, funded by PMI, USAID, PEPFAR, and the Global Fund. The LMIS harmonized the process for collecting logistics data across all programs. A joint PMI and PEPFAR assessment of the supply chain was conducted in August 2011 to evaluate the implementation of the LMIS and measure system performance including product availability at the facility and district pharmacy levels for a variety of products. With improved data availability, accuracy, and through improved supply chain coordination, stockout rates of ACTs decreased from 17% in 2013 to 2% in 2015 (see Figure 12). A joint review of the eLMIS system functions is expected in 2016-2017.

Figure 12: Average stockout rate of ACTs across reporting health facilities in Rwanda, 2012–2015



Source: Rwanda LMIS

With PMI and PEPFAR funds, USAID is assisting in capacity building in the LMO, which has taken on more leadership for supply chain management across all health programs. The LMO is in charge of all the logistics data entry, aggregation, and analysis used to make policy decisions and to aid in decision-making during forecasting and quantification. The LMO provides supportive supervision of supply

chain management to health facilities and district pharmacies. The LMO also provides leadership in implementation and monitoring of the new eLMIS, from which data has been successfully utilized by programs to improve their commodity forecasts.

Parliament approved the creation of the Rwanda Food and Medicines Regulatory Authority in 2013. The authority will assist the Pharmacy Task Force in implementing its mandate to guarantee quality control of incoming and circulating drugs. The Pharmacy Task Force was created in 2005 to oversee retailers and serve as the national drug regulatory authority. Its responsibilities include conducting quality control, inspection, and licensure, and ensuring a basic package of pharmaceutical products. The MOPDD conducts antimalarial drug quality control annually with the support of the pharmacy department of National University of Rwanda, where drugs collected at all levels of health care are sampled and sent for drug analysis.

Progress during the last 12-18 months

The quantification conducted this year included a consumption-based forecast, a services-based forecast, and a demographic-based forecast. The results from each of these forecasts were compared and the team determined the final forecast consumption for January 2016 to December 2017. After calculating the forecast consumption, a supply plan was developed based on quantities on order, stocks on hand, program minimum and maximum stock levels, and seasonality. The final result of the quantification exercise was a supply plan through June 2017, including specific quantities of each product that are required, with a proposed arrival date. Moreover, the eLMIS aggregates data reported by facilities and district pharmacies. Details of this improvement can be found in the RBC's Quantification Report for Malaria Products 2016–2018.

Plans and justification

To improve the procurement of needed commodities, PMI will continue to support forecasting, quantification, and procurement planning for ACTs and RDTs and will support the LMO to institutionalize supply chain management functions and expand the identified supply chain best practices in the community. Support for malaria commodity logistics will continue to focus on monitoring the LMIS and newly rolled out eLMIS to ensure continued availability of ACTs and other malaria commodities at health facility level. PMI will also support the harmonization and integration of supply chain indicators with the national malaria logistics indicators and logistics supervision tool.

Pharmaceutical and supply chain strengthening activities will also include: ensuring capacity building of malaria staff in standardized quantification principles to align them with CPDS procedures; ensuring supply chain system strengthening by formative supervision through district pharmacies; supporting implementation, mentorship, and evaluation of key performance indicators for supply chain management focusing on malaria health commodities; strengthening of MPPD in supply chain management systems in order to improve the procurement process for malaria commodities; and strengthening the utilization of the eLMIS for ordering and forecasting needs for malaria commodities.

Proposed activities with FY 2017 funding: (\$280,000)

- *Central level supply chain management:* Engagement and support at the central level supply chain management to strengthen national and district level pharmaceutical administration and

supply chain with a seconded logistician. Continued coordinated procurement and distribution technical assistance for malaria commodities with implementation of the eLMIS. (\$250,000)

- *Quality control for ACTs:* PMI will also support the MOPDD to collect samples and send them to a WHO-approved laboratory institution outside the country to undertake quality testing for ACTs being used in the country. (\$30,000)

4. Health system strengthening and capacity building

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

MOPDD/PMI objectives

Rwanda has devoted significant resources to strengthening its health system, leveraging resources from its national budget, the Global Fund, the USG, and other donors. With these resources, Rwanda has achieved worldwide recognition for its innovative health financing programs, such as performance-based financing (PBF) and community-based health insurance (CBHI). These programs, as well as current efforts to determine the costs of essential health services and the recently launched eLMIS are supported by the USG and other development partners.

Health systems that allow accessibility to quality affordable health services are critical, as is a strong disease surveillance system to monitor, detect, and respond to disease outbreaks (e.g., malaria and neglected tropical diseases).

Progress since PMI was launched

MOPDD capacity building

PMI has been strengthening the MOPDD capacity through participation in international conferences and technical support to write peer-reviewed manuscripts for publication and sharing of Rwanda's experiences. PMI has been instrumental in the training of entomologists working in the MOPDD and the national reference laboratory. This has ensured that the national entomology laboratory is functional and continues to receive support to further strengthen the skills of the entomologists and other staff in the MOPDD. PMI has supported refurbishing and equipping the entomology laboratory and insectary, routine entomological monitoring, specimen analysis and insecticide resistance testing, training of sentinel site technicians in data reporting, entomological techniques and insecticide resistance testing, and continues to support the capacity building of entomology staff. PMI continues to provide technical support for the laboratory technician in charge of raising and maintaining the *An. gambiae* colony.

PMI, as part of broader USG efforts, continues to support capacity building of the national medical stores to forecast, procure, store, and distribute health commodities and provided technical assistance to the coordinated procurement and distribution system and the LMO for all health commodities. The support included updating and launching of the eLMIS nationwide. The system has improved the reporting on commodities and forecasting especially of artemisinin-based combination therapies and rapid diagnostic tests. PMI continues to support the development of staff capacity. PMI supported the

development of standard operating procedures and job aids on malaria diagnosis, including external quality control, slide preparation, and smear staining.

Peace Corps

Since 2012, PMI Rwanda has supported third-year Peace Corps Volunteers (PCVs) who work with PMI to help increase knowledge and understanding of malaria for other PCVs as well as local communities and health care workers. Although Peace Corps has been collaborating with PMI since FY 2012 initially focusing on iCCM activities, the Peace Corps' STOMP initiative was formally launched in 2013 in Rwanda with a goal to increase the number of volunteers and their counterparts working in malaria prevention.

The key objectives of STOMP Rwanda are to deliver quality Peace Corps-sponsored malaria training, share knowledge and resources for malaria activities, and build a robust and functional team of malaria experts and advocates at Peace Corps Rwanda. To date, PMI has supported six malaria volunteers and has worked with over 500 PCVs in Rwanda who have participated in malaria-related activities over the years.

Field Epidemiology and Laboratory Training Program (FELTP)

PMI has supported Field Epidemiology and Laboratory Training Program (FELTP) malaria residents since FY 2012. To date, three cohorts (13 residents each) of FELTP residents have initiated the two-year program and two cohorts have completed (26 graduates). Among these 26 graduates, 22 have returned to MOH positions, two have assumed WHO positions, and two are employed by non-governmental organizations. Five MOPDD staff members have participated in the FELTP training program.

During the two-year program, FELTP trainees enroll in a long course and pursue a Masters of Public Health. Following completion of the didactic portion, the malaria residents take part in a field practicum where they are posted within the MOPDD and work daily with the staff on malaria control issues. Previous contributions to PMI from FELTP trainees include: a dissertation on insecticide resistance mitigation approaches; piloting an enhanced surveillance and case follow-up reporting system using CHWs and mobile technology in a low-prevalence district; developing a community-level QA/QC strategy for RDTs; implementing therapeutic drug efficacy monitoring to assess the effectiveness of ACTs; documenting best practices for RBM's Progress and Impact Series; and writing manuscripts including, "Prevalence and Factors Associated with Malaria in Pregnancy in Rural Rwandan Health Facilities — A Cross-sectional Study"; "Rwanda's First Malaria Indicator Survey, 2013: Coverage of Malaria Interventions"; and "A Decade of Progress: Impact of Scaling up Malaria Control Interventions in Rwanda, 2005–2012".

Progress during the last 12-18 months

MOPDD capacity building

PMI continues to support training and participation in international conferences for all MOPDD staff. In September 2015, PMI supported the training of six entomologists – three from the malaria entomology laboratory and three from the medical entomology unit in the national reference laboratory on molecular assays focusing on mosquito identification and insecticide resistance. It is expected that the trained staff will have the capacity to undertake entomological activities with minimal external support. In addition, PMI supported the attendance of three MOPDD staff to the American Society of Tropical Medicine and

Hygiene (ASTMH) conference in 2015 where the staff made presentations in the following: “Spatio-temporal variations of malaria transmission intensity in Rwanda”, “Malaria cases and trends in Rwanda 2001-2014”, and malaria in pregnancy.

PMI also supported three seconded positions (housed at the MOPDD):

1. A logistics officer who works with the procurement partner to analyze and respond to eLMIS malaria-specific commodity needs in a timely manner.
2. A laboratory technician for the entomological laboratory.
3. A data manager who works to develop a database and tools, collect and analyze data for monitoring, and also build capacity of staff at the national and district level to monitor malaria activities.

Peace Corps

PMI historically supports two third-year PCVs, however the last PMI-supported PCVs left Rwanda in 2015. Prior to their departure, the two volunteers were involved in various activities related to malaria. They led STOMP training sessions for other volunteers in Rwanda creating awareness on how volunteers can include malaria messaging in their daily work. The training also focused on SBCC and the volunteers learned about project design and management for malaria-specific activities. The PCVs also held a grassroots soccer training which aimed at teaching youth about HIV/AIDS and malaria prevention.

Prior to their departure, the two initiated 119 malaria activities and 1,285 service providers and 44,411 beneficiaries were reached with malaria messages and activities. A new PCV joined the team in Rwanda in March 2016. It is anticipated that there will be another new volunteer in a few months and that they will both continue to support malaria-related activities using available funding.

FELTP

Three of the five malaria FELTP graduates (from the first and second cohorts) currently remain employed within the MOPDD where they continue to apply their epidemiologic competencies to strengthen malaria prevention and control in Rwanda. Cohort three (13 residents) included no FELTP malaria residents selected by the School of Public Health. However, discussions with the MOPDD have occurred and the current plan is to enroll three malaria residents into the fourth cohort beginning in August 2016. Further discussions will take place upon arrival of CDC’s PMI Resident Advisor (RA). Recent malaria-related projects completed by FELTP residents include: evaluation of malaria surveillance data in selected high-burden districts, assessment of severe malaria case management practices, and scientific communications at the national and international level. Non-malaria FELTP residents indirectly contribute to malaria control through their health system strengthening efforts that include: laboratory quality improvement, surveillance system projects, outbreak preparedness and response, and strengthening of scientific communications.

WHO support

PMI also supported the WHO national program officer (NPO) who offers the MOPDD technical support. This includes attending and participating in technical discussions with the MOPDD and acting as the liaison with the WHO regional office in providing relevant malaria technical support. The NPO also offers support for various malaria activities and is the current chair of the Malaria Technical Group. WHO recruited a new NPO in April 2016; PMI was involved in the process of developing a scope of work and in the recruitment. It is envisioned that this NPO will provide leadership for the mid-term

malaria strategy plan review planned for late 2016 and will work closely with the NMCP to provide technical assistance on the changing epidemiology in Rwanda.

Plans and justification

With FY 2017 funding, PMI will continue to support national capacity building, Peace Corps, FELTP, and a WHO national officer. PMI will continue to support the logistics officer who is based at the MOPDD and works closely with the case management team building their capacity. In addition, PMI will support the laboratory technician and the monitoring and data manager. PMI will also support the MOPDD to undertake supervision, conduct DQAs, participate in educational meetings, and disseminate data.

Proposed activities with FY 2017 funding: (\$367,165)

(1) MOPDD capacity building

Support capacity building of the MOPDD: PMI will support capacity building within the MOPDD by supporting supervision visits, quarterly DQAs, dissemination of best practices including national meetings and conferences, M&E results, and presentations and participation at international conferences. (\$212,165)

(2) Peace Corps

Support for third-year PCVs: PMI will continue to support up to two third-year PCVs for placement with an implementing partner. The PCVs will continue to engage in training and educational activities for other PCVs and Rwandan communities. Technical supervision will be provided by a PMI Resident Advisors and the implementing partner. Costs include housing, a computer, workspace in the central office, local travel, and a phone. (\$20,000)

(3) FELTP

Support to FELTP: PMI will continue to support at least two malaria residents in the FELTP program and contribute to the advanced training of Rwandan epidemiologists, many of whom will contribute to malaria pre-elimination efforts in the years ahead. MOPDD staff will continue to be specifically targeted for inclusion into the program. The trainees will receive assistance from PMI Resident Advisors who will help connect the trainees to malaria-specific projects and participate in malaria field assignments and investigations throughout Rwanda. (\$75,000)

(4) Other

Support WHO NPO for malaria: PMI will support a WHO NPO whose scope is to provide technical support to the MOPDD and liaise with other partners such as PMI and the Global Fund. The WHO staff will also support the MOPDD in all malaria technical areas as needed. (\$60,000)

Table L: Health Systems Strengthening Activities

HSS Building Block	Technical Area	Description of Activity
Health Services	Case Management	Improve diagnostics through training and supervision, strengthen QA systems to monitor the quality of laboratory diagnostic services both at the health facility and community level.
Health Workforce	Health Systems Strengthening	Capacity strengthening of entomological staff at the MOPDD based at the entomological laboratory. PMI will also support the training of three malaria staff through FELTP. PMI will support a WHO NPO to provide technical assistance to the MOPDD and continue support to the PCVs to strengthen capacity of health workers in malaria. PMI will support capacity strengthening of MOPDD staff to undertake supervision, DQAs, and participate in relevant technical forums.
Health Information	Monitoring and Evaluation	Strengthen monitoring and disease surveillance systems to improve decision-making, planning, forecasting, and program management through support of monitoring and evaluation staff, support for data analysis, and strengthening of capacity in monitoring at national and district level. PMI also supports a data manager.
Essential Medical Products, Vaccines, and Technologies	Case Management	PMI will also support a logistics officer based at the MOPDD to support procurement-related activities and strengthen data management and capacity building of district pharmacists. PMI will support improved forecasting, procurement, quality control, storage and distribution of malaria commodities, such as ITNs, ACTs, and RDTs.

5. Social and behavior change communication

MOPDD/PMI objectives

Objective six of the MSP is that by 2018, 95% of the population will have correct knowledge of malaria prevention and control. Rwanda's national social and behavior change communication (SBCC) policy for the health sector aims to strengthen the implementation of overall development objectives in Rwanda. This national policy emphasizes enabling the population to make informed health behavior choices through providing appropriate information, using quality messages and methods, including use of media and interpersonal communication. The 2013–2018 National MSP stresses the importance of interpersonal communication within the community as the cornerstone of any malaria intervention in Rwanda. Interpersonal communication should build on an “enabling environment” and strengthened health services. All health behavior change activities are under the auspices of the Rwanda Center for Health Communication within the MOH. This center coordinates, integrates, and harmonizes health messaging across the MOH, working specifically with the MOPDD and other programs.

Progress since PMI was launched

PMI has been a key partner in supporting SBCC activities in Rwanda. Through PMI support many community members have been reached with malaria messages using interpersonal communication, mass media, and mobile video units. In the past several years, MOPDD and partners have continued to re-orient malaria messaging to focus on the reduced disease burden and to sensitize communities on the need for continued vigilance in prevention and prompt diagnosis and treatment. Over 10,000 people are reached annually through mobile video units with PMI support.

PMI-supported activities have created awareness on protection using mosquito nets, ensuring prompt and effective treatment and appropriate communication in areas where IRS is implemented. As a result of these combined efforts, there is evidence of increased knowledge and improved practices in the prevention of malaria. In a KAP survey carried out in 2012, 84% of the respondents indicated having heard a malaria message through the radio, 74% from a community health worker, and 51% from a local authority leader. PMI will continue to work with partners to use different channels and approaches for SBCC to reach communities. A KAP survey is planned for 2016 that will provide updated information on the current levels of knowledge and practices and guide future SBCC interventions.

Progress during the last 12-18 months

In the last year, PMI/Rwanda has supported SBCC activities promoting ITN use, improving malaria case management, and supporting IRS. To promote ITN use and improve case management nationwide, PMI supported billboard messaging stressing diagnostics and treatment, mobile video sessions to promote sleeping under a bed net, drama shows on malaria in towns and villages, sessions on how to use antimalarial treatments, community events on malaria prevention, and interpersonal communication sessions. During this period, 19,694 people were reached through mobile video units, 6,142 persons were reached through drama sessions on malaria, and 23 interactive radio talk shows were undertaken. An estimated 54,000 persons were reached through malaria outreach campaigns in nine high-burden districts including Gatsibo, Kayonza, and Ngoma. The messages focus largely on prevention and prompt diagnosis and treatment of malaria. With the increase in malaria cases, SBCC will continue to use interpersonal communication channels to reach community members on prevention and prompt access to care. Due to PMI and other partners' support for SBCC activities, especially through radio, the 2013

MIS showed that 59% of women had seen or heard messages about malaria in the past six months. In addition, the survey showed that 95% of the women reported mosquito bites as the cause of malaria and 88% recognized fever as a sign of malaria. The 2013 MIS results will be compared to those from the MIS that is planned for 2017-2018 to assess the outcomes of the current SBCC activities.

The following SBCC activities were conducted in three districts in 2015 and two districts in March 2016 to increase acceptance and uptake of IRS: community meetings, door-to-door mobilization, use of CHWs and other volunteers to disseminate information about the project, and mass media. The mobilization also used community work days (*umuganda*) that occur on the last Saturday of each month to sensitize communities to IRS through local leaders.

Plans and justification

With FY 2017 funding, PMI will support implementation of the MOPDD's new SBCC strategy. While there have been delays in the process of finalizing the strategy, it is expected that it will be completed before the end of 2016. The strategy will cover a five-year period: 2016–2020. New plans and strategies for SBCC will be based on the revised communication strategy and built on successes of the ongoing SBCC interventions with an emphasis on the changing malaria situation in Rwanda. It is also expected that the intensification of SBCC interventions targeted to high-burden malaria districts will continue in light of recent increases in malaria cases. The MOPDD will work with the local administration to ensure that SBCC malaria activities are continued low-burden districts. In districts that share borders with other countries, SBCC will need to be intensified for residents, in particular those who cross borders into neighboring countries. Efforts aimed at those who cross borders from countries with high malaria transmission should be considered as well. These efforts can be an important basis for discussion among neighboring countries on possible future collaborations.

Rwanda has integrated health messaging, which helps extend the reach of malaria-only messages. The various partner messages and SBCC activities are coordinated through the Rwanda Center for Health Communication within the MOH. The Global Fund has previously supported significant amounts of malaria SBCC efforts. PMI plans to work closely with the MOPDD to identify and target high-prevalence districts and evaluate SBCC activities' impact. In addition, the MOPDD works in collaboration with the Maternal Community and Health (MCCH) division in SBCC messaging related to malaria in pregnancy. The two divisions also work closely with the community desk to ensure that the ASMs whose main focus is maternal and newborn health play a key role in encouraging pregnant women to attend ANC and access MIP-related services including ITNs. PMI, through its implementing partners, will continue malaria messaging through support of existing Rwandan SBCC channels such as the *umudugudu* (village) and *umuganda* networks (community work and messaging days). PMI will also prioritize evaluation of malaria messages, channels, and impact to ensure that malaria SBCC is effective.

PMI will continue to support two PCVs who will work with other volunteers, communities and health workers to create awareness on malaria and to ensure appropriate behavior change to improve malaria outcomes (see HSS section for details).

Proposed activities with FY 2017 funding: (\$416,400)

- *Community integrated SBCC*: PMI funding will continue to strengthen capacity through the development of communication materials, updating relevant strategies, monitoring the outcomes of SBCC interventions, and working with partners to refocus efforts to interventions that have

the greatest influence in impacting behavior in targeted districts. In addition, PMI will support community-level efforts to implement promotion of ITNs, IRS, MIP, and case management in targeted communities. Integrated health messaging in interpersonal communication and mass media will be used to promote continued use of ITNs, IRS, and MIP especially with the recent increase in malaria cases. ASMs and CHWs will be encouraged to use the opportunities as they interact with women to ensure that they encourage prevention of malaria in general and during pregnancy through the use of ITNs and prompt health care-seeking for any suspected malaria cases. (\$125,000)

- *Central level support for SBCC:* PMI funding will continue to strengthen capacity through central level support to the Health Communication Center and MOPDD to implement their national SBCC strategy once finalized and approved and to continue helping them shape SBCC messages as they relate to the MSP goals. The health communication center is responsible for ensuring appropriate and synergized messaging on health, including malaria. In addition, the support will be used to track malaria messaging to ensure that it has the desired results and re-orient channels and messages as appropriate. This will be undertaken through the KAP survey that is planned in 2016 with previous MOP funding. This survey will provide information on the current knowledge, attitudes, and practices and guide the design of future SBCC interventions. (\$50,000)
- *Repackaging ACTs:* PMI will support the repackaging of ACTs for use at the community level. These ACTs have been specifically packaged with pictorial dosing information and SBCC information in the local language (Kinyarwanda) to ensure proper dosing. This is part of a social marketing initiative to increase acceptability and uptake of ACTs at the community level. (\$241,400)

6. Surveillance, monitoring, and evaluation

MOPDD/PMI objectives

The Planning, Monitoring, and Evaluation Unit under the MOH as well as the MOPDD, districts, and health centers use M&E evidence to refine and target malaria control interventions. The MOPDD developed a 2013–2018 M&E plan with PMI and other stakeholder support. One of the key M&E related objectives of the MSP is Objective 4, which states that by 2018, all health units will report timely, completely, and accurately on key malaria indicators. In addition, Rwanda’s National MSP 2013–2018 outlines Rwanda’s plan to achieve pre-elimination status by 2018, which includes the development of a solid system of reactive case surveillance in targeted pre-elimination zones.

Rwanda’s strong surveillance system has been tracking an increase in cases since 2011, which is concerning in a country with pre-elimination targets. Using the robust data from the surveillance system, the MOPDD is investigating the causes of this increase and has developed a Malaria Contingency Plan to address and halt this increase. Details of this plan are discussed in other sections of this document.

Progress since PMI was launched

Rwanda’s routine health management information system is robust: over 90% of the data reports are completed, submitted in a timely fashion, and are of high quality. It is composed of the HMIS (formerly known as GESIS (*Gestion du système d’information sanitaire*)) that captures data from health facilities

and SIS-COM which are the main reporting systems for tracking disease epidemiology and impact in terms of malaria morbidity and mortality. The HMIS records monthly data at health facility level (health post, health center, dispensary, and hospital) on malaria cases and deaths, blood smears conducted, and antimalarial drugs and ITNs distributed to children under five years of age and pregnant women. The SIS-COM records monthly data on malaria case management at community level collected by CHWs. The HMIS and SIS-COM are both managed at the national level by the Planning, Monitoring, and Evaluation Unit under the MOH and both use the DHIS2 platform. The data entry for both HMIS and SIS-COM is done at the health facility level and data can be viewed at all levels of the system. The two systems function independently within the DHIS2 platform and can be aggregated or disaggregated as necessary. PMI collaborated with the MOH in participating in the annual Global Fund on-site data verification process. Both assessments have found high concurrence between HMIS records and health facility registers.

Based on Rwanda's data-rich environment, the MOPDD identified certain districts in Rwanda (mainly north and western) that are on the path toward malaria pre-elimination, defined by WHO as a malaria test positivity rate (microscopy or RDT) among febrile patients of <5%. Other districts (mainly eastern and southern) remain well above the 5% threshold, resulting in a national-level malaria test positivity rate considerably higher than the pre-elimination target (40% in 2015). The following information sources for measurement and evaluation have historically guided the MOH's programmatic decision-making for malaria and other health programs:

- *HMIS*: The HMIS revised indicators, forms, and a web-based platform (DHIS2) with geospatial information system capacity which was launched in 2010. All public health facility data go into HMIS with performance-based financing for timely and accurate reporting. HMIS also provides data on laboratory-confirmed malaria outpatient cases, inpatient cases, and deaths, as well as data by age and gender on all-cause morbidity and mortality at individual facilities. Since 2012, the community information system SIS-COM has been linked to the HMIS through DHIS2. Private sector treatments began to report into HMIS in 2014. Beginning in 2016, all private health care providers will be required to report malaria cases to the government.
- *Community information system*: This system uses a cell phone-based system that sends data directly from CHWs to the Community Health Desk. This community-based SIS-COM (mUbmizima) includes community diagnosis, treatment, and essential drug logistic information. SIS-COM is separate from HMIS, although since 2012 it has been linked to the HMIS through the DHIS2 web-based platform. SIS-COM incorporates a real-time, web-based data platform, with a minimum set of indicators. The registers and reporting formats collect community data generated by CHWs using cell phones. The data collected by CHWs are simultaneously reported to the health center and district hospital levels which in turn report to the national level. The rapid SMS allows health facilities and district hospitals to take immediate action in cases of emergencies. CHWs report cases of severe malaria and follow-up actions to be taken in these cases. CHWs are not involved in surveillance activities at this time as that is a function of health facilities. SIS-COM is functional nationwide.
- *Integrated Disease Surveillance and Response (IDSR)*: Surveillance activities for IDSR are coordinated and streamlined throughout all levels of the health system from the community, health facility, district hospital, and central levels. The MOH IDSR reports malaria cases and deaths disaggregated by age (children less than five years of age and anyone five and over) on a weekly basis.
- *Entomological surveillance* is described in the vector control section of this report.

- *Logistics management information system* is described in the pharmaceutical management section of this report.
- *DHS/MIS*: These comprehensive nationwide household surveys provide a broad range of population-based data, including bed net indicators (ownership and use by vulnerable populations), and malaria parasitemia and anemia. Population-based indicators change rapidly in Rwanda; thus, the GOR intention is to repeat surveys every two years. A full DHS was completed in 2014-2015 and previously in 2010 and an MIS was conducted in 2013. The 2013 MIS included malaria-related behavioral questions but did not include biomarkers as the estimates would be constrained by sample size. The recently completed 2014-2015 DHS included malaria and anemia biomarkers.
- *Research and routine monitoring*: These activities will include participating in household surveys to track use of ITNs, monitoring drug and insecticide efficacy, evaluating community case management, participating in health facility surveys, and malaria in pregnancy.

The recent trends in malaria data highlight the importance of a strong surveillance and monitoring system.

Health facilities report routine data on confirmed malaria cases through the HMIS and CHWs report through SIS-COM. Both systems, supported through PMI and PEPFAR, are vital for tracking malaria trends and were integrated in 2012 under the DHIS2 web-based platform. DHIS2 allows password-restricted web access to the MOPDD and other stakeholders, plus real-time reporting, analysis, and mapping. The MOPDD, PMI, and HMIS section have developed data dashboards with relevant malaria indicators to facilitate data analysis, presentation, and timely decision-making at the district and central levels by malaria officers and the MOPDD.

Data reports are complete, submitted in a timely fashion, and generally of high quality. Reporting is enhanced through PBF and over 90% of health centers and CHWs report complete and timely data. Integrated DQAs are conducted quarterly through the MOH, and reporting systems include automated logic and cross-checks to ensure data quality.

Progress during the last 12-18 months

Rwanda continues to make progress in monitoring and evaluation, as seen by high quality data from the HMIS and SIS-COM; a completed 2014-2015 DHS; piloting of mobile reporting and investigation in a low-prevalence district; and entomological monitoring. PMI continued to strengthen the MOPDD's M&E capacity by training HMIS unit staff. DHIS2 has been functional since 2012; data are being analyzed and reported in a more timely fashion, with increased quality, and increased access through the new, web-based platform. The MOPDD continues to monitor data quality, with PMI support, by conducting semiannual data quality assessments of reported malaria cases.

The MOPDD is implementing malaria pre-elimination activities and started with an initial six districts. Two more districts were added in 2014, bringing the total number of districts implementing malaria pre-elimination activities to eight in 2015 (Burera, Gakenke, Gisagara, Musanze, Ngororero, Nyabihu, Nyagatare, and Rubavu). Data from 123 health facilities in these eight pre-elimination districts are currently captured using CSPro and analyzed using STATA. PMI has supported the training of health workers, a data manager for pre-elimination activities, and operational costs. Activities include the notification of new cases, case investigation and targeted screening at community level. In 2015, 96,223 cases were notified at health facility level and 74,408 (80%) of those were investigated via reactive case detection with 10% of persons tested having a positive RDT.

In addition to implementing pre-elimination activities in certain districts, the MOPDD is also responding to the four-year surge in malaria cases with a Malaria Contingency Plan. This plan complements the MSP and addresses the increase in malaria cases over the past few years. It emphasizes continuing with the proven and effective interventions laid out in the MSP, including use of ITNs, IRS, prompt case management, iCCM, and SBCC (see Updates in Strategy section above for more information). Vigilant surveillance activities will be necessary to verify that the contingency plan has the desired effect and to ensure that Rwanda continues to move on the path to malaria elimination.

Table M. Monitoring and evaluation data sources

Data Source	Survey Activities	Year								
		2010	2011	2012	2013	2014	2015	2016	2017	2018
National-level household surveys	Demographic Health Survey (DHS) *	X				X				
	Malaria Indicator Survey (MIS)				X				X	
	KAP survey			X				X		X
	EPI survey			X						
Health facility and other surveys	Health facility survey	X		X		X		X		
	SPA survey					X				
Malaria surveillance and routine system support	Support to malaria surveillance system					X	X	X	X	X
	Support to HMIS	X	X	X	X	X	X	X	X	X
Forms at health facility**	Reactive case detection in pre-elimination areas					X	X	X	X	X
Therapeutic efficacy monitoring	<i>In vivo</i> efficacy testing					X	X	X	X	X
Entomology	Entomological surveillance and resistance monitoring	X	X	X	X	X	X	X	X	X
Other malaria-related evaluations	Net durability monitoring		X	X	X	X	X	X	X	X
Other data sources	Malaria Impact Evaluation				X	X				
*Not PMI-funded										
** Information collected weekly at health facilities										

Plans and justification

With FY 2017 funding, PMI will continue to support the MOPDD to strengthen surveillance in both high- and low-incidence districts. Maintaining high quality surveillance and continuing to analyze malaria trends and assess intervention effectiveness is a high priority. PMI, the Global Fund, and the MOPDD in collaboration with the HMIS Unit in the RBC also conduct annual DQAs nationwide to validate HMIS data. Malaria data from health centers, referral hospitals, and the private sector are integrated in the HMIS whereas data from CHWs implementing iCCM are entered in the SIS-COM which then are aggregated and integrated within the HMIS.

In addition to routine case-finding in all districts, those with low incidence will continue to implement reactive case-finding, where index cases at health centers in epidemic-prone districts are investigated at the household level by a team from the district, as a pre-cursor to elimination. The MOPDD, through PMI and Global Fund support, has built a mobile reporting system and trained health centers and district response staff. PMI will continue to make strategic investments that leverage resources from the GOR, development partners, and technical agencies. PMI's national-level support includes health system strengthening, support to the HMIS and SIS-COM, improvement of pharmaceutical and commodity supply chain management, and enhancement of SBCC activities.

PMI is supporting the MOPDD to investigate the multiple potential causes of the increase in cases and will work with the GOR to implement the Malaria Contingency Plan to reverse the trends. In addition, PMI will continue to support the MOPDD to strengthen evidenced-based decision-making throughout the health system with the focus on decentralization. PMI will continue to strengthen M&E staff capacity to maintain high quality data, perform data analysis, and make data-based programmatic decisions. In pre-elimination districts, Rwanda will need to shift towards enhanced surveillance and epidemic detection and response and move from limited aggregate data to individual reporting and line listings with additional data such as travel history. PMI will support a data manager to oversee and analyze the reactive case detection data from the enhanced surveillance districts (see Capacity Building section for more details). With decreasing malaria burden and the transition from stable to unstable transmission in some districts, the GOR has prioritized decentralization of data collection and use to increase the ability of districts to analyze and respond to upsurges in malaria. PMI will also technically support the planning and implementation of a MIS in 2017-2018 (originally planned for 2016-2017; but pushed back since the DHS finished in 2015).

The following is a table of illustrative epidemiologic indicators from Rwanda's routine information system in 2015. This table is intended to capture elements of the data available to the MOPDD in Rwanda but is not intended to evaluate program implementation or progress.

Table N. Routine surveillance indicators, Rwanda (2015)

Indicators	Value	Comments
1. Total number of reported malaria cases Data source: HMIS		
Total diagnostically confirmed cases	2,459,807	
Total clinical/presumed/unconfirmed cases	1,685	
<i>If available, report separately for outpatients and inpatients</i>		
Outpatient number of reported malaria cases		
Diagnostically confirmed	2,459,807	
Clinical/presumed/unconfirmed	1,685	
Inpatient number of reported malaria cases		
Diagnostically confirmed	71,692	Note that these cases are included in OPD cases as entry point.
Clinical/presumed/unconfirmed	671	Note that these cases are included in OPD cases as entry point.
2. Total number of reported malaria deaths Data source: HMIS		
Diagnostically confirmed	488	
Clinical/presumed/unconfirmed	7	
3. Malaria test positivity rate (outpatients) Data source: HMIS		
Numerator: Number of outpatient confirmed malaria cases	2,459,807	
Denominator: Number of outpatients receiving a diagnostic test for malaria (RDT or microscopy)	6,093,693	
4. Completeness of monthly health facility reporting Data source:		
Numerator: Number of monthly reports received from health facilities	-	
Denominator: Number of health facility reports expected (i.e., number of facilities expected to report multiplied by the number of months considered)	-	

Proposed activities with FY 2017 funding: (\$537,100)

- *Supportive supervision visits by the MOPDD:* PMI will help support MOPDD staff to provide adequate supportive supervision to district health teams, health facilities, and community case management workers to ensure high quality recording and reporting of malaria test results and

improved data management and use at the local level. Supervisory visits to selected districts are done monthly, while visits to other health facilities are done on a quarterly basis. (\$100,000)

- *Enhanced monitoring, community surveillance, case investigation, and epidemic response:* PMI will continue to support the strengthening of monitoring of malaria activities and to a limited extent the implementation of activities in two pre-elimination districts. This funding will support reactive case detection and surveillance and monitoring activities. In total, there are eight pre-elimination districts: PMI is supporting two of these districts, while the Global Fund is supporting the remaining six districts. (\$200,000)
- *In-country M&E technical assistance for all health centers:* PMI will support a person, seconded to the MOPDD, to provide technical assistance to strengthen monitoring and also to support pre-elimination related activities, design databases, design and facilitate data entry programs for surveys, and assist in analysis of surveys/studies with the MOPDD. This is an RBC staff position, but the person will work alongside the MOPDD program and will assist with trainings at health facilities. (\$75,000)
- *Contribute to 2017-2018 Malaria Indicator Survey:* PMI will support the planning and the implementation of the 2017-2018 MIS. This will include technical assistance for protocol development, sampling, training, supervision, data analysis, report writing, and dissemination. The Global Fund will be covering the larger share of the funding for this survey. (\$150,000)
- *CDC TA M&E:* To assist MOPDD with data analysis and characterization of epidemiologic trends and risk factors for malaria. (\$12,100)

7. Operational research

MOPDD/PMI objectives

According to the MSP, the MOPDD will support operational research activities as necessary to inform policy and programing.

Progress since PMI was launched

In previous fiscal years, PMI supported a study to determine the prevalence of malaria among pregnant women. The cross section study included six rural health centers with varying malaria transmission and included testing via microscopy, RDTs, and PCR. The results showed a low national burden of malaria among pregnant women (microscopy: 1.6%, RDT: 2.5%, and PCR: 5.7%).

Although this was not formally considered OR, PMI also supported a prospective three-year net durability monitoring activity to examine the physical durability and insecticide residual efficacy of ITNs. The results showed that over 50% of both polyester and polyethylene ITNs failed due to holes or lack of durability between 18 and 24 months in the field¹⁴. The results from these studies were used by the MOPDD to revise their net distribution strategy to replace nets every two years, with supplemental distribution through routine sources in the interim years (see MIP and ITN sections).

¹⁴ Hakizimana *et al.* Monitoring long-lasting insecticidal net (LLIN) durability to validate net serviceable life assumptions, in Rwanda. *Malaria Journal*, 2014, 13:344.

Progress during the last 12-18 months

PMI has not supported any OR-related activities in Rwanda in the last 12-18 months.

Plans and justification

There are no proposed OR activities to be supported by PMI.

Table O. PMI-funded operational research studies

Completed OR Studies			
Title	Start date	End date	Budget
A study to determine the current prevalence of malaria detectable among pregnant women registering for ANC in six districts in Rwanda: Evidence for developing and implementing a new malaria in pregnancy strategy in the context of reducing malaria prevalence	March 2011	December 2012	\$200,000

8. Staffing and administration

Two health professionals serve as Resident Advisors to oversee PMI in Rwanda, one representing CDC and one representing USAID. In addition, one or more Foreign Service Nationals (FSNs) work as part of the PMI team. Although Rwanda has not has an FSN in the past few years, one is expected to start supporting PMI in 2017. All PMI staff members are part of a single interagency team led by the USAID Mission Director or his/her designee in country. The PMI team shares responsibility for development and implementation of PMI strategies and work plans, coordination with national authorities, managing collaborating agencies and supervising day-to-day activities. Candidates for Resident Advisor positions (whether initial hires or replacements) will be evaluated and/or interviewed jointly by USAID and CDC, and both agencies will be involved in hiring decisions, with the final decision made by the individual agency.

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

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

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

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

directly to Ministries or host governments will need to be approved by the USAID Mission Director and Controller, in addition to the U.S. Global Malaria Coordinator

Proposed activities with FY 2017 funding: (\$1,100,000)

- *Staffing and administration:* Support for USAID and CDC Resident Advisors and support staff within USAID Mission plus associated administrative costs. (\$1,100,000)

Table 1: Budget Breakdown by Mechanism

**President's Malaria Initiative – RWANDA
Planned Malaria Obligations for FY 2017**

Mechanism	Geographic Area	Activity	Budget (\$)	%
TBD - IRS Project	Sub-national	Indoor residual spraying	5,500,000	32%
	National	Entomological monitoring	300,000	
CDC	National	CDC technical assistance IRS and entomological monitoring	14,500	0.6%
	National	FELTP trainees in malaria	75,000	
	National	CDC technical assistance M&E	12,100	
MACRO	National	Contribute to 2017-2018 Malaria Indicator Survey	150,000	1%
TBD	National	Net durability monitoring	134,750	10%
	National	Implementation of MIP strategy	100,000	
	National	Malaria diagnostic capacity building	58,465	
	National	Integrated community case management	900,000	
	National	Drug efficacy survey	100,000	
	National	Capacity building of the MOPDD	212,165	
	National	Peace Corps	20,000	
	National	Support MOPDD supervision	100,000	
	National	Enhanced community surveillance, case investigation, and epidemic response	200,000	

	National	Central level SBCC strengthening	50,000	
TBD	National	Community level SBCC	125,000	2%
	National	Repackage ACTs	241,400	
GHSC-PSM	National	LLIN procurement	4,500,000	47%
	National	Management fee for LLINs	193,500	
	National	Distribution of LLINs	500,000	
	National	Procure ACTs	1,916,037	
	National	Procure artesunate	260,000	
	National	Procure RDTs	600,000	
	National	Management fee for ACTs, artesunate, RDTs, other commodities	222,083	
	National	Central supply chain management	250,000	
	National	Quality control of ACTs	30,000	
TBD	National	In-country M&E assistance for all health centers	75,000	
WHO	National	WHO National Program Officer for malaria	60,000	0.3%
USAID/CDC PMI Staff	National	PMI staff (USAID and CDC) and associated administrative expenses	1,100,000	6%
Total			18,000,000	100%

Table 2: Budget Breakdown by Activity

**President's Malaria Initiative – RWANDA
Planned Malaria Obligations for FY 2017**

Proposed Activity	Mechanism	Budget (\$)		Geographic Area	Description
		Total	Commodity		
PREVENTIVE ACTIVITIES					
Entomologic monitoring and insecticide resistance management					
Entomological monitoring	TBD-IRS Project	300,000		National	Support ongoing entomological monitoring at 12 sites
SUBTOTAL ENTO MONITORING		300,000	0		
Insecticide-Treated Nets					
LLIN procurement	GHSC-PSM	4,500,000		National	Procure approximately 1 million LLINs to contribute to routine coverage of EPI, ANC, and community for high-burden districts.
Management fee for LLINs	GHSC-PSM	193,500		National	4.3% fee per the Malaria Strategic Plan for storage of nets at central level and distribution to health facility.
Distribution of LLINs	GHSC-PSM	500,000		National	Distribution of 970,874, LLINs from health centers to beneficiaries (\$0.50 per net).
Net durability monitoring	TBD	134,750		National	Monitor routine efficacy and durability of LLINs distributed through PMI.
SUBTOTAL ITNs		5,328,250	0		
Indoor Residual Spraying					

Indoor residual spraying	TBD - IRS Project	5,500,000	5,500,000	Sub-national	Support the NMCP in spraying approximately 576,000 structures with non-pyrethroid insecticide (includes procurement of insecticide and materials, environmental compliance, SBCC, etc.). This is to support PMI spraying and the combined PMI-GOR spray program.
CDC technical assistance IRS and entomological monitoring	CDC	14,500		National	CDC entomologist technical assistance for monitoring IRS implementation.
SUBTOTAL IRS		5,514,500	5,500,000		
Malaria in Pregnancy					
Implementation of MIP strategy	TBD	100,000		National	Support and strengthen malaria in pregnancy strategy in Rwanda, which includes developing national guidelines and scaling up the plan.
SUBTOTAL MIP		100,000	0		
SUBTOTAL PREVENTIVE		11,242,750	5,500,000		
Case Management					
Diagnosis and Treatment					
Malaria diagnostic capacity building	TBD	58,465		National	Support capacity building in malaria diagnostics.
Procure ACTs	GHSC-PSM	1,916,037	1,916,037	National	Procure 1,741,852 ACTs for the community level.
Procure artesunate	GHSC-PSM	260,000	260,000	National	Procure 100,000 doses of artesunate for severe malaria.
Procure RDTs	GHSC-PSM	600,000		National	Procure 1 million RDTs; GOR and Global Fund will buy other quantities.

Management fee for ACTs, artesunate, RDTs, other commodities	GHSC-PSM	222,083		National	MPDD charge (8%); storage and distribution.
Integrated community case management	TBD	900,000		Sub-national	Implementation of iCCM in seven districts including training, supervision, support, tools, and supplies.
Drug efficacy survey	TBD	100,000		National	Support routine monitoring of the treatment efficacy of first- and second-line antimalarials at three sites.
Subtotal Diagnosis and Treatment		4,056,585	0		
Pharmaceutical Management					
Central supply chain management	GHSC-PSM	250,000		National	Support central system strengthening, including logistics officer, data management, quantification of malaria commodities.
Quality control of ACTs	GHSC-PSM	30,000		National	Quality control for ACTs at national and community level at a WHO-approved/collaborative institution.
SUBTOTAL - Pharmaceutical Management		280,000	2,176,037		
SUBTOTAL CASE MANAGEMENT		4,336,585	2,176,037		
Health System Strengthening/Capacity Building					
Capacity building of the MOPDD	TBD	212,165		National	Support MOPDD staff to attend trainings, conferences, and M&E capacity building. This includes DQAs, dissemination of information in country, MRP, and pre-elimination forums.
Peace Corps	TBD	20,000		National	Support up to two PCVs for the PC/PMI STOMP initiative.
FELTP trainees in malaria	CDC	75,000		National	Support for FELTP trainees in malaria and disease surveillance for capacity building.

WHO National Program Officer for malaria	WHO	60,000		National	Support WHO National Program Officer.
SUBTOTAL HSS & CAPACITY BUILDING		367,165	0		
Social and Behavior Change Communication					
Community level SBCC	TBD	125,000		Targeted districts	Support to SBCC for the community level, including printed and radio messages, interpersonal activities and support of Malaria Day. To cover all interventions (LLIN, MIP, CM, etc).
Central level SBCC strengthening	TBD	50,000		National	Central level support and capacity building to the Health Communication Center and the NMCP to implement national strategy and continue to design messaging as it relates to pre-elimination goal and continue to evaluate.
Repackage ACTs	TBD	241,400		National	Repackage ACTs for use at the community level into packages with pictorial dosing information and SBCC information in the local language (Kinyarwanda) to ensure proper dosing.
SUBTOTAL BCC		416,400	0		
Surveillance, Monitoring, and Evaluation					
Support MOPDD supervision	TBD	100,000		National	Support supervision visits to the district, health center, and community levels including case management, QA/QC for diagnosis, and data.
Enhanced community surveillance, case investigation, and epidemic response	TBD	200,000		National	Support implementation of reactive case investigation and response for pre-elimination districts. This includes enhanced community surveillance and epidemic response in epidemic-prone districts.

In-country M&E assistance for all health centers	TBD	75,000		National	To provide technical assistance to pre-elimination sites, design databases, design and facilitate data entry programs for surveys, and assist in analysis of surveys/studies with the MOPDD.
Contribute to 2017-2018 Malaria Indicator Survey	MACRO	150,000		National	Support planning and technical assistance for implementation of 2017-2018 Rwanda Malaria Indicator Survey. To include assistance for protocol development, sampling, training, supervision, data analysis, report writing, and dissemination.
CDC technical assistance M&E	CDC	12,100			To assist NMCP with analysis of data and review of M&E systems.
SUBTOTAL M&E		537,100	0		
Operational Research					
N/A					
SUBTOTAL OR		0	0		
In-country Staffing and Administration					
PMI staff (USAID and CDC) and associated administrative expenses	USAID/CDC PMI Staff	1,100,000		National	Support for USAID and CDC Resident Advisors and support staff within USAID Mission plus associated administrative costs.
SUBTOTAL In-Country Staffing		1,100,000	0		
GRAND TOTAL		18,000,000	7,676,037		