

This Malaria Operational Plan has been approved by the U.S. Global Malaria Coordinator and reflects collaborative discussions with the national malaria control programs and partners in country. The final funding available to support the plan outlined here is pending final FY 2019 appropriation. If any further changes are made to this plan it will be reflected in a revised posting.



## U.S. PRESIDENT'S MALARIA INITIATIVE



# **PRESIDENT'S MALARIA INITIATIVE**

## **RWANDA**

### **Malaria Operational Plan FY 2019**

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## ABBREVIATIONS and ACRONYMS

ACT	Artemisinin-based combination therapy
AL	Artemether-lumefantrine
ANC	Antenatal care
CDC	Centers for Disease Control and Prevention
CHW	Community health worker
DHS	Demographic and Health Survey
eLMIS	Electronic logistics management information system
FETP	Field Epidemiology Training Program
FY	Fiscal year
Global Fund	Global Fund to Fight AIDS, Tuberculosis and Malaria
GoR	Government of Rwanda
HMIS	Health management information system
IAA	Interagency agreement
iCCM	Integrated community case management
IPTp	Intermittent preventive treatment for pregnant women
IRS	Indoor residual spraying
ITN	Insecticide-treated mosquito net
IV	Intravenous
KAP	Knowledge, attitudes, and practices
LLIN	Long-lasting insecticide-treated net
LMIS	Logistics management information system
LMO	Logistics Management Office
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
OP	Organophosphate
OR	Operational research
PBO	Piperonyl butoxide
PCV	Peace Corps Volunteer
PEPFAR	President's Emergency Plan for AIDS Relief
PMI	President's Malaria Initiative
QA/QC	Quality assurance/quality control
RBC	Rwanda Biomedical Center
RBM	RBM Partnership to End Malaria
RDT	Rapid diagnostic test
SBCC	Social and behavior change communication
SIS-COM	<i>Système Informatique de Santé Communautaire</i> (community information system)
SM&E	Surveillance, monitoring, and evaluation
SP	Sulfadoxine-pyrimethamine
STOMP	Stomping out Malaria in Africa
TES	Therapeutic efficacy study
USAID	United States Agency for International Development
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 percent across 15 high-burden countries in sub-Saharan Africa through a rapid scale-up of four proven and highly effective malaria prevention and treatment measures: insecticide-treated mosquito nets (ITNs); indoor residual spraying (IRS); accurate diagnosis and prompt treatment with artemisinin-based combination therapies (ACTs); and intermittent preventive treatment of pregnant women (IPTp). With the passage of the Tom Lantos and Henry J. Hyde Global Leadership against HIV/AIDS, Tuberculosis, and Malaria Act in 2008, PMI developed a U.S. Government Malaria Strategy for 2009–2014. This strategy included a long-term vision for malaria control in which sustained high coverage with malaria prevention and treatment interventions would progressively lead to malaria-free zones in Africa, with the ultimate goal of worldwide malaria eradication by 2040–2050. Consistent with this strategy and the increase in annual appropriations supporting PMI, four new sub-Saharan African countries and one regional program in the Greater Mekong Subregion of Southeast Asia were added in 2011. The contributions of PMI, together with those of other partners, have led to dramatic improvements in the coverage of malaria control interventions in PMI-supported countries, and all 15 original countries have documented substantial declines in all-cause mortality rates among children less than five years of age.

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

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

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

This FY 2019 Malaria Operational Plan presents a detailed implementation plan for Rwanda, based on the strategies of PMI and the national malaria control program, which is called and henceforth referred to as the Malaria and Other Parasitic Diseases Division (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 2019 funding.

The proposed FY 2019 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 Rwanda Extended Malaria Strategic Plan 2013–2020 focuses on expanding the capacity for vector monitoring and employing insecticide resistance management practices across the country. PMI has supported entomological monitoring in Rwanda since 2007, including vector species composition and density, seasonality, and insecticide resistance monitoring. In 2018, PMI supported two workshops focusing on the use of CDC bottle bioassays to detect insecticide resistance and measure resistance intensity. The results of these workshops validated past results showing insecticide resistance to permethrin, deltamethrin, and lambda-cyhalothrin. However, testing with permethrin, demonstrated insecticide susceptibility can be reestablished in the presence of piperonyl butoxide (PBO).

With FY 2019 funds, PMI will support a full package of entomological monitoring in three PMI-funded IRS spray districts and two PBO long-lasting ITN districts. PMI monitoring will include insecticide resistance testing, vector density/behavior monitoring, residual efficacy monitoring, and advanced molecular analysis of specimens. Global Fund will support entomological monitoring in spray districts not supported by PMI.

### **Insecticide-treated nets (ITNs):**

Rwanda achieved universal coverage of ITNs for the first time in 2011 for all age groups. Since then, PMI has collaborated with the NMCP and the Global Fund to continue the procurement and distribution of ITNs. PMI has historically procured ITNs for routine distribution through antenatal care (ANC) clinics, expanded program for immunization clinics, and boarding schools. In 2016/2017, PMI procured 1 million ITNs and Rwanda distributed approximately 4.7 million ITNs through a mass distribution universal coverage campaign. With FYs 2016, 2017, and 2018 funding, PMI will procure approximately 2.6 million PBO LLINs for Rwanda as part of the 2019 mass campaign, as well as for routine distribution in districts receiving PBO LLINs during the campaign. With FY 2019 funding, PMI will procure 1 million LLINs for distribution through ANC and expanded program for immunization clinics. Districts that will have received PBO LLINs previously, will continue to receive PBO LLINs through routine channels. PMI will also continue to support net durability and insecticide resistance monitoring, as well as social and behavior change communication (SBCC) activities at national and community levels to ensure correct and consistent net use.

### **Indoor residual spraying (IRS):**

The MOPDD, in collaboration with Global Fund and PMI, will continue to expand IRS in high malaria burden districts. The Government of Rwanda (GoR) in 2017 contributed more than \$2 million to the purchase of long-lasting, non-pyrethroid insecticides, thus enabling blanket IRS coverage of Huye and Nyanza. From September to October 2017, PMI supported IRS campaigns across Kirehe, Nyagatare, and parts of Gisagara, covering 231,258 structures and protecting 919,735 people.

With FY 2019 funds, PMI will continue to support IRS in three high-burden districts, covering approximately 360,000 structures and protecting 1.2 million people, using a long-lasting, non-pyrethroid insecticide. The Government of Rwanda with Global Fund support will conduct IRS in other identified high-burden districts.

## **Malaria in pregnancy (MIP):**

Rwanda supports two out of the three prongs of the WHO-recommended strategy to reduce malaria in pregnancy. The MOPDD discontinued IPTp in 2008 due to significant parasite resistance to sulfadoxine-pyrimethamine. PMI continues to support other interventions to both prevent cases and encourage early detection and treatment of malaria in pregnant women, including procurement of ITNs and distribution to pregnant women at ANCs, training of healthcare workers on antenatal care, and support to a cadre of maternal health community health workers (*Agents de Santé Maternelle*) who monitor pregnant women in their village and encourage them to attend their ANC appointments. The Maternal Child and Community Health Department, in coordination with the MOPDD and with support from PMI and other partners, has developed an integrated approach to deliver quality healthcare for pregnant women. The MOPDD also works with Maternal and Child Health to deliver folate and iron to improve pregnancy outcomes.

PMI is supporting the MOPDD to implement and evaluate a pilot program of intermittent screening and treatment for malaria among 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 and are expected by the end of 2018. With FY 2019 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 Ministry of Health (MoH), will also continue to support training and facilitate supervision of *Agents de Santé Maternelle* by health center supervisors, evaluate performance of community outreach to pregnant women, and strengthen linkages between *Agents de Santé Maternelle* 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 as the first-line treatment for uncomplicated malaria and in 2009 adopted the WHO recommendation to require diagnostic confirmation of all fever cases. Parenteral artesunate was adopted for use in severe malaria cases starting in 2012. Historically, the Global Fund has procured the majority of RDTs, ACTs, and artesunate needs for Rwanda, with PMI and the GoR supplementing commodities as necessary.

PMI has prioritized capacity building at the community level and together with the GoR supports the integrated community case management approach. According to 2017 data, diagnosis and treatment by community health workers (CHWs) accounted for an estimated 53 percent of all malaria treatment in Rwanda. Per the 2017 Malaria Indicator Survey, the age group with the highest parasitemia is children 5–14 years of age. In response to the increase in cases and the shifting epidemiology, Rwanda has expanded community-based treatment to children older than five years of age and adults. Also in response to the increase in cases, the GoR granted free malaria diagnosis and treatment to the most economically vulnerable populations.

With FY 2019 funds, PMI has committed to supplying a portion of the national needs for RDTs and ACTs. The GoR will supplement with Global Fund and national resources as necessary. PMI will continue to support integrated community case management in seven districts and fund SBCC activities to promote timely care-seeking and proper use of ACTs. 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 systems for accurate malaria diagnosis.

### **Social and behavior change communication:**

PMI funds Rwanda's national malaria communications strategy, which strives to ensure that 95 percent of the population has correct knowledge of malaria prevention and control by 2020. 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 supported numerous malaria health messages across various channels such as interpersonal communication, radio, and mobile video units.

With FY 2019 funds, PMI will support nationwide SBCC activities at the Health Communication Center and the MOPDD to implement their SBCC strategy. At the national level, PMI support will focus on designing, implementing, monitoring, and evaluating SBCC activities for outcome indicators. Community-level SBCC will strengthen local capacity for SBCC and community mobilization and engagement using various channels. Rwanda will continue SBCC messaging focused on encouraging people, including pregnant women, to sleep under ITNs and to visit 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, 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. Data from Rwanda's Health Management Information System (HMIS) is 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. Malaria data from health centers, referral hospitals, and the private sector are integrated in the HMIS, whereas data from CHWs implementing integrated community case management are entered in the Community Information System (SIS-COM), which is then aggregated and integrated within the HMIS.

With FY 2019 funding, PMI will continue to support the MOPDD to strengthen evidence-based decision-making throughout the health system and surveillance, especially at the decentralized district levels. PMI will support supervision to strengthen health facility- and community-level surveillance, technical assistance for district-level epidemiological trend analysis, and use of data for program management. These activities will also include data analysis for the planned PBO net pilot. PMI will also contribute funding for a Demographic and Health Survey in 2019–2020.

### **Operational research (OR):**

The MOPDD, working with PMI and partners, is piloting an intermittent screen and treat approach for pregnant women in targeted high-burden districts using RDTs during all ANC visits in an effort to bring down the higher burden in pregnant women and prevent the deleterious effects of malaria in pregnancy. This approach involves screening pregnant women at each ANC visit, and treating those who test positive. The expected primary outcome is a reduction of placental parasitemia at the time of delivery. Enrollment in the pilot began in early 2017 and, as of May 2018, enrollment was completed. Results of the research study will inform the national MIP strategy going forward.



Over the past five years, Rwanda has actively promoted rice cultivation in its wetland areas as a means to provide food security for the population and to reduce the reliance on imported food staples. Unfortunately, all the areas where rice cultivation has expanded have also seen exponential increases in malaria. PMI proposes to conduct an operational research study on whether targeted larviciding and/or water resource management (regular flushing and draining of fields) can reduce the population of *Anopheles* and thus reduce prevalence of malaria. This MOP will provide a second year of funding for a proposed study on the effectiveness of targeted larviciding and/or water resource management on mosquito control in areas of intensive rice cultivation.

#### **Other health systems strengthening:**

Rwanda has a strong commitment to improving 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 entomology laboratory and logistics management information system; and the integration of service delivery with other programs, such as Maternal and Child Health and Expanded Program for Immunization. PMI also works with Peace Corps to strengthen the capacity of Peace Corps Volunteers and local communities to understand and prevent malaria via educational programs and activities. In addition, PMI supports the Field Epidemiology Training Program, where MoH trainees have malaria-specific training and participate in malaria control efforts. During the two-year program, trainees work daily on malaria control issues and participate in malaria field investigations.

With FY 2019 funds, PMI will work with the MOPDD and continue to support capacity strengthening at all levels, but more specifically for 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, Field Epidemiology Training Program trainees, and the WHO National Program Officer.

## II. STRATEGY

### 1. Introduction

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

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needs to achieving the targets of the MOPDD and PMI, and provides a description of activities that are planned with FY 2019 funding.

## **2. Malaria situation in Rwanda**

Rwanda is a small (26,338 km<sup>2</sup>), 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, *cellules* (cells), and 14,837 *umudugudus* (villages of 50–100 households). The entire population is at risk for malaria, including an estimated 1.8 million children less than five years of age (14.6 percent of the population) and 443,000 pregnant women per year (30.2 percent standardized birth rate; projections based on 2012 census results).

The MOPDD has classified 19 of the country's 30 districts as high endemic or endemic zones for malaria by climate, altitude, and malaria prevalence. According to the MOPDD's health management information system (HMIS) data from 2017, the Eastern and Southern Provinces accounted for 79 percent of the disease burden, and 11 endemic districts accounted for 59 percent of malaria cases in 2017. Of these, five high-burden districts (Bugesera, Gisagara, Gatsibo, Kirehe, and Nyagatare) received IRS in late 2017 or early 2018 with support from PMI, the Government of Rwanda (GoR), and the Global Fund, reaching approximately 483,000 homes and protecting more than 1.9 million people. Malaria transmission occurs year-round with two peaks from May to June and from November to December 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., villages and boarding schools in proximity to marshlands or rice fields), 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 leading cause of morbidity of children less than five years of age. In 2008, malaria dropped to the third cause of morbidity, and by 2012 dropped further to the fourth cause of morbidity in children less than five years of age. According to data provided by the Rwanda HMIS, overall malaria incidence declined 86 percent between 2005 and 2011, outpatient malaria cases declined 87 percent, inpatient malaria deaths declined 74 percent, and malaria test positivity rate declined 71 percent. According to the 2010 Rwanda Demographic and Health Survey (DHS), malaria prevalence decreased from 2.6 percent in 2008 to 1.4 percent in 2010 in children less than five years of age. More than 95 percent of total reported malaria cases are laboratory confirmed.

From 2012 to 2016, however, malaria incidence increased every year in Rwanda from 48 per 1,000 population in 2012 to 403 per 1,000 in 2016. Rwanda saw more than an eight-fold increase in reported malaria cases, from 564,407 in 2012 to 4,794,778 in 2016. Increases in malaria cases were observed in all 30 districts (Figure 1). Ten districts, primarily in East and South Provinces, had the largest increases in malaria cases. The number of cases increased five-fold in East Province (from 356,736 in 2012 to 1.7 million in 2016), and 13-fold in South Province (from 132,108 in 2012 to nearly 1.8 million in 2016). An increase in malaria-related deaths was also reported – from 419 deaths in 2013 to 715 deaths in 2016 – but the overall case fatality rate was reported to decrease from 1.8 percent to 1.5 percent during this

same period. Additionally, the DHS 2014–2015 revealed an increase of malaria prevalence among children less than five years of age (from 1.4 percent in 2010 to 2.2 percent) and stable prevalence among women aged 15–49 years (from 0.7 percent in 2010 to 0.6 percent). The Malaria Indicator Survey (MIS) 2017 confirmed the increase in malaria with prevalence (by microscopy) rising to 7.2 percent among children less than five years of age (compared with 2.2 percent in the DHS 2014–2015). The MIS 2017, which also provided the first set of prevalence estimates for other age groups, yielded a prevalence 11.2 percent among children 5–14 years of age and 5.4 percent among those  $\geq 15$  years.

In response to the dramatic increase in malaria cases and data requests from partners, the MOPDD conducted an in-depth analysis of surveillance and other data to ascertain the potential causes of the increase in cases. Among the different reasons that were identified were inconsistent vector control activities, increased rice cultivation, an increase in the total number of patients seeking healthcare in health facilities, increased number of health facilities reporting into the system, improved availability of rapid diagnostic tests (RDTs) and ACTs (encouraging patients to seek care at fully stocked health facilities), low universal ITN coverage (43 percent coverage of one ITN for every two people),<sup>1</sup> vector resistance to pyrethroid insecticides, increased rainfall, and agricultural environmental modification. The MOPDD developed a Malaria Contingency Plan which identified improved strategies to reduce the case burden, and these strategies were incorporated into the extended Malaria Strategic Plan for 2013–2020 and implemented.

For example, Rwanda expanded community-based treatment of malaria in September 2016 to include children more than five years of age and adults, and in November 2016, the GoR granted free malaria diagnosis and treatment to the most economically vulnerable populations (*Ubudehe* 1 and 2). With these expansions of community management of malaria, by early 2017, community health workers (CHWs) accounted for 56 percent of all malaria diagnosis treatment in Rwanda. In late 2016 and early 2017, GoR distributed more than five million ITNs through a mass distribution campaign, thereby increasing the proportion of the population with access to an ITN from 64 percent (DHS 2014–2015) to 72 percent (MIS 2017). IRS was implemented with an organophosphate insecticide beginning in September 2016 to pre-empt resistance to carbamate insecticides, and spray operations were expanded from three to five districts. MOPDD has engaged with other governmental sectors such as the Ministry of Agriculture to address concerns of malaria increase potentially related to environmental changes, and irrigation and farming practices.

With continued increases in malaria, a further situational analysis in 2017 led to a revision of the Contingency Plan. During that situational analysis, it was noted that malaria has been increasing in the eastern African region. In addition, experts hypothesized that a potential contributor to the increase in cases was the government initiative to convert marshlands into rice fields to improve food security and create economic opportunities for small farmers. Areas of expanded rice cultivation were noted to map geographically and temporally with areas experiencing increasing malaria burden. Although this finding was suggestive of a correlation of expansion of rice cultivation with increased malaria cases, causative association could not be established.

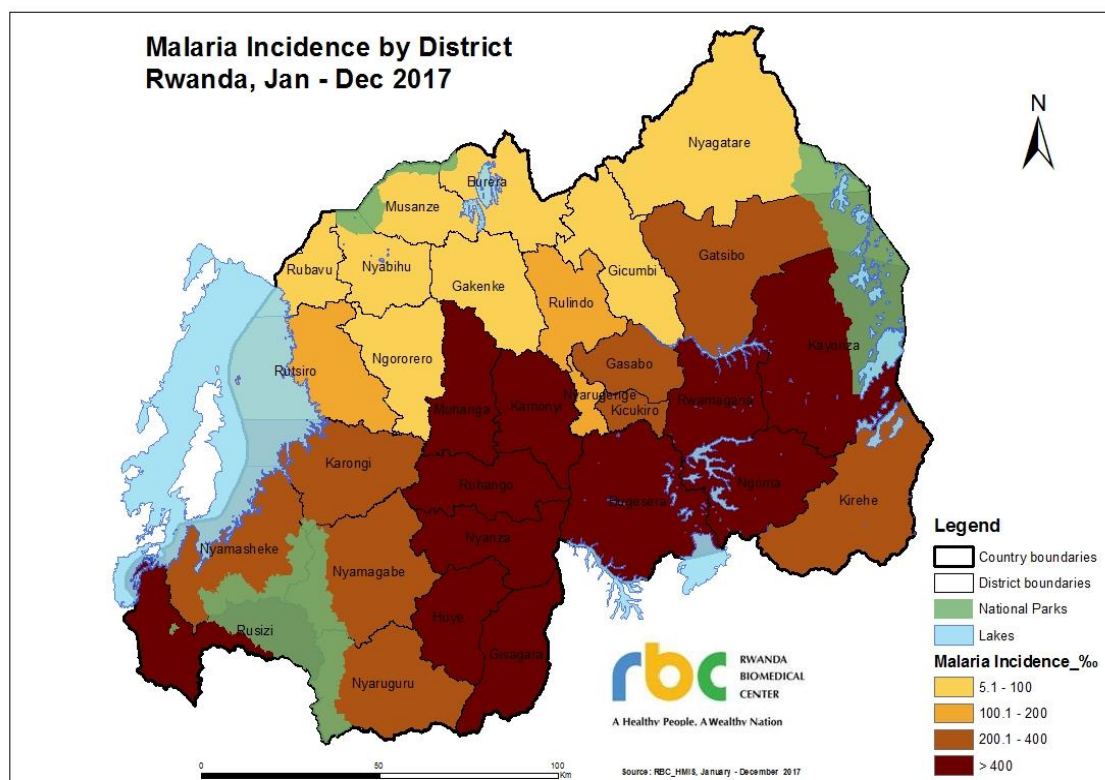
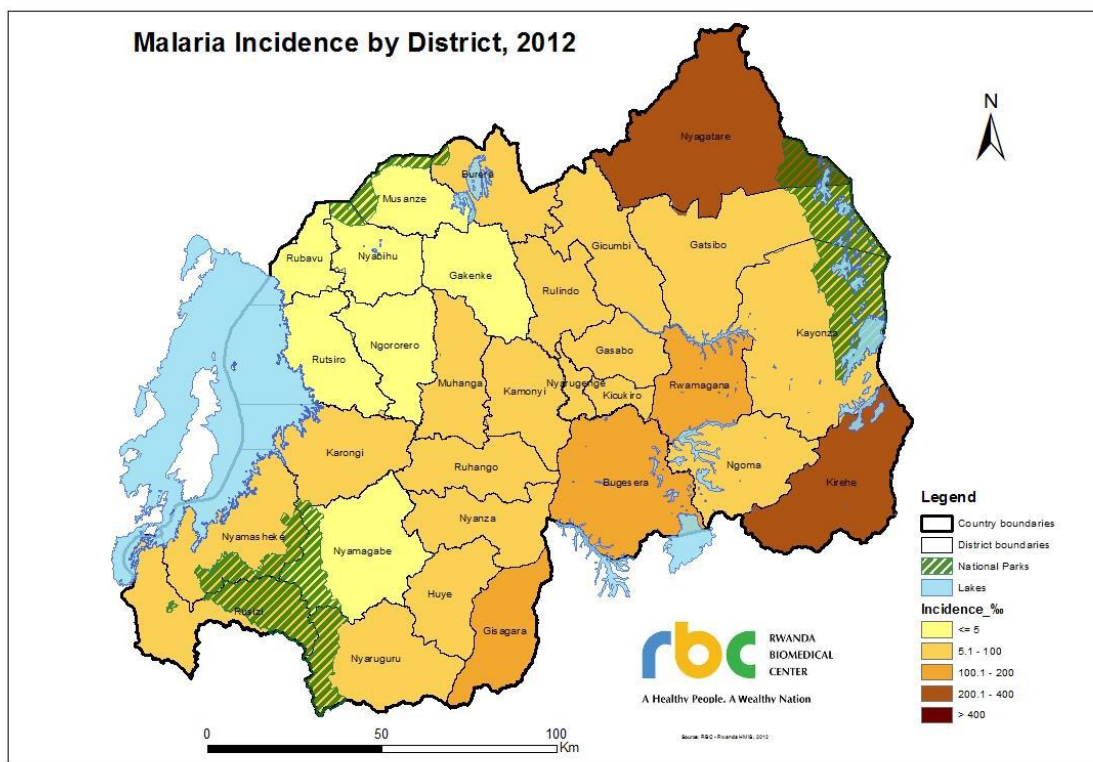
From 2016 to 2017, malaria cases in Rwanda stabilized, with 4,746,958 confirmed cases reported in 2017, minimally decreased from 4,794,778 cases in 2016. National incidence remained stable with 401 cases per 1,000 population in 2017 compared with 403 in 2016. Although cases rose slightly in East (up 14 percent) and South (up 1 percent) Provinces, case declines were noted in North, West, and Kigali Provinces. In all, 17 of 30 (57 percent) districts saw malaria cases decline from 2016 to 2017. Severe cases and deaths also declined with severe malaria incidence decreased from 39.0 per 10,000 cases in

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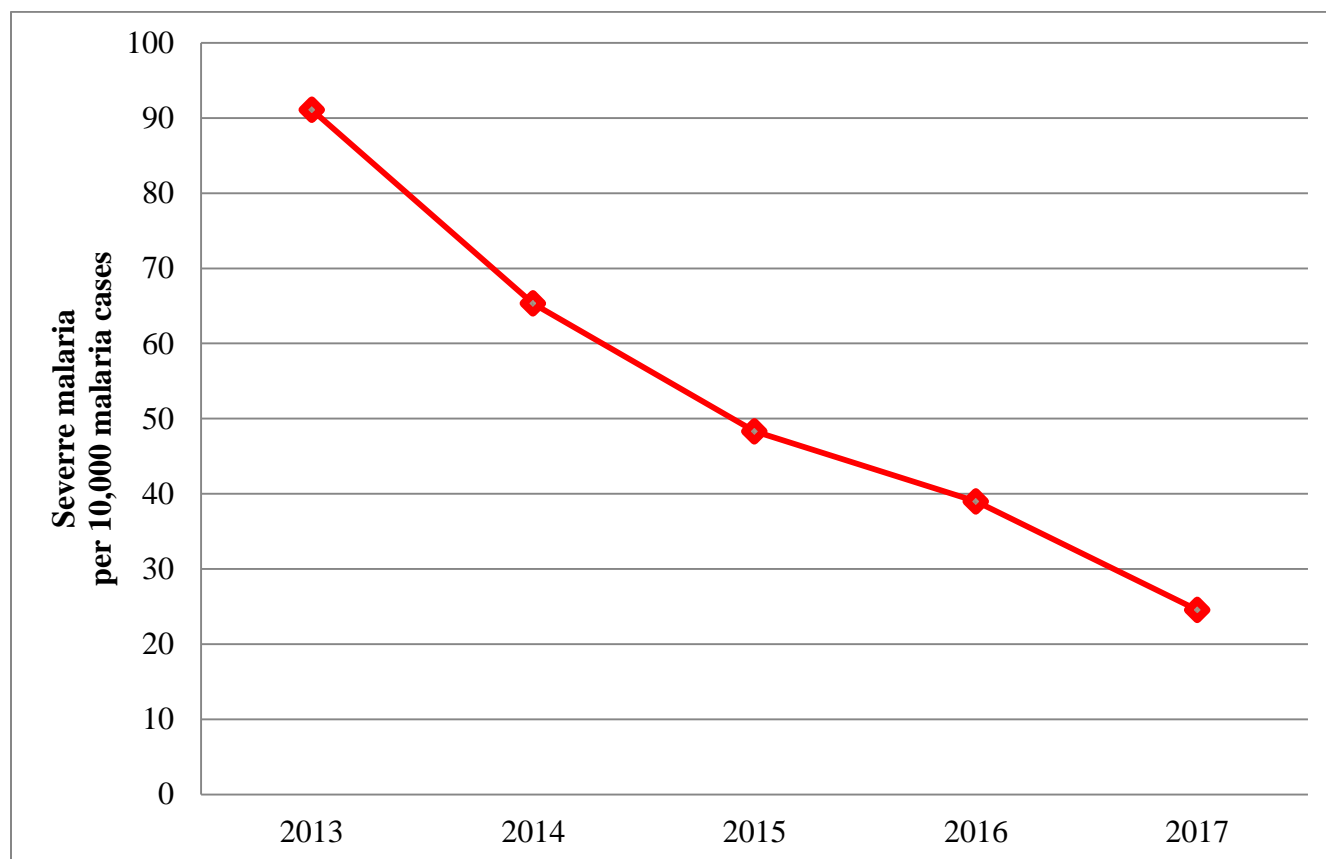
<sup>1</sup> Rwanda DHS 2014–2015.

2016 to 24.5 per 10,000 cases in 2017 (Figure 2), and malaria-related deaths decreasing from 715 in 2016 to 376 in 2017, indicating strong case management.

**Figure 1: Malaria Incidence by District in Rwanda, 2012 and 2017**



**Figure 2: Trends in Severe Malaria Incidence, 2013–2017**

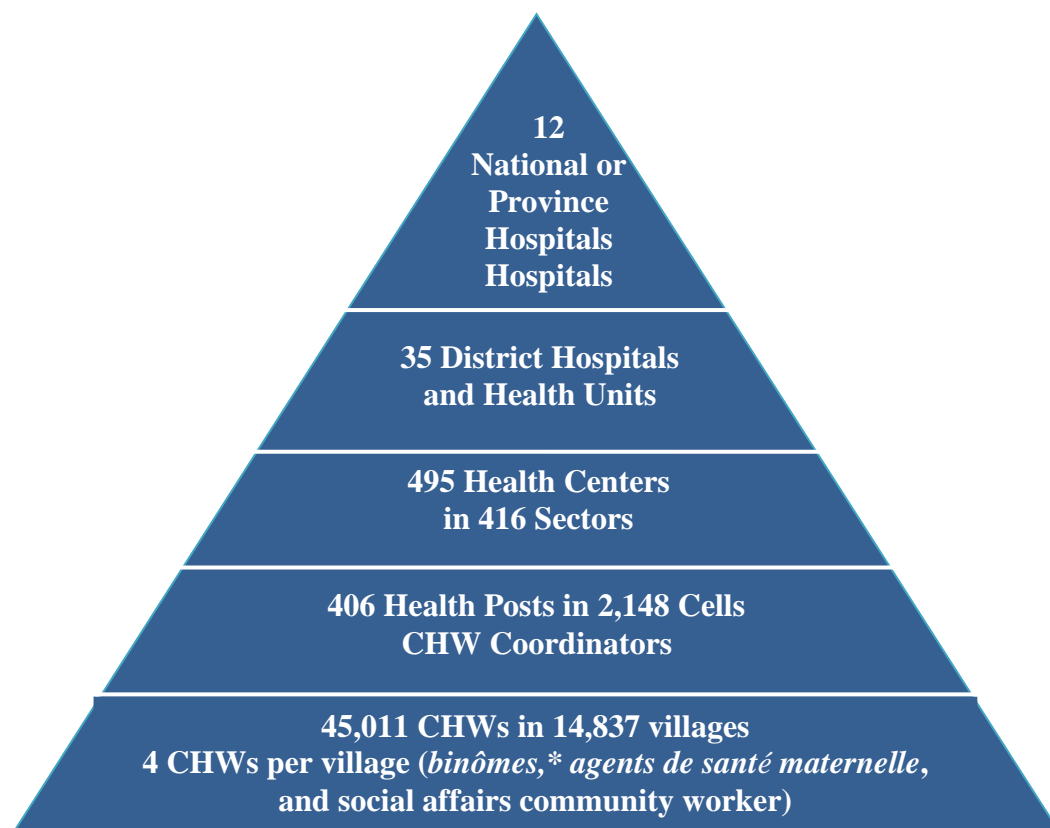


### **3. Country health system delivery structure and Ministry of Health (MoH) organization**

The Rwanda health system has five tiers and is led by the MoH (Figure 3). 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.”

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

**Figure 3: Current Rwanda Health System Overview**



\**binôme*: two community health workers (one male and one female) in a village who implement iCCM

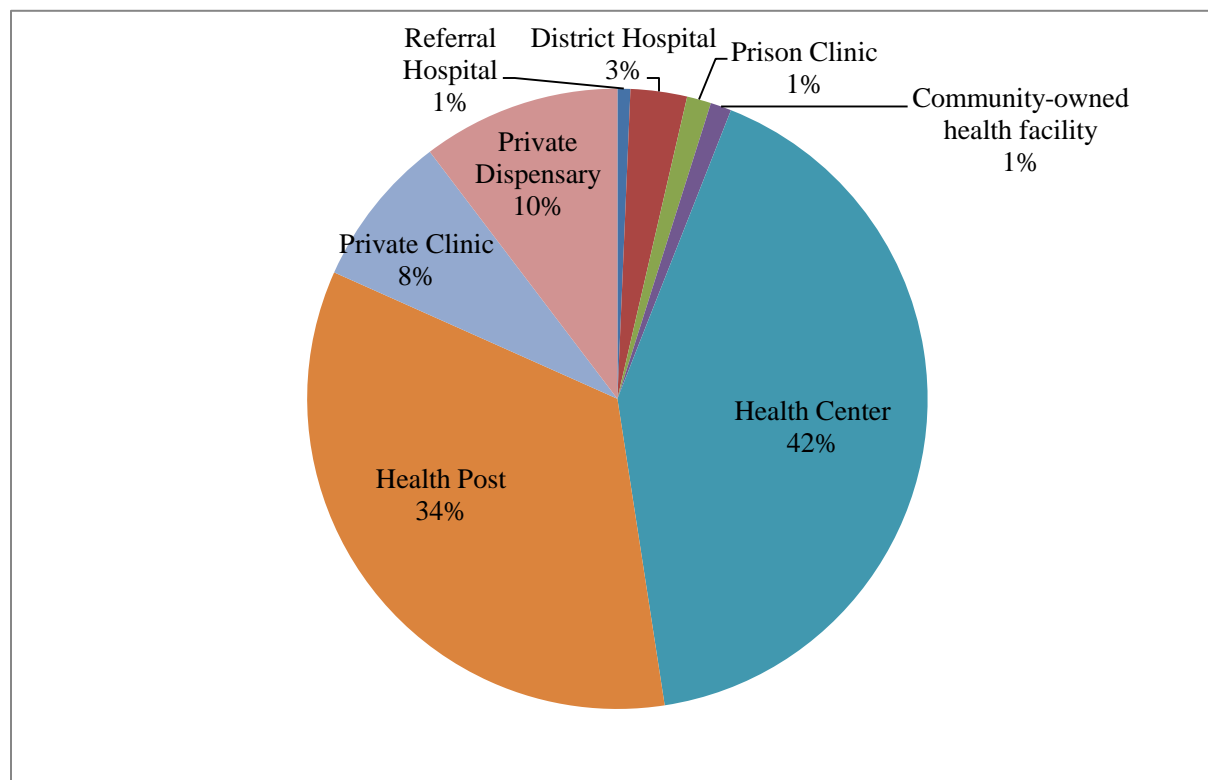
## Health facilities

The ownership of Rwanda health facilities is identified in four main categories: public, faith-based (subsidized by GoR), private, and community. Of the 931 facilities that reported administrative status in 2015, public funding contributed to 64 percent of all health facilities (46 percent public health facilities and an additional 18 percent from public facilities run in partnership with faith-based organizations). The remaining health facilities are operated by the private sector (35 percent) or are community-owned (1 percent).<sup>1</sup> The number of health facilities in Rwanda at the end of 2015 was 1,221, which includes 406 health posts, 495 health centers, and 35 district hospitals. There are an estimated 218 private clinics and dispensaries. All these facilities report data into the HMIS. Figure 4 graphically represents the proportions of different Rwandan health facilities, which are well distributed throughout the country as shown in Figure 5.

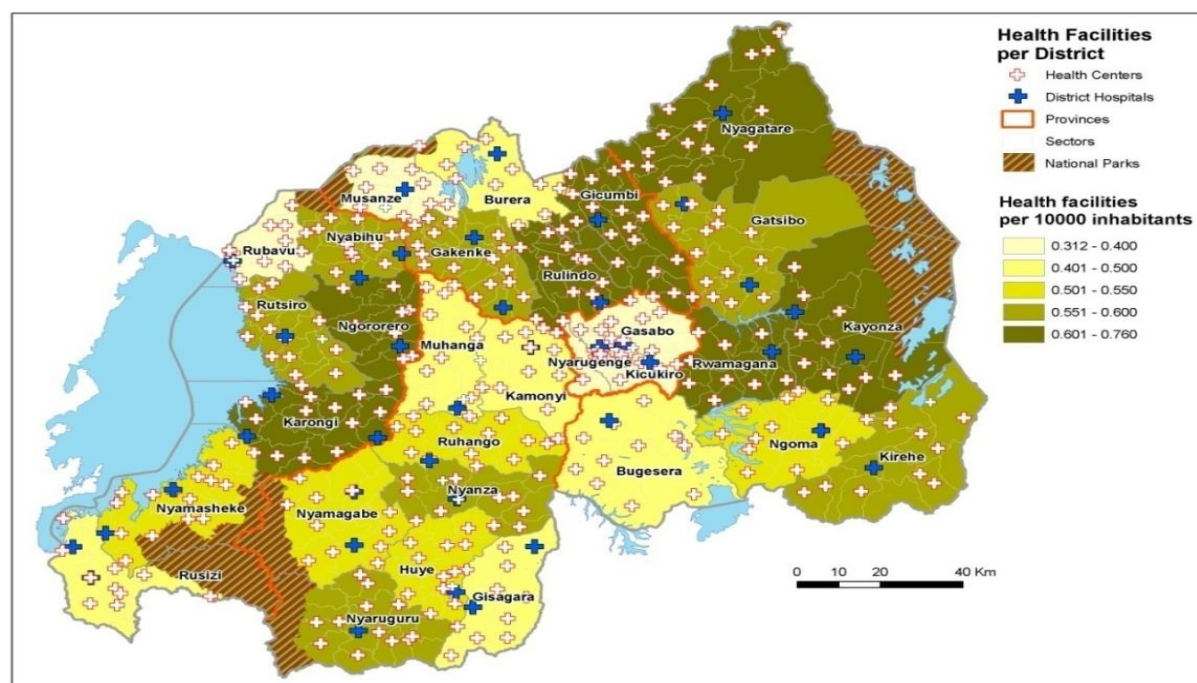
<sup>1</sup> Rwanda Health Statistical Booklet, published 2015. Available at: [http://moh.gov.rw/fileadmin/templates/hmis\\_reports/2015\\_20Annual\\_20Statistical\\_20booklets\\_20V13\\_20Signed.pdf](http://moh.gov.rw/fileadmin/templates/hmis_reports/2015_20Annual_20Statistical_20booklets_20V13_20Signed.pdf)



**Figure 4: Distribution of Health Facilities — Rwanda, 2015<sup>2</sup>**



**Figure 5: Geographical Distribution of Rwandan Health Facilities by District<sup>2</sup>**



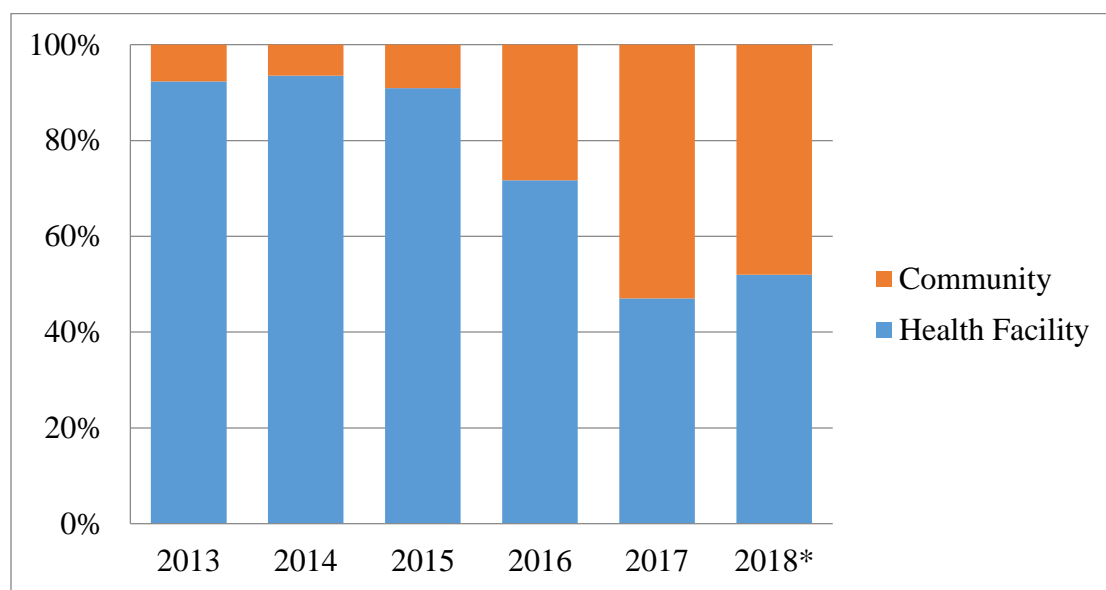
<sup>2</sup> Rwanda Health Statistical Booklet, published 2015. Available at: [http://moh.gov.rw/fileadmin/templates/hmis\\_reports/2015\\_20Annual\\_20Statistical\\_20booklets\\_20V13\\_20Signed.pdf](http://moh.gov.rw/fileadmin/templates/hmis_reports/2015_20Annual_20Statistical_20booklets_20V13_20Signed.pdf)



## Sources of outpatient care

In 2015, health facilities received a total of 14,362,926 new cases. Among them, 12,623,000 (87.9 percent) were patients seen in health centers, 512,907 (3.6 percent) in district and provincial hospitals, and 157,861 (1.1 percent) in referral hospitals. An additional 331,055 (2.3 percent) were treated by CHWs practicing integrated community case management (iCCM), while 558,777 (3.9 percent) attended private facilities. Nationally, outpatient visits increased 22.6 percent from 2014 to 2015.<sup>3</sup> A dramatic increase in the proportion of malaria cases diagnoses in the community is a result of the expansion of community-based management of fever to all ages in late 2016, as previously noted (Figure 6).

**Figure 6: Source of Malaria Care in Rwanda 2013–March 2018**



\*2018 for partial year only (January to March 2018)

## 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 (see Figure 3). Health centers use a network of 45,000 volunteer CHWs: 30,000 *binômes* (two CHWs (one male and one female)) who implement community case management, and 15,000 *Agents de Santé Maternelle* focused on maternal health; 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 CHWs' access to cell phones. Table 1 summarizes the services provided at each type of health facility.

**Table 1: Minimum Package of Services by Health Facility Type**

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 healthcare, inpatient, referral, and maternity
Dispensaries	Primary healthcare, outpatient, and referral
Health Posts	Outreach activities (i.e., immunization, family planning, growth monitoring, antenatal care)

Administratively, Rwanda consists of four provinces and Kigali City, 30 districts, 416 sectors, 2,148 cells, and 14,837 villages. The 2014–2015 DHS showed that insurance coverage has remained stable since the 2010 DHS and that 79 percent of the households have at least one family member with health insurance and that among those insured 97 percent have community health insurance (*mutuelles*). Each district has at least 1 district hospital and an average of 1 health center per 20,000 people.

#### 4. National malaria control strategy

The MOPDD, in collaboration with RBM Partnership to End Malaria (RBM), the World Health Organization (WHO), Global Fund, PMI, and other partners, developed the 2013–2018 Malaria Strategic Plan in 2012, and revised it in March 2017 as the Extended MSP 2013–2020. The original MSP addressed challenges and gaps identified in a Malaria Program Review completed in March 2011 and incorporated recommendations from a malaria pre-elimination forum that took place in September 2012. The Malaria Mid-Term Review, undertaken in September 2016, provided a detailed evaluation of achievements of the Rwanda malaria control program, identified enabling factors in terms of strategies/activities, and described gaps between planning and implementation. These included the recommendation to review the applicability of pre-elimination strategy in line with WHO guidance, strengthen the supply chain, maintain the current level of performance of the HMIS for effective malaria surveillance, and develop a structured operational research agenda. The Extended MSP was developed in 2017 through consultations with health service providers at all levels of the healthcare system and development partners, drawing on the lessons learned and recommendations from the Malaria Mid-Term Review. Included in the extended plan was a determination to refocus malaria resources from pre-elimination activities to enhanced prevention and treatment efforts for malaria control.

Under the strategic plans, 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 2013–2020 Extended MSP is to be free from malaria as a way to contribute to socio-economic development. The mission of the national malaria control program is to contribute to

socio-economic development “by strengthening and implementing appropriate interventions and quality health delivery services in partnership with stakeholders.”

The Rwanda Extended MSP 2013–2020’s goal is:

- To reduce malaria mortality by 30 percent of 2015–2016 level by 2020

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

- Objective 1: By 2020, at least 90 percent of population at risk will be effectively protected with locally appropriate preventive and vector control interventions
- Objective 2: By 2020, all malaria cases will be promptly treated in line with the national guidelines
- Objective 3: By 2020, all health facilities provide complete reporting so as to strengthen surveillance, monitoring and evaluation and inform operational research
- Objective 4: By 2020, strengthen coordination, collaboration, and effective program management at all levels
- Objective 5: By 2020, 75 percent of the population will have correct practices and behaviors towards malaria control

The strategy’s goals and objectives are aligned with three of the GoR’s primary strategic documents illustrated by Figure 7: Vision 2020, the overarching strategy used to guide long-term development in Rwanda; the National Strategy for Transformation and Prosperity for 2017-2024; and Rwanda’s mid-term development plan, which in turn serves as the framework for the national Health Sector Strategic Plan IV for 2018–2024. The MSP also builds on strategies contained in the WHO Global Technical Strategy for Malaria 2016–2030. The GoR is currently working on a revised national strategy for vision 2050.

**Figure 7: Rwanda’s Development and Health Strategic Framework**



The MSP focuses on prevention and treatment of malaria and strengthening surveillance, evaluation, and program management and coordination. It addresses gaps observed in the implementation of Rwanda's previous strategies, and provides detailed approaches for achieving malaria-related results and targets. The plan emphasizes the guiding principles of decentralization, equity, and accessibility of services, partnership with multi-sectorial approach, integration of activities, program ownership, and evidence-based interventions.

## **5. Updates in the strategy section**

Since development of the FY 2018 MOP:

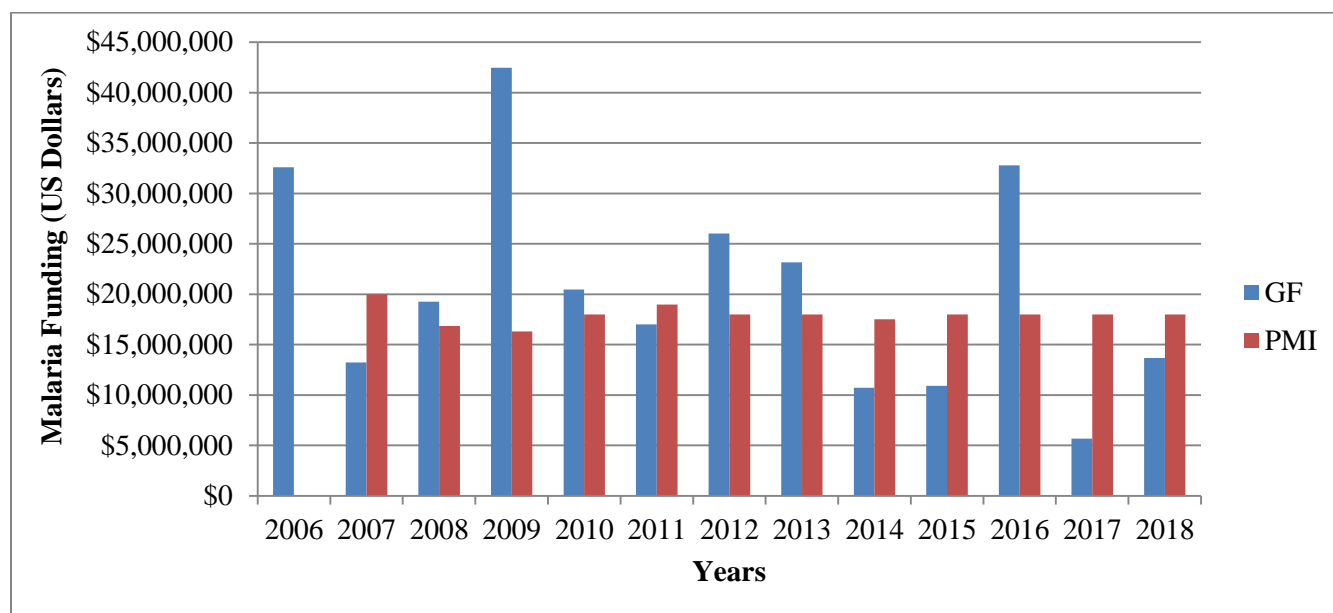
- In response to a continued increase in malaria cases after the initial contingency plan went into effect January 2016, GoR performed an in-depth analysis of national data with key stakeholders from July to August 2017. Major findings from the analysis were the demonstrable effectiveness of IRS for reducing malaria burden where applied (particularly when delivered with full-district coverage, consistently, and timed appropriately); limited impact of mass ITN distribution despite relatively high net ownership and use (presumably related to documented insecticide resistance); high burden of malaria in East and South Provinces with geographical and temporal overlap with areas of dam projects for hydropower or irrigation and areas of expanded rice cultivation; and relatively high burden of malaria among children older than five years of age and adults. The major findings provided evidence to support expanding optimized IRS implementation, piloting newer generation nets, addressing malaria in older age groups, and engaging other sectors such as agriculture and environment to combat the rise in malaria cases. Improvements in implementation and initiatives for multi-sectoral engagement were described in the newly developed Revised National Malaria Contingency Plan 2016–2020. Key interventions to be strengthened are:
  - Consistent and effective full long-lasting ITN (LLIN) coverage
  - Consistent and effective IRS in high malaria endemic districts
  - Larval source management
  - Malaria case management
  - Behavior change communication
  - Malaria prevention in pregnancy
  - Surveillance, monitoring, and evaluation and operational research
  - Integration, collaboration, and coordination with key stakeholders (including other GoR Ministries)
  - Cross border collaboration
- MOPDD entered into a 3-year agreement with Global Fund for \$41 million in continued support during 2018–2020 for malaria prevention and treatment to include commodities, health systems strengthening, entomologic monitoring, and indoor residual spraying.
- The Rwanda MoH and the Rwanda Biomedical Center (RBC) have expressed interest in pursuing a pilot of piperonyl butoxide (PBO) ITNs and have requested from PMI procurement of PBO nets and technical assistance for implementation of a pilot and impact assessment following deployment in eight to nine high-burden districts not receiving IRS.
- MOPDD Vector Control Unit has entered into a partnership with the government of Egypt to test larviciding in one district in South Province and is coordinating with a Rwandan company (AGROPY) to test larviciding in five districts.

## 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 8). Other technical development assistance for malaria comes from RBM and WHO. The Global Fund malaria grant supports the expansion of community case management with RDTs, antimalarials for treatment at health facilities and in the community, procurement of ITNs, strengthening of monitoring and evaluation systems, and resources for health communications, health systems strengthening, HMIS, and program management operating costs. The MOPDD had one Global Fund malaria grant for the 2015–2017 allocation period set at \$49 million, and has recently signed a new agreement covering 2018 to 2020 with \$41 million over the three years representing a 16 percent decrease in funding from the previous grant. In order to sustain the gains made after the 2016–2017 ITN mass distribution, the GoR has requested support from Global Fund to implement another mass ITN campaign in 2019 for distribution of 6.6 million ITNs in 27 districts nationwide. The GoR has also requested funding from both Global Fund and PMI to continue IRS in three to five high-burden districts as a strategy to manage insecticide resistance. Additionally, funds have been requested from PMI and Global Fund for implementation of entomological and insecticide resistance monitoring to inform vector control interventions. Net durability monitoring and quality control of IRS will also be supported by PMI. The GoR has requested Global Fund support the procurement and distribution of 5.6 million RDTs in calendar year 2020 with PMI to procure an additional 990,437 RDTs. Similarly, Global Fund has been asked to support procurement and distribution of 1.9 million ACT doses, with PMI providing an estimated 3.8 million additional doses of ACTs. There is no geographic division of PMI- and Global Fund-supported interventions other than IRS. PMI works closely with the MOPDD to ensure that there is no duplication of activities.

**Figure 8: Global Fund and PMI Support to Rwanda, 2006–2018<sup>4</sup>**



Sources: [www.theglobalfund.org](http://www.theglobalfund.org); [www.pmi.gov](http://www.pmi.gov)

<sup>4</sup> Figures are planned amounts per fiscal year.

PMI works in collaboration with the President's Emergency Plan for AIDS Relief (PEPFAR) on crosscutting programmatic issues related to HIV/AIDS and malaria interventions. This has included support to the Medical Procurement and Distribution Division (MPDD) of the MoH and co-funding, since 2012, the Field Epidemiology Training Program (FETP). 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 the Global Health Security Agenda was initiated in May 2016. A three-day workshop brought together multi-sectoral professionals to assess Rwanda's standing on issues that help attain a world safe and secure from global health threats posed by infectious diseases. The Global Health Security Agenda aims to address global health security risks and assure global preparedness for 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 U.S. Government funds are committed to Global Health Security Agenda activities in Rwanda.

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

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

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

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

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<sup>5</sup> [http://whqlibdoc.who.int/publications/2007/9789241596084\\_eng.pdf](http://whqlibdoc.who.int/publications/2007/9789241596084_eng.pdf)

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

- Proportion of households with at least one ITN
- Proportion of the population with access to an ITN. [Please see <http://www.malariasurveys.org/documents/Household%20Survey%20Indicators%20for%20Malaria%20Control.pdf> for a description of this indicator.]
- Proportion of children under five years old who slept under an ITN the previous night
- Proportion of pregnant women who slept under an ITN the previous night
- Proportion of the population that slept under an ITN the previous night
- Proportion of children under five years old with fever in the last two weeks for whom advice or treatment was sought
- Proportion of children under five with fever in the last two weeks who had a finger or heel stick
- Proportion receiving an ACT among children under five years old with fever in the last two weeks who received any antimalarial drugs
- Proportion of women who received two or more doses of intermittent preventive treatment for pregnancy women (IPTp) for malaria during antenatal care (ANC) visits during their last pregnancy
- Proportion of women who received three or more doses of IPTp for malaria during ANC visits during their last pregnancy

## 8. Progress on coverage/impact indicators to date

**Table 2: Evolution of Key Survey Based Malaria Indicators in Rwanda from 2005 to 2017**

Indicator	2005 DHS	2007-08 DHS	2010 DHS	2013 MIS	2014-15 DHS	2017 MIS
% Households with at least one ITN	15%	56%	82%	83%	81%	84%
% Population with access to an ITN	9%	38%	64%	66%	64%	72%
% Children under five who slept under an ITN the previous night	13%	57%	70%	74%	68%	68%
% Pregnant women who slept under an ITN the previous night	17%	60%	72%	74%	73%	68%
% Population that slept under an ITN the previous night	9%	40%	58%	61%	61%	64%
% Children under five years old with fever in the last two weeks for whom advice or treatment was sought	52%	44%	50%	68%	57%	56%
% Children under five with fever in the last two weeks who had a finger or heel stick	N/A	N/A	21%	30%	36%	38%
% Children receiving an ACT among children under five years old with fever in the last two weeks who received any antimalarial drugs	N/A	N/A	37%	92%	99%	99%
% Women who received two or more doses of IPTp during their last pregnancy in the last two years	0%	17%	N/A *	N/A	N/A	N/A
% Women who received three or more doses of IPTp during their last pregnancy in the last two years	0%	4%	N/A *	N/A	N/A	N/A
Under-five mortality rate per 1,000 live births	152	103	76	N/A	50	N/A
% children under five with parasitemia (by <b>microscopy</b> , if done)	N/A	3%	1%	N/A	2%	7%
% children under five with parasitemia (by <b>RDT</b> , if done)	N/A	N/A	3%	N/A	8%	12%

\*Rwanda discontinued IPTp in 2008



**Table 3: Evolution of Key Malaria Indicators Reported through Routine Surveillance Systems in Rwanda from 2012 to 2017**

	2012	2013	2014	2015	2016	2017
<b>Total # Cases (Confirmed and Presumed) <sup>1</sup></b>	564,407	1,051,480	1,749,711	2,763,956	4,794,778	4,746,958
<b># Confirmed Cases <sup>2</sup></b>	564,407	1,051,480	1,749,711	2,763,956	4,794,778	4,746,958
<b># Presumed Cases <sup>3</sup></b>	0	0	0	0	0	0
<b>Total # &lt;5 Cases <sup>4</sup></b>	119,563	216,423	310,905	444,198	653,501	591,365
<b>Total # Malaria Deaths <sup>5</sup></b>	459	419	499	489	715	376
<b>Data Completeness (%) <sup>6</sup></b>	88%	91%	93%	96%	98%	98%
<b>Test Positivity Rate <sup>7</sup></b>	16%	29%	29%	37%	42%	50%

<sup>1</sup>Total # cases: Total number of reported malaria cases. All ages, outpatient, inpatient, confirmed and unconfirmed cases.

<sup>2</sup># confirmed cases: Total diagnostically confirmed cases. All ages, outpatient, inpatient.

<sup>3</sup># presumed cases: Total clinical/presumed/unconfirmed cases. All ages, outpatient, inpatient.

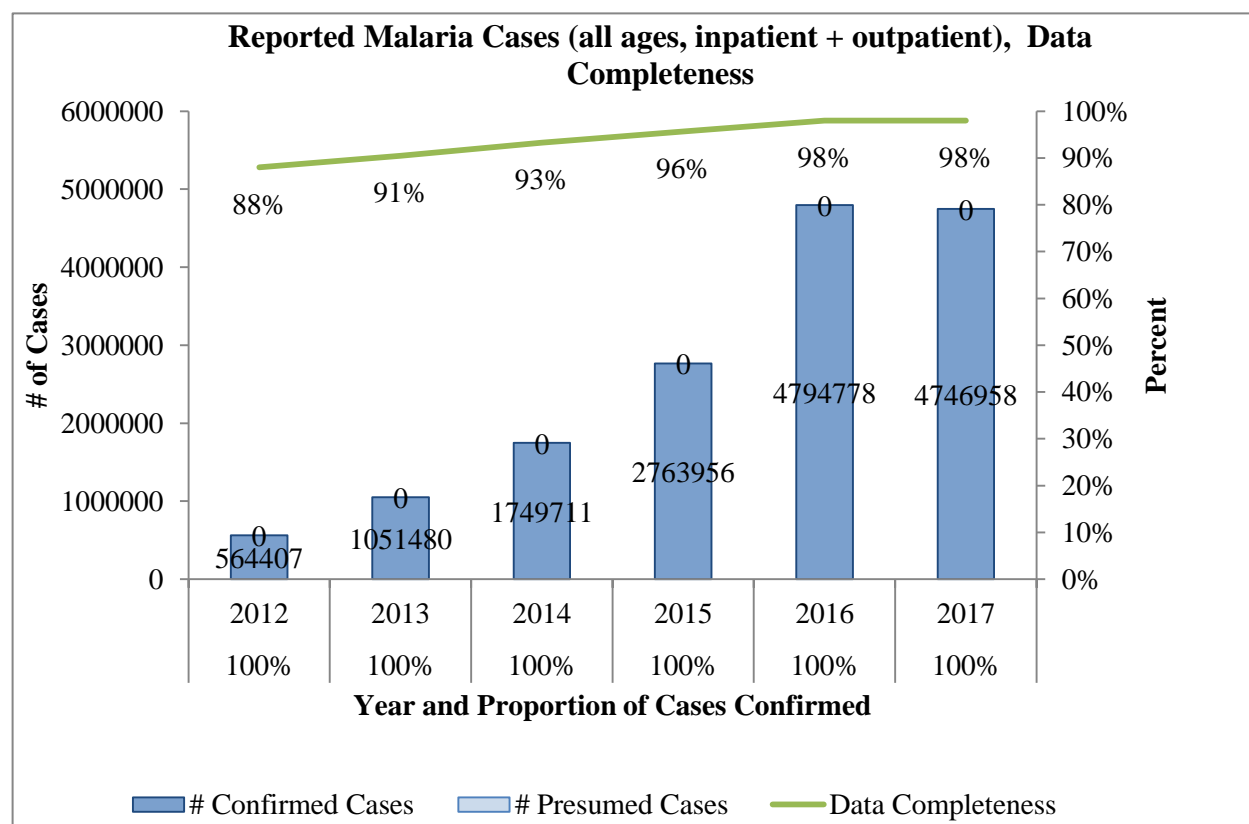
<sup>4</sup>Total #<5 cases: Total number of <5 cases. Outpatient, inpatient, confirmed, and unconfirmed.

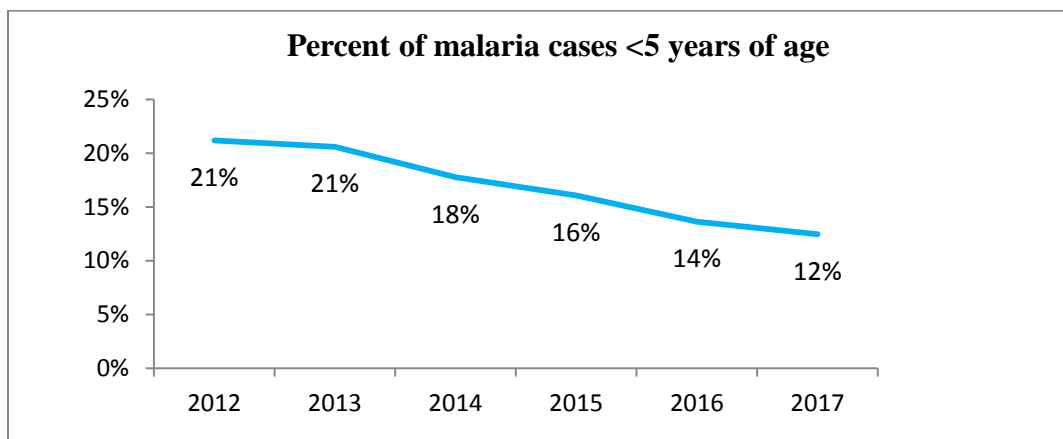
<sup>5</sup>Total # Malaria Deaths Reported: All ages, outpatient, inpatient, confirmed, and unconfirmed

<sup>6</sup>Data completeness: Number of monthly reports received from health facilities/Number of health facility reports expected (i.e., number of facilities expected to report multiplied by the number of months considered)

<sup>7</sup>Test Positivity Rate: Number of confirmed cases (#2 above)/Number patients receiving a diagnostic test for malaria (RDT or microscopy)

**Figures 9 and 10: Trends in Key Malaria Indicators Reported in Routine Surveillance Systems**





**9. Other relevant evidence on progress**

N/A

### III. OPERATIONAL PLAN

The overall PMI strategy for Rwanda is aligned, complementary, and supportive of both Rwanda's 2013–2020 national MSP and the newly introduced Malaria Contingency Plan, with specific goals to address the increase in malaria cases over the past several years. In 2017, the MOPDD revised the Malaria Strategic Plan to remove the focus on pre-elimination and reorient the program towards control of malaria transmission. To support these actions, PMI will make strategic investments that leverage resources from the GoR, development partners, and technical agencies. PMI's national-level support includes procurement of ITNs, health system strengthening, surveillance, monitoring, and evaluation support to the MOPDD to promote data use, improvement of pharmaceutical and commodity supply chain management, and enhancement of SBCC activities. PMI also supports IRS in select high-burden districts, as well as integrated prevention and treatment interventions, including provision of antimalarial commodities and diagnostics in health facilities and communities, iCCM, and malaria in pregnancy.

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 2019 PMI budget for Rwanda is \$18 million. PMI will support the following interventions with these funds.

#### 1. Vector control

##### MOPDD/PMI objectives

The Rwanda National Strategic Extension Plan (2013-2020) focuses on maintaining universal coverage with long-lasting ITNs (LLINs), expanding IRS to new districts, increasing the capacity for vector monitoring and conducting routine insecticide resistance management across the country.

Rwanda's national ITN strategy is to ensure universal coverage with ITNs. Maintaining universal coverage will be achieved through continuous distribution channels (i.e., ANC clinics, expanded program for immunization clinics, and public boarding schools), as well as universal coverage mass campaigns. 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 RBM 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 mass campaigns, which differs from WHO's recommendation of a three-year mass campaign schedule. This is based on a net durability study in Rwanda that showed ITNs lose efficacy within 18-24 months.<sup>6</sup>

With monetary support from Global Fund and PMI, the GoR has steadily expanded IRS from three to five districts. The number of total structures sprayed with combined Global Fund and PMI support has increased from 227,969 in 2013 to 483,595 from September 2017 to February 2018. The total population protected by IRS in Rwanda has expanded from 975,259 in 2013 to 1,933,024 in 2017. The proportion

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<sup>6</sup> Hakizimana *et al.* Monitoring long-lasting insecticidal net (LLIN) durability to validate net serviceable life assumptions, in Rwanda. *Malaria Journal*, 2014, 13:344.

of structures sprayed in targeted areas has remained high at approximately 98 percent. The MOPDD's strategy is to expand blanket spraying to eight high malaria burden districts by 2019 with the overarching goal to reduce current malaria infections 30 percent by 2020. In 2017, an organophosphate insecticide was used in both PMI- and Global Fund/GoR-supported districts.

PMI currently supports IRS operations in two districts. In addition, 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. Data to monitor vector insecticide susceptibility, ITN performance, and pre- and post-IRS impact-related entomological indicators (i.e., vector density, taxonomy, and parity rates) are collected in 12 sites across Rwanda.

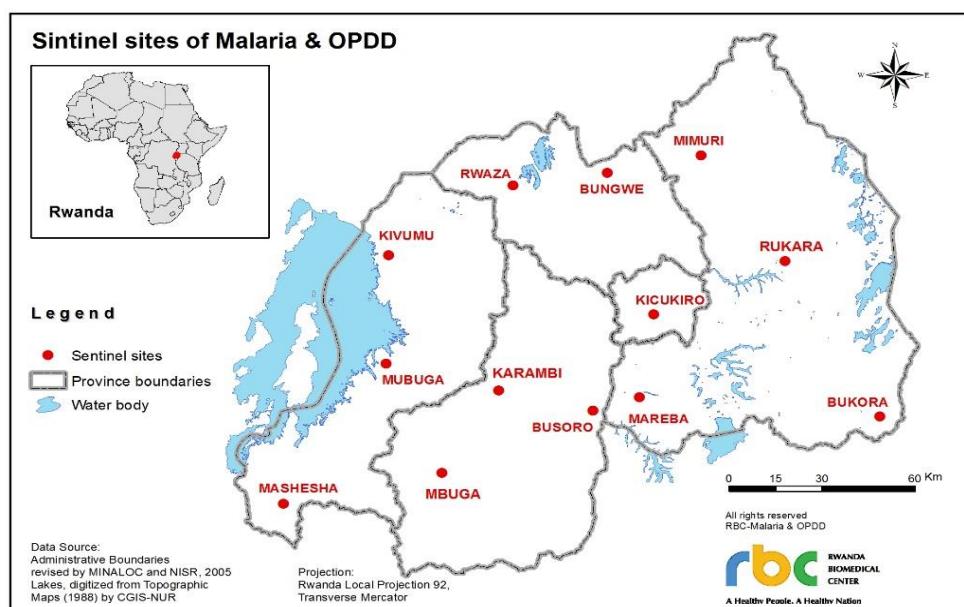
#### a. Entomologic monitoring and insecticide resistance management

##### Progress since PMI was launched

PMI has supported entomologic monitoring in Rwanda since 2007. The GoR maintains 12 entomologic monitoring sites, including a thirteenth site, Mbuga, used for collecting meteorological data (Figure 11). Pyrethrum spray catches and human landing catches are the two methods employed for collecting field mosquitoes.

Over the past 10 years, PMI has gained a significant understanding of vector biology in Rwanda. Mosquitoes collected since 2007 have shown a statistical difference between indoor and outdoor collections in all districts. *An. gambiae* s.l. demonstrated more exophagic than endophagic behavior. Past mosquito collections have consistently shown *Anopheles gambiae* s.l. comprising the majority of species captured, followed by *An. funestus*, *An. pharoensis*, *An. ziemmani*, *An. Coustani*, and *An. maculipalpis*. Since 2016, molecular testing (using PCR) has been conducted on all *An. gambiae* s.l., with around 63 percent determined to be *An. arabiensis* and the remainder being *An. gambiae* s.s.

**Figure 11: Entomological monitoring sites supported by PMI — Rwanda, 2017\***



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

### Progress during the last 12-18 months

Monthly entomological data collection was conducted in three districts receiving IRS (Bugesera, Kirehe, and Nyagatare (two sectors in each district)), and one non-IRS district (one sector in Ngoma), from July 2016 to June 2017. In total, 9,246 adult female *Anopheles* mosquitoes were collected using human landing catches and pyrethrum spray catches.

*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. Bugesera had the highest average vector density of the IRS districts (0.55 *An. gambiae* s.l./house/day) compared to Kirehe (0.43 *An. gambiae* s.l./house/day) and Nyagatare (0.33 *An. gambiae* s.l./house/day). Ngoma had the highest mosquito density (1.0 *An. gambiae* s.l./house/day). Average hourly biting rates per person per hour (b/p/h) varied across the four districts; they were highest in Nyagatare (average 0.56 b/p/h indoors and 0.55 b/p/h outdoors), followed by Ngoma (control district) (average 0.41 b/p/h indoors and 0.45 b/p/h outdoors), and Kirehe (average 0.16 b/p/h indoors and 0.28 b/p/h outdoors). Bugesera showed the lowest rates (average 0.10 b/p/h indoors and 0.19 b/p/h outdoors). Rice farming in Nyagatare could be a contributing factor for the higher biting rates compared to other districts.

From July 2016 to June 2017, a total of 3,504 mosquitoes were collected from the four districts (pre- and post-IRS) and subsequently tested for *Plasmodium* circumsporozoite proteins using ELISA. Sporozoite rates across sites ranged from 0.9 percent to 2.2 percent. General comparison of positivity between the intervention sectors and the control sector showed that there was no significant difference ( $P>0.05$ ) between positivity in the control site and four of the intervention sectors on the post-spray period collections.

Results of insecticide resistance testing are shown in the tables below.

**Table 4: *An. gambiae* s.l. Insecticide Suseptibility<sup>1</sup> in PMI- Funded Rwandan IRS Districts Using WHO Bioassay Tubes (2017)**

Sites	District	Insecticide Class						
		% mortality 24 hours post exposure						
		Delta-methrin 0.05%	Permethrin 0.75%	Lambda-cyhalothrin 0.05%	Pyrimiphos-methyl 0.25%	Bendiocarb 0.1%	Fenitrothion 1%	DDT 4%
Nyagatare	Nyagatare	80	80	58	100	100	100	50
Remera	Ngoma	82	64	67	100	90	100	79
Kirehe	Bokora	98	97	97	100	100	100	100
Mimuli	Nyagatare	98	98	85	100	100	98	100

<sup>1</sup>WHO 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.

PBO synergist assays conducted by MOPDD in four districts from four provinces in 2017 all demonstrated pyrethroid resistance with restoration of susceptibility to 100 percent on addition of PBO. Similar results were found with PBO assays in eight districts from the same four provinces in 2015.

PMI has continued to support training workshops and assist the MOPPD with insecticide resistance technical training. Two entomological technical assistance visits in January and May 2018 provided in-depth training on the use of the CDC bottle assay and corroborated findings of insecticide resistance

(Table 5). Trainees from the 12 entomology sentinel sites and facilitators from the Ministry of Health's MOPDD and PMI-supported implementing partners participated in these visits. Tests comparing permethrin and permethrin plus PBO exposed mosquitoes confirmed insecticide susceptibility to permethrin is restored once exposed to PBO (Table 6).

**Table 5: *An. gambiae* s.l. Susceptibility<sup>1</sup> in Bugesera to Five Insecticides Using the CDC Bottle Assay, January 2018**

Insecticide Class					
% mortality (0-120 min exposure) 1X diagnostic dose <sup>1</sup>					
Time (min)	Delta-methrin	Permethrin	Lambda-cyhalothrin	Pirimiphos-methyl	Bendiocarb
0	0	0	0	0	0
15	38	0	78	5	100
30	<b>69</b>	<b>18.5</b>	<b>81</b>	45	<b>100</b>
45	76	44	81	70	100
60	84	70	81	<b>100</b>	100
75	92	82	81	100	100
90	96	85	89	100	100
105	100	93	89	100	100
125	100	96	89	100	100

<sup>1</sup>CDC bottle bioassay diagnostic doses ( $\mu\text{g}/\text{bottle}$ ) for *Anopheles* at 30min diagnostic time: Deltamethrin: 12.5, Permethrin: 21.5, Lambda-cyhalothrin: 12.5, Bendiocarb: 12.5; and 60min diagnostic time: Pirimiphos-methyl: 20.

**Table 6. *An. gambiae* s.l. susceptibility<sup>1</sup> in Bugesera to permethrin (1X) and permethrin (1X) + PBO using the CDC bottle assay, May 2018**

Insecticide Class		
% mortality (0-120 min exposure) 1X diagnostic dose <sup>1</sup>		
Time (min)	Permethrin	Permethrin + PBO
0	0	0
15	10	91
30	<b>43</b>	<b>95</b>
45	73	95
60	90	96
75	97	96
90	97	99
105	100	100
125	100	100

<sup>1</sup>CDC bottle bioassay diagnostic dose ( $\mu\text{g}/\text{bottle}$ ) for *Anopheles* at 30min diagnostic time to permethrin: 21.5.

Plans and justification for proposed activities with FY 2019 funding:

PMI will continue to support entomological monitoring in PMI-supported IRS districts and those districts receiving PBO LLINs. Monthly entomologic monitoring in PMI-supported IRS districts include

collecting adult mosquitoes using pyrethrum spray catches and human landing catches to assess vector species distribution and density, seasonality, and behavior. Monthly data collection will also include determination of insecticide decay rates. Moreover, PMI will support insecticide resistance testing, including intensity assays and synergist testing, as well as molecular analysis of specimens for species identification and sporozoite rates.

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

## **b. Insecticide-treated nets**

### *Progress since PMI was launched*

A 2009 universal coverage campaign was planned in Rwanda to expand the coverage achieved during the campaign implemented in 2006 (which targeted children less than 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. In 2013, the MOPDD conducted a targeted universal coverage campaign in high-burden districts. An additional distribution campaign in March 2015 replaced some of these ITNs.

In 2016, PMI procured 1 million ITNs with FY 2015 funds. Although PMI has historically procured ITNs that are earmarked for routine distribution, these ITNs were distributed as part of the mass campaign in 2016/2017. In total, 4,706,107 ITNs were distributed as part of the mass campaign, which targeted all districts in the country, with a top-up among the population that had not received ITNs from the distribution undertaken in 2015 in ten districts. Although the mass campaign was supposed to take place in 2016 alone, there were delays in distributing all the ITNs due to concerns raised by the MoH about the quality of some of the ITNs procured by partners. These issues were resolved, and all ITNs were distributed by February 2017.

### *Progress during the last 12-18 months*

The Rwandan 2017 MIS showed that after the 2016/2017 mass distribution campaign, LLIN access was high: 72 percent of the de facto household population could sleep under an ITN if each ITN in the household were used by up to two people.

Since PMI-procured LLINs went toward the mass campaign in 2016/2017, Global Fund procured 1 million LLINs to cover routine distribution channels in 2017-2018. There have been delays in procuring LLINs for routine distribution with FYs 2016 and 2017 PMI funds, but the issues surrounding the delays have been resolved, with PMI procuring rectangular nets instead of conical LLINs moving forward. Hence, with FYs 2016, 2017, and 2018 funding, PMI will procure approximately 2.6 million PBO LLINs for Rwanda as part of the 2019 mass campaign and for routine distribution in districts receiving PBO LLINs during the campaign.

To ensure increased utilization of ITNs, 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 was conducted in November 2017. Preliminary data show that 72 percent of those interviewed noted that sleeping under an ITN could prevent malaria.

Following the 2016/2017 mass campaign, the MOPDD had planned to initiate LLIN durability monitoring. While some LLIN bioassays have been conducted, formal durability monitoring was not started within the six-month window post campaign, and therefore the activity has been put on hold until the next mass campaign.

### Commodity gap analysis

Each year, the MOPDD undertakes a quantification of ITNs needed in the country based on their own fiscal year, which runs from July to June.

**Table 7. ITN Gap Analysis**

<b>Calendar Year</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>
<b>GOR Fiscal Year<sup>1</sup></b>	<b>2017-2018</b>	<b>2018-2019</b>	<b>2019-2020</b>
Total Targeted Population	11,839,420	12,132,544	12,432,365
<b>Continuous Distribution Needs</b>			
Channel #1: ANC	449,898	461,037	472,430
Channel #2: Expanded Program for Immunization	449,898	461,037	472,430
Channel #3: Boarding Schools			250,000
<i>Estimated Total Need for Continuous Channels</i>	899,796	922,074	1,194,860
<b>Mass Campaign Distribution Needs</b>			
2018/2019/2020 mass distribution campaign(s)		6,740,302	
<i>Estimated Total Need for Campaigns</i>		6,740,302	
<b>Total ITN Need: Routine and Campaign</b>	<b>899,796</b>	<b>7,662,376</b>	<b>1,194,860</b>
<b>Partner Contributions</b>			
ITNs carried over from previous year		100,204	236,154
ITNs from MOH			
ITNs from Global Fund <sup>2</sup>	1,000,000	5,127,452	
ITNs from other donors			
ITNs planned with PMI funding		2,670,874	1,000,000
<b>Total ITNs Available</b>	<b>1,000,000</b>	<b>7,898,530</b>	<b>1,236,154</b>
<b>Total ITN Surplus (Gap)</b>	<b>100,204</b>	<b>236,154</b>	<b>41,294</b>

<sup>1</sup>Rwanda 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.

<sup>2</sup>The 1 million PMI-procured ITNs were distributed as part of the mass campaign in 2016/2017, and there was replacement of these with nets procured through the Global Fund for routine distribution.

### Plans and justification for proposed activities with FY 2019 funding:

With FY 2019 funding, PMI will procure 1 million LLINs for distribution through routine channels to new cohorts of children less than five years of age and pregnant women. In addition, nets will be distributed at boarding schools. Districts that will have received PBO LLINs previously will continue to receive PBO LLINs through routine channels.

PBO LLINs will be targeted to high malaria burden provinces, ideally covering the Southern Province. This pilot distribution will be evaluated by population-level data on ITN ownership and use and population-based prevalence data on parasitemia gathered through national surveys. In addition, surveillance data from the routine information systems at community and health facility level will be



used to determine trends in symptomatic disease, and entomological monitoring will be conducted to measure vector dynamics (density, seasonality, and behavior of vectors), and trends in mosquito infectivity and insecticide resistance. Lastly, LLIN durability monitoring will be conducted on both PBO and non-PBO, mass-distributed LLINs.

PMI will focus SBCC efforts at the national and community levels to promote correct and consistent usage of LLINs (described under the SBCC section), with particular emphasis on hanging and use of rectangular nets, especially through the PMI-Peace Corps collaboration.

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

### c. Indoor residual spraying

#### *Progress since PMI was launched*

Analysis conducted in mid-2017 indicated that malaria burden from the five districts receiving IRS at least twice during 2013–2016 decreased from 57.6 percent of national confirmed malaria cases to 18.8 percent. While national case counts increased more than eight-fold from 2012, districts with full IRS coverage saw a combined decrease in malaria cases by 31.4 percent in the 12 months after IRS spray rounds. With this favorable impact, the GoR has focused on maximizing IRS. Due to resistance to pyrethroid insecticides, Rwanda transitioned from pyrethroids to carbamate-class insecticides for IRS in early 2013, and in late 2015 decided to rotate from carbamates to organophosphate-class insecticides. PMI-supported IRS districts transitioned from carbamates to organophosphate-class insecticides in September 2016, and GoR-sprayed districts transitioned to organophosphates in September 2017. In order to address the ongoing causes of the increase of malaria since 2012, one of the mitigation strategies identified in the Malaria Contingency Strategy was to transition from focal spraying back to blanket spraying in counties with the highest malaria burden. During the September 2016 spray campaign, PMI, in collaboration with MOPDD, selected Kirehe and Nyagatare for blanket spraying using an organophosphate (pirimiphos-methyl). Pirimiphos-methyl remained effective for 10 months in Kirehe and for 11 months in Nyagatare (Figure 12). Table 8 summarizes PMI-supported IRS rounds.

**Table 8: PMI-Supported IRS in Rwanda, By District, 2016–2020**

Calendar Year	Number of Districts <sup>1</sup> Sprayed	Insecticide Used	Number of Structures Sprayed	Coverage Rate	Population Protected
2016 (Feb-Mar)	2	bendiocarb	147,947	98%	774,778
2016 (Sep-Oct)	2	pirimiphos-methyl	198,000	99%	812,714
2017 (Sep)	3	pirimiphos-methyl	231,258	99%	919,735
2018 <sup>2</sup>	2	pirimiphos-methyl	206,611		813,177
2019 <sup>2</sup>	3	long-lasting, non-pyrethroid	270,000		1,000,000
2020 <sup>2</sup>	3 to 4	long-lasting, non-pyrethroid	360,000		1,200,000

<sup>1</sup>Districts sprayed with PMI support from 2016 to 2020 include Nyagatare and Kirehe, plus additional district(s) TBD for 2019–2020.

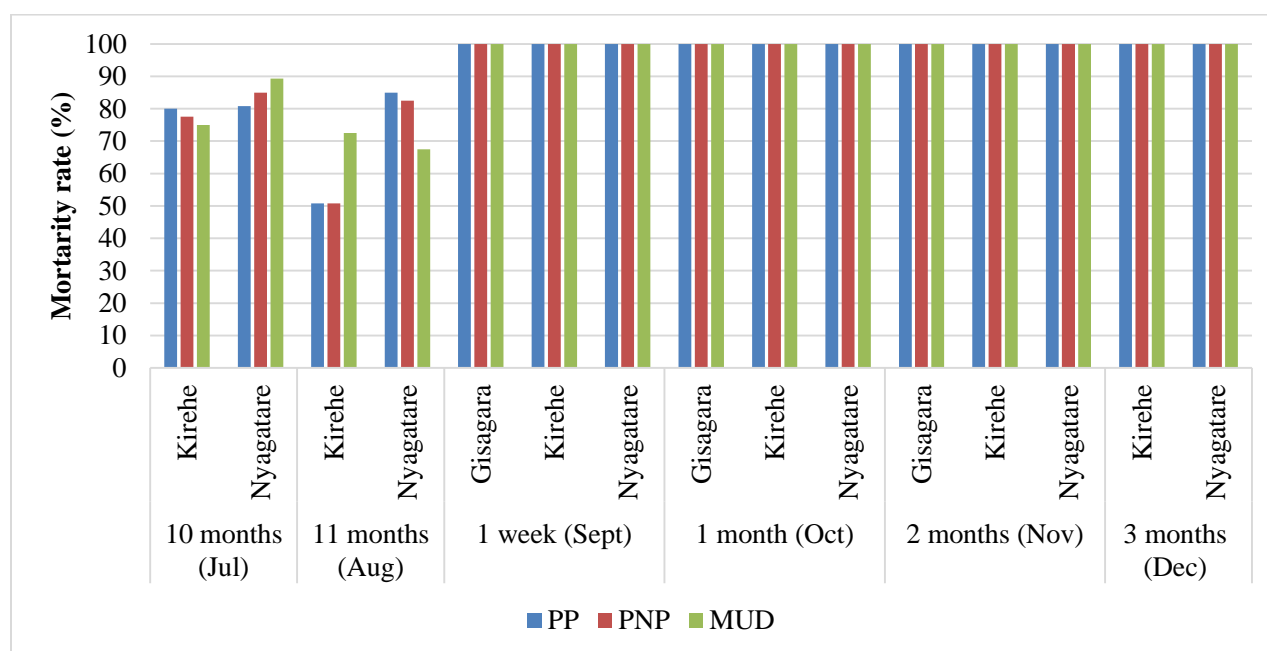
<sup>2</sup>Represents targets based on the 2018 IRS work plan, and/or projected targets based on national strategic plan and/or discussions with the NMCP.

### Progress during the last 12-18 months

In September 2017, a PMI-funded spray campaign was conducted in Kirehe and Nyagatare and sectors of Gisagara, using the organophosphate Actellic 300 CS (pirimiphos-methyl). This spray campaign, conducted over 20 days, achieved 99.3 percent coverage and protected 919,735 people. Quality control tests using WHO cone bioassays were conducted within one week and one month post-spray and showed 100 percent mortality of susceptible *An. gambiae* s.s. Tests conducted three months post-spray also showed 100 percent mortality of the test mosquitoes on all wall surfaces (mud, plaster with paint, and plaster without paint) (Figure 12).

In 2017, PMI trained 5,825 individuals to support IRS activities in the three districts. Of these, 1,587 were spray operators (630 men and 957 women), 373 were team leaders (195 men and 178 women), and 2,865 were village information, education, and communication mobilizers (2,603 men and 262 women). More than half (60.3 percent) of all spray operators trained to implement IRS were women.

**Figure 12: WHO Cone Bioassay Results (July–December 2017)**



In 2017/2018, the GoR provided more than \$2 million towards IRS in Huye and Nyanza in Southern Province spraying 156,504 structures and protecting 611,178 people. Under MOPDD direction, GoR, PMI, and Global Fund contributions were coordinated during the September 2017 and February 2018 spray campaigns.

### Plans and justification for proposed activities with FY 2019 funding:

Currently, over 70 percent 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. In 2018, PMI-supported IRS will be conducted in Kirehe and Nyagatare, covering approximately 207,000 structures. In 2019 and 2020, PMI plans to support IRS in three to four districts and to preemptively rotate at least in part to a new chemical class of insecticides (neonicotinoids). It is expected that the NgenIRS project will accelerate and expand access to

neonicotinoids, the cost of which is expected to be comparable to organophosphates. PMI will work with the GoR to set up a rotation of non-pyrethroid, long-lasting insecticide products for IRS to manage the development of insecticide resistance, as the GoR also plans to begin transitioning their IRS campaigns to neonicotinoids. The GoR, with Global Fund support, will conduct IRS in high-burden districts not supported by PMI. PMI's support will be marked with increased emphasis on MOPDD engagement for IRS and capacity building in anticipation of greater GoR support.

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

## **2. Malaria in pregnancy**

### **MOPDD/PMI objectives**

Rwanda's malaria in pregnancy (MIP) strategy follows the WHO recommendations to prevent, promptly detect, and treat malaria in pregnant women. This includes providing ITNs to pregnant women on their first ANC visit, iron and low-dose folate, and case management of febrile pregnant women with parasitological diagnosis by microscopy or RDTs. Rwanda discontinued IPTp in 2008 due to increasing parasite resistance to sulfadoxine-pyrimethamine and decreasing malaria prevalence nationwide at the time. Currently, the MOPDD is conducting a study to explore the feasibility of an intermittent screen and treat 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 artemether-lumefantrine (AL) in the second and third trimester for uncomplicated cases. Severe malaria in pregnant women is treated with injectable artesunate.

### **Progress since PMI was launched**

Maternal mortality in Rwanda fell from 750 deaths (2005 DHS) to 210 deaths (2014–2015 DHS) per 100,000 live births, a 72 percent decline. Although 99 percent pregnant women visit ANC at least once during their pregnancy, starting ANC at a median gestational age of four months, only 44 percent of women make four or more ANC visits. Net usage among pregnant women continued to rise from 17 percent (2005 DHS) to 73 percent (2014–2015 DHS) before declining in 2017 to 68 percent (MIS 2017).

The Rwandan Maternal Child and Community Health Division (MCCD), in coordination with the MOPDD and with support from PMI and other partners, has developed an integrated approach to deliver quality healthcare for pregnant women. The services provided by these units, in addition to fetal growth monitoring and birth preparation, make up the antenatal care package, which is now available nationwide. CHWs who focus on maternal health (*Agents de Santé Maternelle*) 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 performance-based financing and high enrollment in community health insurance schemes (*mutuelles*). The MoH, with the support of partners, has worked to improve the quality of services for case management at health facilities through training and capacity building efforts at national and district levels.

After discontinuing IPTp in 2008, the MOPDD is reassessing their MIP approach, particularly in high-burden districts. Results of the 2011–2012 rapid assessment showed a low nationwide malaria prevalence of 2 percent 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 was disproportionately elevated relative to other districts (up to 6.3 percent by microscopy), which exacerbates poor birth and maternal outcomes in these focal areas.

#### *Progress during the last 12-18 months*

The MOPDD, working with PMI and partners, began a pilot intermittent screen and treat approach for pregnant women in targeted high-burden districts using RDTs during all ANC visits in an effort to reduce the higher burden in pregnant women and prevent the deleterious effects of malaria in pregnancy. This approach involves routinely screening pregnant women at each ANC visit with an RDT and treating those who test positive. In addition, each woman is provided an ITN at first ANC visit. The primary outcome is a reduction of placental parasitemia at the time of delivery. Enrollment in the pilot began in early 2017 and as of May 2018, enrollment had completed. Currently, qualitative interviews and focus groups are being evaluated and laboratory specimen processing and data cleaning are underway. Data analysis will soon begin, and an initial draft of the report is expected in late 2018. The MOPDD will use the results of the intermittent screen-and-treat approach for pregnant women pilot to design their future MIP national strategy.

#### *Plans and justification for proposed activities with FY 2019 funding:*

With FY 2019 funding, PMI will continue to support MIP activities in Rwanda by purchasing LLINs for ANC clinics. PMI will procure PBO nets for women attending ANC in districts receiving PBO LLINs during the 2019 mass campaign. Furthermore, PMI will continue to coordinate with U.S. Government maternal and child health 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.

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

### **3. Case management**

#### *MOPDD/PMI objectives*

The goal of the Extended National Strategic Plan is to “reduce malaria mortality by 30 percent of the 2015–2016 level by 2020.” Its case management objective is that, by 2020, all malaria cases will be promptly treated according to national guidelines. 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. The CHWs are supplied with malaria commodities by health facilities. The electronic logistics management information system (eLMIS) does not track commodities at the community level.

CHWs report use of commodities through SISCOM and the information is integrated in the eLMIS reporting at health facilities.

All health facilities use 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 less than five years of age with ACTs. In response to the recent upsurge in cases of malaria, CHWs have been permitted to test and treat cases in older age groups as of 2016. In addition, in November 2016, the GoR granted free malaria diagnosis and treatment to the most economically vulnerable populations (categories *Ubudehe* 1 and 2). Case management guidelines are currently being updated to include pre-referral management and treatment of severe malaria at the community level with rectal artesunate.

Because of the increase of malaria cases in recent years, the Extended National Strategic Plan has dropped all previously proposed pre-elimination activities for the foreseeable future.

**Table 9. Status of Case Management Policy in Rwanda**

<b>Status of Case Management Policy in Rwanda according to National Guidelines for the Treatment of Malaria in Rwanda, 2013</b>	
What is the first-line treatment for uncomplicated <i>P. falciparum</i> malaria?	Artemether lumefantrine (AL)
What is the second-line treatment for uncomplicated <i>P. falciparum</i> malaria?	Oral quinine
What is the first-line treatment for severe malaria?	Parenteral artesunate
In pregnancy, what is the first-line treatment for uncomplicated <i>P. falciparum</i> malaria in the first trimester?	Oral quinine
In pregnancy, what is the first-line treatment for uncomplicated <i>P. falciparum</i> malaria in the second and third trimesters?	Artemether lumefantrine (AL)
In pregnancy, what is the first-line treatment for severe malaria?	Parenteral artesunate
Is pre-referral treatment of severe disease recommended at peripheral health facilities? If so, with what drug(s)?	Intramuscular artesunate
Is pre-referral treatment of severe disease recommended for community health workers? If so, with what drug(s)?	No
If pre-referral rectal artesunate is recommended, for what age group? (note: current international guidelines do not recommend administering to those $\geq 6$ years)	N/A

### 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 referral process (if needed) 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. PMI/Rwanda supports supportive supervision for RDTs at the community level. Currently, approximately 30,000 CHWs implement the iCCM package throughout the country's 30 districts. PMI jointly implements iCCM with the Global Fund. Currently, PMI supports community malaria care in seven districts (3,392 villages) and the Global Fund supports the other districts. Financing of community-based healthcare is provided through the community insurance scheme, small fees collected for medications, and community performance-based financing. PMI-supported SBCC activities have focused on creating awareness among communities on prompt diagnosis of fever and treatment of malaria.

The use of intravenous (IV) artesunate was adopted in 2012 and scaled up in 2013 for severe malaria treatment. In 2013, with PMI support, the national guidelines for malaria treatment were revised and published. 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 percent were children less than 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.

### 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 percent microscopic laboratory confirmation of malaria cases at health facilities and RDTs at the community level according to Rwanda's routine HMIS. Ongoing efforts to improve diagnostic quality over the past year included the training of 12 laboratory technicians on microscopy diagnosis and on conducting malaria microscopy quality assurance/quality control (QA/QC) in health centers. Regarding microscopy QA/QC, central-level laboratorians review a random sample of slides from the district health facilities and district-level laboratorians review slides from a random selection of health facilities in their district. If discordant results are found upon slide review, feedback is provided along with corrective measures and formative supervision. Draft Integrated Malaria Control Guidelines under development by MOPDD in 2018 indicate that QA/QC of CHW proficiency with RDTs is done by direct observation of the CHW's performance of RDT testing during routine supervisory visits. Supervisory visits are to be made at a minimum of every six months or quarterly if possible. A checklist for observing CHW performance of the RDT as provided by the National Reference Laboratory is included in the appendix of the draft document.

The recent surge in malaria cases has motivated a stronger focus on high-quality case management practices, both at the health facility and community levels. Monthly mentorship visits on integrated management of childhood illness from district health staff to 160 health centers have been conducted in

seven PMI-supported districts, and 276 health providers in 10 districts were oriented on community health mentorship. In addition to routine supportive supervisory visits, cell coordinators for each area met monthly with the CHWs to share data, answer questions, and provide support. With FY 2017 funds, PMI supported the training of 2,453 healthcare workers and CHWs on malaria diagnosis and case management. To strengthen the reporting of case management data from the community, 77 cell coordinators in Kirehe were trained on data collection and reporting. PMI supports home-based management of malaria with CHW training and commodities. Aggregated 2017 data show that 53 percent of people with malaria were diagnosed and treated in the community versus 47 percent at the health facility level.

MOPDD is carefully reviewing surveillance data to follow the impact of this initiative. An evaluation of the performance of CHWs for iCCM (not limited to home-based management of malaria) conducted in eight districts in August 2017 found that malaria was the most common illness seen by CHWs in the preceding three months (38 percent of illnesses) and was correctly treated at 85 percent of encounters. While RDTs were the most available of all iCCM commodities in stock for CHWs, lack of ACT availability impacted CHW performance. MOPDD has since launched an initiative for rapid, secure text messaging for CHWs to alert the supporting health facility of impending or actual stockouts of malaria commodities.

Despite the increase in malaria cases in recent years, there has not been a proportionate increase in severe cases, and fatality rates from malaria remain low. This is likely to have resulted from successful efforts to ensure early and appropriate treatment.

PMI is currently supporting a therapeutic efficacy study (TES) for the first-line drug artemether-lumefantrine in three study sites (Rukara, Bugarama, and Masaka) with plans to enroll 88 patients per site. The TES protocol was developed in accordance with WHO standard antimalarial drug efficacy protocols and approved by the Rwanda Ethics Committee. Data collection started in March 2018 and enrollment should conclude in September 2018, followed by laboratorian training and specimen testing in late 2018 or early 2019 depending on laboratory availability. Final results are expected in the first half of 2019 and MOPDD anticipates the next TES will be conducted in 2021 with FY 2020 PMI funds. The RBC Malaria Annual Report for 2016-2017 indicated that a study conducted in 2015 showed high level of drug efficacy with PCR-corrected cure at 98 percent or 99 percent for the two medications tested. Should Rwanda consider adopting another ACT as second-line therapy for uncomplicated *P. falciparum* malaria, PMI will advocate for including it in future TESs.

**Table 10. PMI-funded TESs**

Ongoing TESs			
Year	Site name	Treatment arm(s)	
2018	Rukara, Bugarama, Masaka	AL	Enrollment began March 2018
Future TESs			
Year	Site name	Treatment arm(s)	
2021	TBD	TBD	Anticipated MOP FY2020

#### Commodity gap analysis

The MOPDD led a joint quantification exercise in November 2017 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, 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. Data from Tables 11 and 12 are consumption-based forecast estimates.

While data for severe malaria commodities are not included in the tables, the GoR is planning to purchase quinine and IV artesunate (MOPDD does not use IV artemether). GoR plans to fund and use rectal artesunate in the community setting, with training starting in 2018.

**Table 11: RDT Gap Analysis**

Calendar Year	2018	2019	2020
GOR Fiscal year	2017-2018	2018-2019	2019-2020
RDT Needs			
Total country population	11,839,420	12,132,544	12,432,365
Population at risk for malaria <sup>1</sup>	11,839,420	12,132,544	12,432,365
PMI-targeted at-risk population	11,839,420	12,132,544	12,432,365
Total number of projected fever cases	10,194,696	10,778,468	10,999,477
Percent of fever cases tested with an RDT <sup>2</sup>	57%	57%	57%
<b>Total RDT Needs by Projected Fever Cases</b>	<b>5,810,977</b>	<b>6,143,727</b>	<b>6,269,702</b>
Partner Contributions (to PMI target population if not entire area at risk)*			
RDTs carried over from previous year	0	724,642	108,848
RDTs from Government	0	0	0
RDTs from Global Fund	3,035,619	5,527,932	5,640,747
RDTs from other donors	0	0	0
RDTs planned with PMI funding	1,000,000	0	990,437
Additional RDTs procured with PMI funding	2,500,000	--	--
<b>Total RDTs Available</b>	<b>6,535,619</b>	<b>6,252,574</b>	<b>6,740,032</b>
<b>Total RDT Surplus (Gap)</b>	<b>724,642</b>	<b>108,848</b>	<b>470,330</b>

<sup>1</sup>Population at risk equals total population because all areas of country at risk for malaria.

<sup>2</sup>Current % fever tested with an RDT was calculated from 2017 HMIS data



**Table 12: ACT Gap Analysis**

Calendar Year	2018	2019	2020
GOR Fiscal Year	2017-2018	2018-2019	2019-2020
<b>ACT Needs</b>			
Total country population	11,839,420	12,132,544	12,432,365
Population at risk for malaria <sup>1</sup>	11,839,420	12,132,544	12,432,365
PMI-targeted at-risk population	11,839,420	12,132,544	12,432,365
Total projected number of malaria cases <sup>2</sup>	4,738,654	4,738,554	4,501,722
<b>Total ACT Needs<sup>3</sup></b>	<b>5,290,845</b>	<b>5,533,420</b>	<b>5,633,784</b>
<b>Partner Contributions</b>			
ACTs carried over from previous year	0	1,094,338	0
ACTs from Government	0	0	0
ACTs from Global Fund <sup>4</sup>	3,573,293	2,109,528	1,864,718
ACTs from other donors	0	0	0
ACTs planned with PMI funding	1,741,852	1,772,273	2,300,000
Additional ACTs procured with PMI funding	1,070,038	--	--
<b>Total ACTs Available</b>	<b>6,385,183</b>	<b>4,976,139</b>	<b>4,164,718</b>
<b>Total ACT Surplus (Gap)</b>	<b>1,094,338</b>	<b>-557,281</b>	<b>-1,469,066</b>

<sup>1</sup>Population at risk equals total population because all areas of country at risk for malaria.

<sup>2</sup>Total projected number of malaria cases was updated based on the total number of malaria cases recorded from January to December 2017. The quantification assumed that this number will be the same for the following year and reduce by 5% and 10% in 2020 and 2021, respectively. However, the number of malaria cases (service-based method) was not preferred to be used as the final quantification results; instead the consumption-based estimate was preferred. Therefore, the total ACT needs are based on historical consumption trends and consider supply plan aspects such as stock on hand, shipments on order and minimum-maximum system. For the commodities needed as per the supply plan, shipments needed to come at the beginning the following financial year (July 2020) were added to the quantities in FY 2019. This will avert a gap in funding in case there is an unexpected increase in malaria cases as seen in the past. This is why the ACTs needed seem to increase while the projected malaria cases are decreasing.

<sup>3</sup>Supply plan aspects such as stock on hand, shipments on order and minimum-maximum system were considered in estimating the total needs. This is to cater for the amount of stock that needs to be sitting in warehouses along the supply chain to avoid stockouts at the facility level.

<sup>4</sup>In FY 2017/2018, Global Fund funded more ACTs than those in the initial Global Fund concept note due to increased needs compared to the initial plan. A funding reallocation was done to ensure ACTs availability in country.

### **Quantification of IV artesunate/IM artemether**

IV artesunate procurement was previously supported by the Global Fund, but PMI proposes to support the procurement of approximately 80,000 60mg vials for use at the health facility level with FY 2019 funds.

### **Quantification of rectal artesunate**

PMI will support the procurement of approximately 400,000 100mg suppositories of rectal artesunate for use by CHWs at the community level for children under 6 years of age with signs of severe malaria while awaiting transfer to higher level of care.

#### Plans and justification for proposed activities with FY 2019 funding:

Rwanda's Extended Malaria Strategic Plan 2013–2020 to “ensure all malaria cases are treated in accordance with the national treatment guidelines” has three strategies, all supported by PMI:

Strategy 1: Provide malaria diagnosis to all suspected malaria cases at all levels

Strategy 2: Provide prompt and correct treatment to uncomplicated malaria cases at all levels

Strategy 3: Strengthen quality assurance and control of all malaria consumables and commodities

To accomplish MOPDD's case management goal, PMI supports capacity building for malaria diagnosis, procurement of RDTs and ACTs for use by CHW, procurement of additional ACTs for uncomplicated malaria treatment in health facilities, and training for case management at health facility and community levels. Gaps in commodities (including artesunate) will be filled through Global Fund and GoR procurements.

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

#### **4. Crosscutting and other health systems strengthening**

In order to successfully implement the aforementioned activities, PMI supports a suite of activities that cut across and benefit insecticide- and drug-based prevention and case management activities. For example, availability of high-quality commodities is necessary to ensure high ITN coverage and effective case management, and health-seeking behavior of individuals and communities is necessary to improve coverage of all interventions. In addition, the gains achieved in malaria control in Rwanda can only be sustained if there are strong health systems and local capacity. Hence, systems strengthening and capacity building are intrinsic in all PMI intervention-specific activities previously mentioned (e.g., training and supervision of health workers, technical assistance for planning and monitoring interventions, etc.). Non-intervention specific or crosscutting health systems strengthening activities are described below.

##### **a. Pharmaceutical management**

#### MOPDD/PMI objectives

The MoH, through the MOPDD and the Medical Procurement and Production Division (MPPD), conducts annual quantifications for malaria medicines and RDTs to meet the need of the public sector facilities in the country. The PMI commodities and supply chain logistics partner provides technical assistance in both an annual quantification exercise as well as quarterly supply plan re-assessments relative to the quantification findings. Rwanda's malaria supply chain is part of an integrated system with a harmonized and recently rolled-out electronic LMIS (fully replacing the now defunct paper-based LMIS). The supply chain has four levels: central (MPPD), districts, health facilities, and the community level, which collectively operate via a pull logistics system with each facility estimating needs based on historical orders that account for seasonal transmission, and issues data, informing subsequent orders from MPPD. One of the priorities of the GoR is to strengthen district pharmacies to manage commodity distribution systems. The MPPD delivers commodities to the 30 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 eLMIS 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. Given the relative health of the malaria supply chain in Rwanda, stock

disturbances are typically corrected within days. Community health workers are provided commodities through their supporting health facility. Stock levels are tracked by CHWs and reported on a monthly basis. The MOPDD is also using the RapidSMS platform for CHWs to report any impending stockouts and to have a resupply from the health facility.

### *Progress since PMI was launched*

Rwanda health programs, including malaria, benefit from robust country-led support and ownership, which has been critical to ensuring sustainable progress vis-à-vis supply chain logistics and technical assistance strengthening. The procurement and management of antimalarials and other commodities continues to go through the MPPD – which is mandated to avail high-quality, cost-effective medicines, medical equipment (including RDTs) and related medical supplies – is organizationally part of the RBC. The LMO was established in 2012 to provide central coordination and technical assistance in logistics management across commodities and health areas. In 2013, the GoR developed a National Supply Chain Strategic Plan, which informed the subsequent development of the National Pharmaceutical Supply Chain Strategic Plan (2013-2018). The primary objective of this strategy is to improve all health outcomes and aims to achieve this, in part, by strengthening supply chain management. The LMO manages malaria commodities as part of the Coordinated Procurement and Distribution System. This central level coordination, both internally and externally with donors and other partners, has led to a supply chain with relatively few stockouts, including antimalarials.

With PMI and PEPFAR funds, USAID continues to assist in capacity building of the LMO, which has taken on more leadership for supply chain management across all health programs, including management. 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 eLMIS, from which data has been successfully utilized by programs to improve their commodity forecasts.

The MOH made the transition from the paper-based LMIS, originally launched in 2011, to an electronic LMIS in just two years' time, with implementation in 2014 and completion in 2016, with funding from PMI, the Global Fund, USAID and PEPFAR. Data is now available and is a significant contributing factor to the relative agility, and responsiveness of the malaria supply chain, with a health facility-reporting rate of 100 percent (n=586 health facilities). Data is available real time and facilities can generate reports from the system at any time including indicators such as stock on hand, consumption and expiries. These data are utilized to provide improved 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. The eLMIS aggregates data reported by facilities and district pharmacies; these data and other details highlighting system functionality can be found in the RBC's Quantification Report for Malaria Products 2017–2020.

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 percent in 2013 to a low of 1.3 percent in 2016, then back up slightly to 3.3 percent in 2017.

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 healthcare are sampled and sent for drug analysis.

### *Progress during the last 12-18 months*

As part of the MoH's response to the marked increase in malaria cases, there has been a renewed focus on supply chain strengthening and malaria supply chain performance. PMI, through its supply chain and logistics partner, has contributed to these strengthening efforts by supporting an annual seasonality-based quantification, which included forecasted consumption for antimalarials and RDTs from FY 2018 through FY 2024, and the subsequent development of a FYs 2018-2019 supply plan, evaluated quarterly and updated based on actual consumption and malaria cases. Additionally, the frequency of supervisory site visits to district-level pharmacies and health facilities increased, focusing not only on malaria case management but also supply chain function and performance (and stock status) to help ensure an uninterrupted supply of good quality antimalarials and RDTs. Malaria commodity stockout rates decreased from 12 percent in Q3 FY 2017 to 6 percent in Q2 FY 2018, likely due in part to the 100 percent eLMIS reporting and continued quality assurance around eLMIS implementation.

System improvements, data accuracy, and overall utility of the eLMIS require continued monitoring and strengthening, particularly at the central (MPPD) and district levels. And although the 2016/2017 eLMIS evaluation showed clear benefits in moving from a paper-based to an electronic system (including \$2.8 million savings after only a year), the more recent assessment showed eLMIS training was a critical gap at various levels of the health system. A post implementation review for eLMIS is planned for FYs 2017-2018 and PMI has been supporting data accuracy/validation from the district level pharmacy orders using eLMIS to help improve utility.

With USAID and PMI financial support, a National Supply Chain Assessment was conducted in mid-2017 at the request of the MoH to gain a better understanding of the strengths and weakness of the Rwanda health commodities supply chain and assess the capacity and maturity of supply chain sector across 11 pre-established modules (e.g., forecasting and supply planning; LMIS; human resources; financial solvency; etc.) and 14 key performance indicators. This report stands as a baseline against which future improvements can be evaluated vis-à-vis supply chain strengthening. Findings and recommendations are based on the 14 different functional modules but of note, MPPD and the district pharmacies scored relatively low across some KPIs, including procurement with failure by the MPPD to adhere to some best practices. The assessment found that district pharmacies often source locally procured products in lieu of going through MPPD, which is sanctioned legally when needed products are out of stock at the MPPD. Findings from the assessment are informing not only the MoH regarding where investments should be made to result in a more robust national-level high-functioning health commodities supply chain, but also future donor investments, including PMI.

Likely fueled by findings and recommendations from the National Supply Chain Assessment, the RBC is also moving toward the reorganization of the MPPD. In response, the RBC requested support from PMI to help restructure the MPPD into a fully autonomous parastatal organization. With technical assistance from PMI's supply chain and logistics partner, a roadmap was developed to guide the RBC in

consolidating the 30 district pharmacies and the MPPD into one legally recognized and financially independent entity owned by the GoR, to be known as the Regional Medical Stores, Ltd. Included in this transformation roadmap is a draft timeline with a planning phase through mid-2018, one year of interim operations (though mid-2019), and then one year of optimizing processes to yield a fully functional parastatal by mid-2020. Although still a priority for RBC, the transformation may take longer than expected as the RBC is devoting significant resources toward gaining better control over malaria.

The GoR is also exploring implementation of GS1 standards, an internationally recognized set of pharmaceutical and related commodities barcodes that is product specific and standardized from one country to the next, regardless of origin/destination. There are a number of potential benefits of adopting GS1 standards, including increased supply chain transparency; implementation of track-and-trace to help decrease diversion, dispensing errors and improve product recall; and greater overall gains in supply chain efficiencies. Staff from the MPPD and PMI's supply chain partner recently attended an international GS1 conference on best practices and challenges from other countries currently implementing these activities, and in preparation for their own GS1 event hosted recently. The adoption of GS1 barcodes and related activities to become GS1 compliant is a lengthy process, requiring significant ministerial support and financing as well as a tremendous level of organization and coordination. PMI has been supporting the MPPD in these preliminary scoping exercises through the provision of technical assistance.

*Plans and justification for proposed activities with FY 2019 funding:*

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 focus on monitoring the nascent eLMIS and striving to expand its utility for data capture to ensure continued availability of ACTs and other malaria commodities at health facility level resulting in a more agile supply chain. PMI will continue to 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 the procedures of the Coordinated Procurement and Distribution System; 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.

Responding to findings in the National Supply Chain Assessment, PMI will support improved quality control surveillance, as the report demonstrated a gap in the general area of Quality and Pharmacovigilance (one of the 14 supply chain modules assessed during the baseline). This activity is aligned with historical PMI support to the GoR in their efforts around maintaining and strengthening drug quality surveillance.

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

## b. Social and behavior change communication

### MOPDD/PMI objectives

The Rwanda Social and Behavior Change Communication Strategy 2017-2020 articulates the interventions and approaches that will be used for the prevention and control of malaria. Similarly, Rwanda's national 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, and using quality messages and methods, including use of media and interpersonal communication. The 2013–2020 Extended 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. Based in the Rwanda Biomedical Center, the activities of the Center for Health Communication are implemented through the Health Promotion Technical Working Group, of which the MOPDD is a member. This center coordinates, integrates, and harmonizes health messaging across the MoH, working specifically with the MOPDD and other programs. PMI is the main partner supporting malaria SBCC activities in Rwanda.

**Table 13. Behavioral and Communication Objectives for Key Malaria-Related Behaviors**

Behavioral Objective	Baseline	Target
<i>De facto</i> household population sleeping under a ITN the night before the survey in households owning at least one ITN	74%*	64%**
Communication Objective (s)	Baseline	Target
1. Proportion of population who know that sleeping under an ITN protects against malaria	72.4***	TBD
Behavioral Objective	Baseline	Target
Prompt care-seeking for fever	TBD	TBD
Communication Objective	Baseline	Target
1. Proportion of population who know that every case of malaria can potentially lead to death	87.9%***	TBD
2. Proportion of population who recognize fever as a sign of malaria	91%***	TBD
Behavioral objective	Baseline	Target
Maintain high acceptance of IRS among the population in targeted districts	99.3%****	85%****
Communication Objective (s)	Baseline	Target
1. Proportion of population who know IRS is a very effective intervention to prevent malaria	TBD	TBD
Notes		
<p>*This is the national percentage of household population who slept the night before the survey under an ITN among households owning at least one ITN (MIS 2017).</p> <p>** The targets set in the Extended Malaria Strategic Plan 2013-2020 for 2019/2020 for ITNs is different from the MIS 2017. The indicators will need to be harmonized.</p> <p>*** KAP survey 2017/2018</p> <p>****This was the coverage of structures sprayed in PMI supported districts. The target is 85% coverage. Interventions aim at spraying all structures found.</p>		

### Progress since PMI was launched

PMI has been a key partner in supporting SBCC activities in Rwanda. With 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 increase in malaria cases and to sensitize communities on the need for continued vigilance in prevention and prompt diagnosis and treatment. Each year, more than 10,000 people are reached through interpersonal communication and mobile video units with PMI support. The actual number of people reached is undertaken on an annual basis using a media tracking survey by the implementing partner.

Although there is specific malaria messaging, the MoH also has integrated health messaging, which helps extend the reach of malaria-only messages. PMI partners work closely with the MOPDD to identify and target SBCC activities with an emphasis on interpersonal communication. 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 *Agents de Santé Maternelle* play a key role in encouraging pregnant women to attend ANC and access MIP-related services. 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 continue to monitor partner malaria messages, channels, and outcomes to ensure that malaria SBCC is effective.

PMI has supported activities to create awareness on consistent use of ITNs, ensuring prompt and effective treatment, and appropriate communication in areas where IRS is implemented. Due to PMI and other partners' support for SBCC activities, preliminary data from the 2017 KAP survey showed that 72 percent of those interviewed had heard a malaria message through the radio while 46 percent had heard a message from a health worker. The KAP survey also showed that 91, 52, and 64 percent of those interviewed knew that a key sign of malaria was fever, chills, and headache, respectively. The KAP survey provides baseline data on some of the communication and behavioral objectives and will be used to develop messages and interventions to address any gaps in knowledge and practices in the prevention and control of malaria. It is expected that there will be a follow up survey in three years.

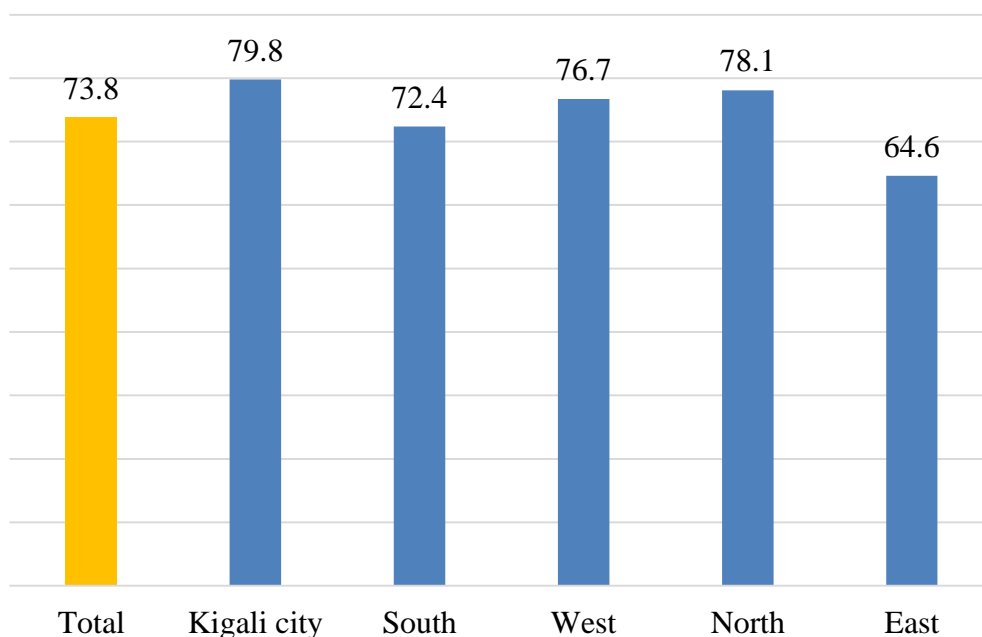
### Progress during the last 12-18 months

In the last year, PMI has supported SBCC activities promoting ITN use, improving malaria case management, and supporting IRS. To promote ITN use and improve case management nationwide, PMI employed multi-channel approaches stressing the importance of prevention and prompt diagnosis and treatment of malaria, including interpersonal communication, mobile video sessions, drama shows on malaria in towns and villages, and community events. During this period, mass media campaigns were able to reach a large part of the population through national and regional radio broadcasts with the airing of 138 radio spots and 833 malaria mentions on prevention and treatment in at least five radio stations. Though there is no data to show the number of people reached through mass media, plans are underway to conduct a media monitoring survey that will provide information on estimated population reached with malaria messages and also evaluate the effectiveness of mass media in terms of ability to recall hearing messages and intentions for behavior change.

Over 17,000 people were reached through mobile video units, and about 16,000 persons were reached through drama sessions on 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. In terms of knowledge on the causes, signs, and prevention of malaria, preliminary data from a KAP survey in 2017 shows that 95.2 percent of those interviewed knew that mosquitoes cause malaria, and 72 percent noted that sleeping under an ITN can prevent malaria. Recent data from the MIS (Figure 13) shows that among households who own at least one ITN, a majority of household members use ITNs at the national level (74 percent) and provincial level (80 percent in Kigali). In addition, among households owning an ITN, 82 percent of pregnant women age 14-49 years and 79 percent of children under five slept under an ITN the previous night. There was, however, variation at the sub-national level, with 93 percent of women in North Province having slept under an ITN.

**Figure 13: Percentage of Household Population Who Slept Under an ITN the Night Before the Survey Among Households Owning at Least One ITN (MIS 2017)**



SBCC activities were also conducted in two PMI-supported IRS districts (Nyagatare and Kirehe) in 2017 to increase acceptance and uptake of IRS. The communication channels used included community meetings, door-to-door mobilization, use of CHWs and other volunteers to disseminate information about IRS. As a result, over 99 percent of the targeted structures were sprayed due to the acceptance of IRS by community members. 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 and malaria prevention in general.

*Plans and justification for proposed activities with FY 2019 funding:*

With FY 2019 funding, PMI will support continued implementation of the MOPDD's SBCC strategy working in collaboration with other partners. This will include the implementation of SBCC activities at the national and community levels to strengthen the capacity of MOPDD and implementing partners to develop, implement, and monitor SBCC interventions. In addition, new plans and strategies for SBCC will build on successes of the ongoing SBCC interventions with an emphasis on the current malaria situation in Rwanda. It is expected that the GOR will mobilize additional resources for this intervention



in light of the increase in malaria cases. The MOPDD will work with partners and the local administration to ensure that SBCC malaria activities are continued in all districts.

There are on-going discussions within PMI to support Rwanda to roll out PBO ITNs. Rwanda has been using conical ITNs and this will be the first time since 2012 that there will be a large distribution of rectangular ITNs in targeted districts (as PBO ITNs are rectangular). SBCC interventions will focus on ensuring acceptance of rectangular ITNs, as well as on use of innovative approaches to ensure community understanding and continued use of regular conical ITNs among those not receiving the PBO ITNs.

Other SBCC activities will include central level support for strengthening capacity through the Health Communication Center and MOPDD to implement Rwanda's national SBCC strategy, and to continue helping Rwanda shape SBCC messages. Support will focus on designing, implementing, monitoring, and evaluating SBCC activities. At the community level, PMI support will focus on ensuring adoption of appropriate behaviors relating to promotion and use of ITNs, IRS, MIP, and case management. It is expected that a large portion of PMI support will focus on interpersonal communication channels at the community level, with more limited mass media activities at the national level.

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

### c. Surveillance, monitoring, and evaluation

#### MOPDD/PMI objectives

The Planning, Monitoring, and Evaluation Unit of the MoH as well as the MOPDD, districts, and health centers, use monitoring and evaluation evidence to refine and target malaria control interventions. Rwanda's revised MSP includes a strategic objective on M&E: "By 2020, strengthen surveillance, monitoring and evaluation and operational research." This objective emphasizes the timely and complete reporting of malaria information across the levels of the health sector.

**Table 14. Surveillance, Monitoring, and Evaluation Data Sources**

Data Source	Survey Activities	YEAR								
		2011	2012	2013	2014	2015	2016	2017	2018	2019
Household surveys	Demographic Health Survey (DHS) *				X					(X)
	Malaria Indicator Survey (MIS)			X				X		
	KAP survey		X				X		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	(X)
	Support to HMIS	X	X	X	X	X	X	X	X	(X)
Other data sources	Malaria Impact Evaluation			X	X					

### Progress since PMI was launched

Rwanda's routine health management information system is robust: over 90 percent of the data reports in all public health facilities are completed, submitted in a timely fashion, and are of high quality. It is composed of the HMIS, formerly known as *Gestion du système d'information sanitaire* (GESIS), that captures data from health facilities and CHWs. 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 less than five years of age and pregnant women. The SIS-COM records monthly data on malaria case management at the community level collected by CHWs. The HMIS and SIS-COM are managed at the national level by the Planning, Monitoring, and Evaluation Unit under the MoH, have been supported through PMI and PEPFAR, and are integrated under the DHIS2 platform. DHIS2 is a web-based platform that allows restricted web access to the MOPDD and other stakeholders. 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 supports supervision by the MOPDD senior staff to the regional and district levels where they spot check data and work with staff on improving quality and examining local trends in disease burden. Supervisory visits are done monthly to districts needing extra assistance, and quarterly to all other districts. PMI also supports a data manager/analyst who visits districts that need more in-depth technical assistance to work with them on how to manage and present the data in a useful fashion to meet their programmatic needs. Various indications that may trigger the need for additional supervisory visits include missing data, aberrations in reported data, extraordinary case increases, or requests from a district for additional support. 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.

The following information sources for measurement and evaluation have historically guided the MoH's programmatic decision-making for malaria and other health programs:

- *HMIS*: 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, SIS-COM has been linked to the HMIS through DHIS2. Private sector providers began to report into HMIS in 2014 and, starting in 2016, all were required to report malaria cases to the government, although the rate remains low. The impact of low private facility reporting is assumed to be relatively small since, according to the most recent DHS (2014-2015), only approximately 10 percent of children with fever seek treatment in the private sector, with most of these taken to a pharmacy presumably to obtain medication. As increasing numbers of private facilities are integrated into HMIS, the percentage missed by HMIS will decline even further.
- *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. Functional nationwide, 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. 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.

- *Integrated Disease Surveillance and Response*: Surveillance activities for Integrated Disease Surveillance and Response are coordinated and streamlined throughout all levels of the health system from the community, health facility, district hospital, and central levels. The MoH Integrated Disease Surveillance and Response 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 MOP.
- *Logistics management information system* is described in the pharmaceutical management section of this MOP.
- *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. The GoR has conducted the following surveys with malaria data included: DHS 2010, MIS 2013, DHS 2014/15, MIS 2017, and a planned DHS for 2019/2020. As previously mentioned, the MIS 2017 collected parasitemia data for all age groups at the provincial level.
- *Research and routine monitoring*: These activities include use of household surveys to track use of ITNs, monitoring drug and insecticide efficacy, evaluating home- based management of malaria in adults, and use of health facility surveys. The recent trends in malaria data highlight the importance of a strong surveillance and monitoring system.

Data reports are complete, submitted in a timely fashion, and generally of high quality. Each health facility has a data manager responsible for data collection and analysis with daily checks of data accuracy. Health facilities also meet monthly with CHW supervisors to assess data quality from community reporting. The district data team ensures the reliability of data and verifies the data monthly before it is submitted to the central level. Any issues in data quality are addressed at monthly mentorship meetings of district data managers with health center data managers. At the central level, the RBC performs death audits and health program staff are responsible for checking data completeness and analyzing data for their programs with technical support from the central HMIS team. Death audits (including assessment of data accuracy and completeness) are conducted upon notification of malaria-related death. The MoH HMIS unit has quarterly systems checks in place, and reporting systems include automated logic and cross-checks to ensure data quality. Nationwide data quality audits are conducted biannually by the RBC division that contains the Monitoring and Evaluation Unit. A selection of indicators are evaluated for each data quality audit, but not the same indicators each time so some indicators are likely to be assessed only annually. Accuracy and completeness of data are assessed along with validation of calculated indicators. For public health facilities, overall HMIS data completeness is reported to be 98 percent and accuracy at 95 percent. Reporting is enhanced through performance-based financing and over 90 percent of health centers and CHWs report complete and timely data. Performance based financing is supported by the GOR and partners, but there has been a significant decline in funding and there are ongoing discussions of how to maintain this approach.

#### *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, the completion of the 2017 MIS, and entomological monitoring. PMI supports the

MOPDD staff to conduct data analysis and produce reports from DHIS2 in a timelier fashion. The MOPDD continues to monitor data quality, with PMI support, by conducting semiannual data quality assessments of reported malaria cases.

In response to the malaria upsurge, in 2016, the MOPDD developed the Malaria Contingency Plan and revised its National Malaria Control Strategy. In July 2017, the Global Fund formally requested a data review to answer on-going questions regarding the continued increase in cases of malaria nationwide. The MOPDD hosted a one-week workshop, which included PMI and other malaria stakeholders, to review data on the coverage and impact of their malaria control strategy. A number of issues came to light during the workshop, which then informed a revised concept note submitted by the GoR. These issues included delayed implementation and incomplete coverage of IRS in some districts and highlighted the shortcoming of bendiocarb insecticide as compared to districts using organophosphates. In terms of case management, the review team noted the increased importance of community level diagnosis and treatment, which has enabled Rwanda to maintain low and declining case fatality rates. Another issue that was highlighted was the correlation of increased malaria incidence in regions of the country where rice cultivation has expanded in recent years. Based on these findings, the new concept note calls for timely and complete implementation of IRS, expansion of community case management, and multi-sectoral outreach to other Ministries such as the Ministry of Agriculture.

Also, in 2017, the MIS was completed which included parasitemia testing for all age groups and district level estimates of indicators of ITN ownership and use. A preliminary set of key indicators has been released but the final report is not yet available.

#### Plans and justification for proposed activities with FY 2019 funding:

With FY 2019 funding, PMI will continue to support the MOPDD to strengthen surveillance nationwide. Maintaining high quality surveillance and continuing to analyze malaria trends and assess intervention effectiveness are high priorities. PMI will continue to strengthen staff capacity to maintain high quality data, perform data analysis, and make data-based programmatic decisions. With the changing 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 thus continue to support a data manager to provide analytic expertise and support districts on the enhanced decentralized district data analysis. PMI will also provide limited support for the inclusion of a malaria module in the 2019–2020 DHS, which will capture malaria prevalence estimates, as well as results of net type, ownership and usage collected approximately four to six months after planned ITN mass distribution. These data will help inform an impact assessment of the PBO net pilot in comparison with non-PBO areas.

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

#### **d. Operational research**

##### MOPDD/PMI objectives

According to the MSP, the MOPDD will support operational research (OR) 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-sectional 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 percent, RDT: 2.5 percent, and PCR: 5.7 percent).

Although it 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 percent of both polyester and polyethylene ITNs failed due to holes or lack of durability between 18 and 24 months in the field.<sup>1</sup> 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).

### Progress during the last 12-18 months

The MOPDD, working with PMI and partners, is piloting an IST approach for pregnant women in targeted high-burden districts using RDTs during all ANC visits in an effort to bring down the higher burden in pregnant women and prevent the deleterious effects of malaria in pregnancy. This approach involves screening pregnant women at each ANC visit and treating those who test positive. The expected primary outcome is a reduction of placental parasitemia at the time of delivery. Enrollment in the pilot began in early 2017 and as of May 2018, enrollment was completed. The team estimates draft report will be available in late 2018. The MOPDD will use data from the monitoring and evaluation activities of the pilot to design their future MIP national strategy. The pilot began in early 2017 (with FY 2013 funds) and will run for two years with results anticipated at the end of 2018.

**Table 15. PMI-funded Operational Research Studies**

<b>Completed OR Studies</b>			
<b>Title</b>	<b>Start date</b>	<b>End date</b>	<b>Budget</b>
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
<b>Ongoing OR Studies</b>	<b>Start date</b>	<b>End date</b>	<b>Budget</b>
A pilot implementation of the intermittent screen and treat approach for pregnant women	Jan 2017	Dec 2018	\$200,000

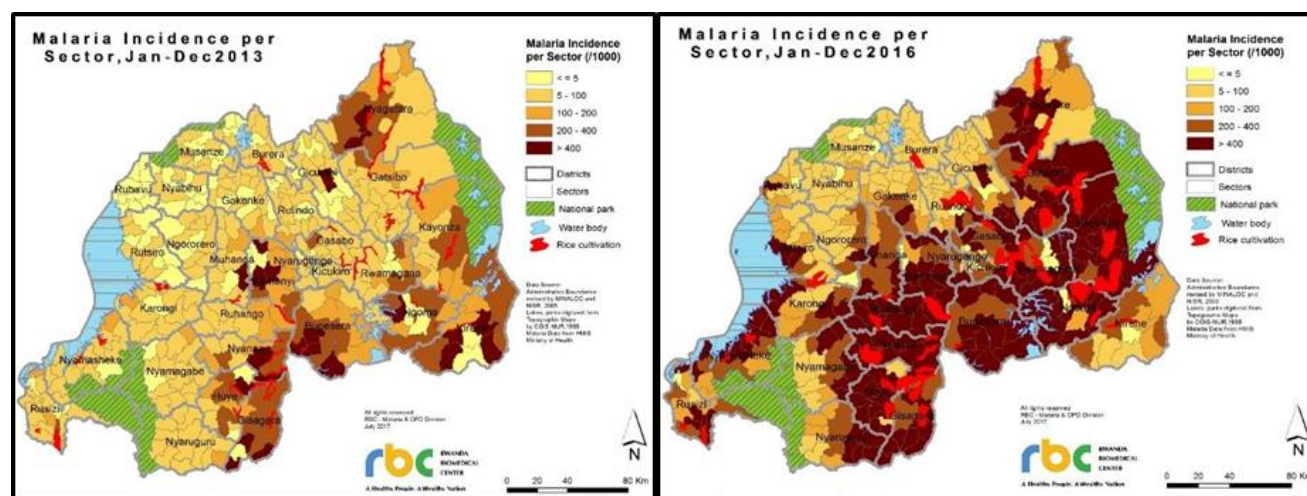
### Plans and justification for proposed activities with FY 2019 funding:

As part of the process to respond to the requested revision of the Global Fund concept note in mid-2017, the MOPDD examined trends in epidemiologic data in areas of rice cultivation. Over the past five years, Rwanda has actively promoted rice cultivation in its wetland areas as a means to provide food security

<sup>7</sup> Hakizimana *et al.* Monitoring long-lasting insecticidal net (LLIN) durability to validate net serviceable life assumptions, in Rwanda. *Malaria Journal*, 2014, 13:344.

for the population and to reduce the reliance on imported food staples. Unfortunately, all the areas where rice cultivation has expanded have also seen exponential increases in malaria. As depicted in Figure 14, areas of rice cultivation (shown by red patches) have expanded from 2013 to 2016, and appear to be geographically and temporally coincident with the sectors with highest malaria incidence (darkest brown areas).

**Figure 14: Correlation Between Increase in Rice Cultivation Practices and Malaria Incidence**



Evidence from Asia and Latin America has shown that intensive rice cultivation can provide breeding habitats for *Anopheles* mosquitoes and lead to increased malaria transmission. However, these regions have piloted various programs to mitigate the impact of rice cultivation on mosquito-borne diseases such as larviciding, periodic draining/flooding of the fields, and other approaches. As part of the response to the increased malaria burden, PMI proposes to conduct an OR study on whether targeted larviciding and/or water resource management (regular flushing and draining of fields) can reduce the population of *Anopheles* and thus reduce prevalence of malaria. This OR project will be geographically limited in scale (perhaps one district or less in South or East Provinces) and will be designed in line with best practices in other areas, such as Peru, that are currently using these methods to control mosquitoes in rice fields. The study measurements will include incidence of malaria and impacts on the adult vector population. The OR activity will be launched with FY 2019 MOP funds after a design workshop bringing together stakeholders from different sectors using FY 2018 reprogrammed funds. The protocol for the OR study will be designed jointly by the MOPDD and PMI and will be submitted for approval to the PMI OR committee as well as the Rwandan National Institutional Review Board.

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

#### **e. Other health systems strengthening**

PMI supports a broad array of health system strengthening activities which cut across intervention areas, such as training of health workers, supply chain management and 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 U.S. Government, and other donors. With these resources, Rwanda has achieved worldwide recognition for its innovative health financing programs, such as performance-based financing and community-based health insurance. These programs, as well as current efforts to determine the costs of essential health services and the use of eLMIS, are supported by the U.S. Government 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

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 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, 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 U.S. Government efforts, continues to support capacity building of the national medical stores to forecast, procure, store, and distribute health commodities and provides technical assistance to the coordinated procurement and distribution system. In 2014, the support included updating and launching of the eLMIS nationwide. Currently, the validation process of requisition for malaria commodities is based on data from the eLMIS. The eLMIS has reduced data quality issues, including the reduction in stockout rates at health facilities for malaria commodities from 12 percent in quarter three in 2017 to 6 percent during the second quarter of 2018. PMI will continue to work with other partners to strengthen the supply chain.

Since 2012, PMI has supported third-year PCVs who work with PMI to help increase knowledge and understanding of malaria for other PCVs as well as local communities and healthcare 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 11 malaria volunteers and has worked with over 613 PCVs in Rwanda who have participated in malaria-related activities over the years. These PVCs include those working in health and education sectors and thus are well-placed to disseminate messages on malaria in the communities in which they live.

PMI has supported FETP malaria residents since FY 2012. To date, four cohorts (13–17 residents each) of FETP residents have initiated the two-year program and 3 cohorts have completed (29 graduates).

Among these 29 graduates, 25 have returned to MoH positions, 2 have assumed WHO positions, and two are employed by non-governmental organizations. Five MOPDD staff members have participated in the FETP training program. Three of the five malaria FETP 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 FETP malaria residents selected by the School of Public Health. However, discussions with the MOPDD occurred and three malaria residents were enrolled into the fourth cohort that began in November 2016.

During the two-year program, FETP trainees enroll in a long course and pursue a Masters of Science in Field Epidemiology. Following completion of the didactic portion, the malaria residents take part in a field practicum where they work daily with public health staff on malaria control issues. Previous contributions to PMI from FETP 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*

PMI continues to support training and participation in international conferences for all MOPDD staff, although fewer staff have participated in these conferences due to long lead times required for official clearances to travel. PMI supported four staff to participate in international meetings (including the American Society of Tropical Medicine and Hygiene, where they presented papers), technical meetings organized by Roll Back Malaria, and training on malaria surveillance. PMI has also been instrumental in building the capacity of the MOPDD staff to provide supportive supervision at the decentralized levels. With FY 2017 funding, PMI supported MOPDD staff to conduct severe malaria and death audits in all thirty districts with the aim of working with health facility staff to address any issues that may contribute to severe malaria cases and mortality. The MOPDD also undertook supportive supervision to strengthen the scaled up home based management of malaria program.

PMI also supported three seconded positions (housed at the MOPDD): a logistics officer, who works with the procurement partner to analyze and respond to eLMIS malaria-specific commodity needs in a timely manner and support quantification of malaria commodities; a laboratory technician for the national entomological laboratory; and a data manager, who supports development of a database and tools, collection and analysis of data for monitoring, and capacity building of staff at the national and district level to monitor malaria activities.

Currently there are two PVCs – a response and a third year extension volunteers – working on “stomp out malaria” activities (e.g., training community mobilizers and teachers on malaria prevention and outreach activities in various communities). As a result, an estimated 3,302 community members were reached with malaria prevention messages, 976 community educators were trained to promote malaria prevention and improved care-seeking, and 133 teachers were trained and able to incorporate malaria messages as part of their lesson planning and teaching activities. The PCVs also organized mobilization



activities around the world malaria day and have participated in the ongoing PMI-supported operational research study on intermittent screen and treat for pregnant women.

Over the last six months, PMI supported training of 46 entomological technicians. The training focused on evaluation of insecticide resistance in vectors using CDC bioassays, vector identification and data analysis. The technicians were also trained on insecticide resistance intensity, and detection of metabolic resistance using CDC bottles and PBO. These trainings have ensured capacity building among entomologists who work in the various sentinel sites to evaluate insecticide resistance and susceptibility.

For the first time, the current FETP cohort includes fellows who are based at the district levels. Their projects support malaria surveillance improvement at the sub-national levels. Recent malaria-related projects completed by FETP 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 FETP 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. Cohorts begin every two years; the next one will start in the fall of 2018.

PMI also supported the WHO National Program Officer 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 Officer also offered support for various malaria activities and is the current chair of the Malaria Technical Group. Over the last year, the National Program Officer supported the MOPDD in data review and analysis and was instrumental in the finalization of the malaria contingency plan 2016-2020. The Officer continued to provide technical leadership and has worked closely with the MOPDD to provide technical guidance with the changing malaria epidemiology in Rwanda.

#### *Plans and justification for proposed activities with FY 2019 funding:*

With FY 2019 funding, PMI will continue to support national capacity building, PCVs, and FETP. The PCVs will continue to engage in training and educational activities for other PCVs and Rwandan communities. Technical supervision will be provided by PMI Resident Advisors and the implementing partner. PMI will continue to support the logistics officer who is based at the MOPDD and supports capacity building of the MOPDD's Case Management Team. PMI will also continue to support the entomology laboratory technician and the data manager. PMI will support the MOPDD to undertake supervision, conduct data quality audits, participate in educational meetings, undertake data analysis workshops, and disseminate data via national meetings, conferences presentations, and participation at international conferences.

PMI will continue to support at least two malaria residents in the FETP program and contribute to the advanced training of Rwandan epidemiologists, many of whom will contribute to malaria control efforts in the years ahead. Malaria-focused 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.

PMI will support a WHO national program officer 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.

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

## **5. Staffing and administration**

Two health professionals serve as Resident Advisors (RAs) to oversee PMI in Rwanda, one representing CDC and one representing USAID. There is no Foreign Service National (FSN) currently on the PMI team. Both PMI staff members are part of a single interagency team led by the USAID Mission Director or his/her designee in country. The PMI team shares responsibility for development and implementation of PMI strategies and work plans, coordination with national authorities, managing collaborating agencies and supervising day-to-day activities. Candidates for RA positions (whether initial hires or replacements) will be evaluated and/or interviewed jointly by USAID and CDC, and both agencies will be involved in hiring decisions, with the final decision made by the individual agency.

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

The PMI lead in country is the USAID Mission Director. The day-to-day lead for PMI is delegated to the USAID Health Office Director and thus the two PMI RAs, 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 RAs are physically based within the USAID health office but are expected to spend approximately half of their time with and providing TA to 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.

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