USAID
FROM THE AMERICAN PEOPLE

CDC
Centers for Disease Control and Prevention

Department of Health & Human Services · USA

A Decade of Progress

The President's Malaria Initiative

Tenth Annual Report to Congress | April 2016

A Decade of Progress

The President's Malaria Initiative

Tenth Annual Report to Congress | April 2016

Foreword

The President's Malaria Initiative's (PMI's) Tenth Annual Report to Congress marks a decade of U.S. Government leadership in the fight against malaria. PMI is widely recognized as a highly successful global health and foreign assistance program. With PMI support, hundreds of millions of people have benefited from protective measures and have been diagnosed and treated for malaria. PMI has reached into the poorest of communities in sub-Saharan Africa, where malaria flourishes, arming women, children, and families with tools to protect themselves from malaria and providing them with fast-acting medicines to cure malaria if they do become infected. The efforts of PMI have paid off. Working with host-country governments, donor governments, multilateral agencies, non-governmental organizations, and academic and research partners, 6 million deaths have been averted. In a number of PMI focus countries, we witnessed reductions in both death and illness from malaria. Those countries are now setting their sights on eliminating malaria transmission from all or part of their nations, an idea that was inconceivable 10 years ago when PMI was launched.

I am deeply grateful for the leadership of two U.S. Presidents. President George W. Bush created the Initiative in 2005, when the disease was almost certainly a death sentence for most poor children in Africa. President Barack Obama not only embraced the effort, but also significantly expanded our reach. And, bipartisan leadership from the House and Senate has sustained our work. Thanks to the generosity of the American people, lives are being saved every day from a disease that is preventable and treatable.

While we are making great progress in lifting the barriers of access to life-saving preventive and curative tools, much more needs to be done to serve the hardest to reach populations, particularly ethnic minorities, migrant workers, marginalized populations, and the poorest of the poor. Malaria control remains one of the best investments in global health today, and it remains a critical component of the U.S. Government's commitment to ending preventable child and maternal deaths and ending extreme poverty. Ending malaria will help build a healthier and more secure world.

As PMI celebrates the remarkable achievements over the past decade, we remain committed to maintaining the gains made and developing new tools to address threats such as drug and insecticide resistance. The U.S. Government shares the long-term vision of affected countries and global partners of *A World without Malaria*. Working together with affected countries and our partners, we strive to end malaria for good.

R. Timothy Ziemer
Rear Admiral, Unites States Navy (Retired)
U.S. Global Malaria Coordinator

Table of Contents

Abbreviations and Acronyms

ACCM	All-cause child mortality
ACT	Artemisinin-based combination therapy
AMP	Alliance for Malaria Prevention
ANC	Antenatal care
CDC	U.S. Centers for Disease Control and Prevention
CHW	Community health worker
DFID	U.K. Department for International Development
DHS	Demographic and Health Survey
DRC	Democratic Republic of the Congo
EDS	Electronic data system
EPI	Expanded Program on Immunization
EUV	End-use verification tool
FIND	Foundation for Innovative New Diagnostics
FY	Fiscal year
GHSA	Global Health Security Agenda
Global Fund	The Global Fund to Fight AIDS, Tuberculosis and Malaria
GMS	Greater Mekong Subregion
HEW	Health extension worker
HHS	U.S. Department of Health and Human Services
HMIS	Health management information system
iCCM	Integrated community case management
IPTp	Intermittent preventive treatment for pregnant women
IRS	Indoor residual spraying
ISO	International Organization for Standardization
ITN	Insecticide-treated mosquito net
LMIS	Logistics management information system
MIS	Malaria Indicator Survey
MMV	Medicines for Malaria Venture
NIH	National Institutes of Health
NMCP	National malaria control program
OTCMS	Over-the counter medical sellers
OTSS	Outreach training and supportive supervision
PEPFAR	U.S. President's Emergency Plan for AIDS Relief
PMI	U.S. President's Malaria Initiative
ProAct	Proactive community treatment
QA/QC	Quality assurance/quality control
RBM	Roll Back Malaria
RDT	Rapid diagnostic test
RMIS	Routine malaria information system
SMC	Seasonal malaria chemoprevention
SNP	School net program
SP	Sulfadoxine-pyrimethamine
TES	Therapeutic efficacy surveillance
UNICEF	United Nations Children's Fund
USAID	U.S. Agency for International Development
WHO	World Health Organization

Executive Summary

Erin Schiavone/PMI AIRS Project

A DECADE OF GLOBAL PROGRESS

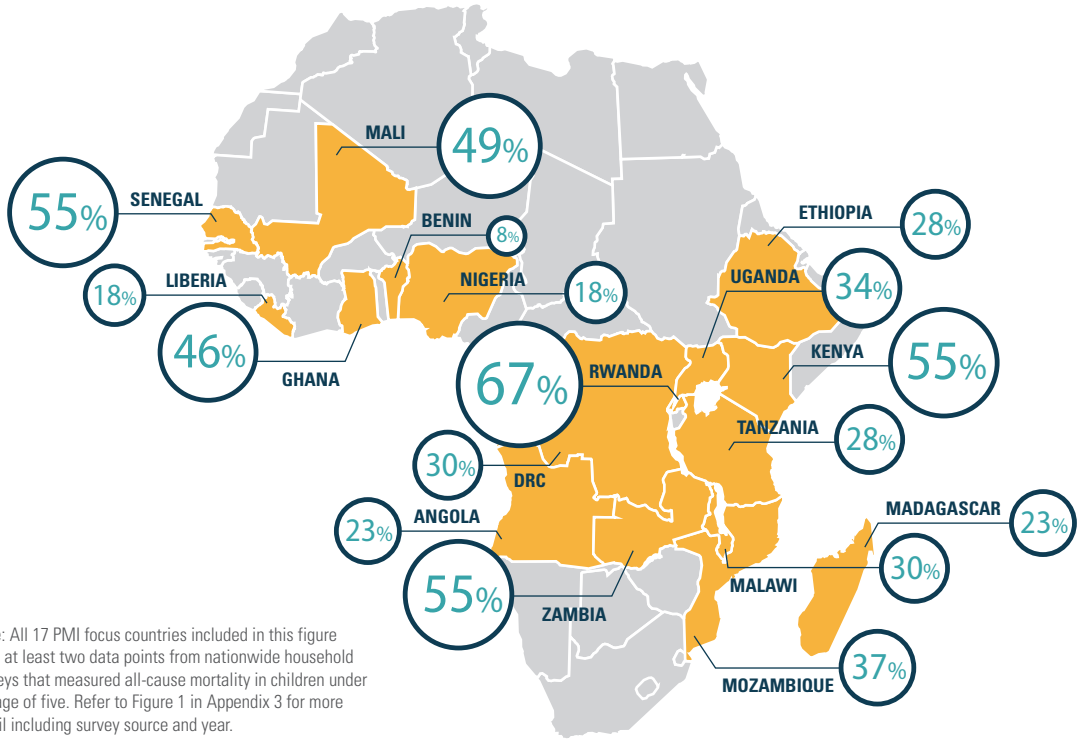
THE malaria fight is one of the most inspiring global health stories of our time. Investments in malaria prevention and control have been among the best investments in global health and development, resulting in a dramatic decrease in malaria deaths and illness. Working together, hundreds of millions of people have been reached with effective preventive tools and diagnosis and treatment. Even in the poorest of settings where malaria flourishes, we are arming women, children, and families with cost-effective tools to protect themselves from malaria and with fast-acting medicines to cure malaria if they do become infected.

The year 2015 marks a decade of renewed U.S. Government leadership and commitment in the global malaria fight. The past decade witnessed a key turning point in the long battle against malaria, and we have reached several historic milestones. Global progress on malaria control has been unequivocal – the World Health Organization estimates that more than 6.2 million malaria deaths were averted worldwide between 2000 and 2015.[1] Most of these estimated lives saved were among children under the age of five living in sub-Saharan Africa – the most vulnerable group at risk for malaria. During this time period, new malaria cases fell by 37 percent, and malaria mortality declined by an estimated 48 percent worldwide. Even greater reductions in malaria mortality were recorded in sub-Saharan Africa, where deaths among children under the age of five declined by 71 percent. Based on these results, the World Health Organization and UNICEF reported that the Millennium Development Malaria Goal of halting and reversing malaria incidence by 2015 was achieved.

These momentous gains in loosening malaria's grip are the collective result of significant and well-coordinated investments by national governments and donors, support from technical agencies and national institutions, and the hard work and dedication of health workers, non-governmental organizations, and affected communities. These investments have translated into a formidable scale-up of proven, cost-effective, and life-saving malaria control interventions, namely insecticide-treated mosquito nets (ITNs), indoor residual spraying (IRS), intermittent preventive treatment for

1 World Malaria Report, 2015. World Health Organization.

Figure 1. Reductions in All-Cause Mortality Rates of Children Under Five Years of Age in PMI Focus Countries



Note: All 17 PMI focus countries included in this figure have at least two data points from nationwide household surveys that measured all-cause mortality in children under the age of five. Refer to Figure 1 in Appendix 3 for more detail including survey source and year.

pregnant women (IPTp), diagnostic tests, and highly effective antimalarial drugs.

The U.S. Government's leadership and its financial and technical contributions through the President's Malaria Initiative (PMI) have been central to the remarkable achievements of the past decade. The story of U.S. leadership in the fight against malaria is one of immense success and progress. President George W. Bush launched PMI and pledged U.S. support for the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund). President Barack Obama significantly expanded the Initiative, and bi-partisan leadership from the House and Senate sustains our work. During this time, PMI has garnered recognition from diverse stakeholders as a highly effective program that successfully pairs global leadership on malaria prevention and control with solid country-level partnership and support.

Investment in the malaria fight is one of the best buys in global health. The push to end malaria is saving millions of lives, increasing attendance at school, improving worker productivity, and boosting local economies. Ending malaria will help build a healthier and more secure world. We can be the generation that ends malaria – one of the oldest and deadliest diseases on the planet.

SAVING CHILDREN'S LIVES

Decreases in malaria cases and deaths have been major contributors to the reductions in all-cause child mortality that have been recorded in nationwide household surveys across PMI focus countries. Of the 13 PMI focus countries in Africa for which there are at least 2 measurements from serial national household surveys, 10 showed reductions in the proportion of young children infected with malaria parasites. Furthermore, to date, 17 of the 19 PMI focus countries in Africa have data from paired nationwide

surveys that were conducted since PMI activities began. In all 17 countries, these surveys show significant declines in all-cause mortality rates among children less than five years of age. These reductions range from 8 percent to 67 percent. Of note, four countries (**Kenya, Rwanda, Senegal,** and **Zambia**) have achieved a greater than 50 percent mortality reduction since PMI began in those countries (see Figure 1). PMI is carefully estimating the contribution of malaria control efforts to declines in mortality in PMI focus countries through in-depth impact evaluations conducted in collaboration with Roll Back Malaria (RBM) partners. While these declines cannot be solely attributed to malaria control, the large-scale rollout of malaria prevention and treatment measures across sub-Saharan Africa during the past decade have clearly been a major factor in these unprecedented improvements in child survival. For example, a 2012 evaluation of the impact of malaria control in Tanzania concluded that all-cause under-five child mortality fell by 45 percent between 1999 and 2010, and this dramatic reduction in mortality was at least in part due to reductions in malaria mortality that resulted from the nationwide scale-up of malaria prevention and control interventions.[2]

ACHIEVING AND SUSTAINING SCALE OF PROVEN INTERVENTIONS

There has been a tremendous scale-up of malaria prevention and treatment measures across PMI focus countries since PMI was announced in June 2005. This achievement is the result of the U.S. Government's unwavering commitment together with the efforts of governments in malaria-affected countries, the Global Fund, the World Bank, the United Kingdom Department for International Development, the World Health Organization, UNICEF, and many other partners.

PMI's direct contributions to this global effort have been substantive. As a result of PMI's support, millions of people have benefited from protective measures against malaria, and millions more have been diagnosed and treated for malaria. To date, PMI has procured more than 197 million long-lasting ITNs, 229 million rapid diagnostic tests (RDTs), 376 million artemisinin-based combination therapies (ACTs), and 58 million sulfadoxine-pyrimethamine (SP) treatments in addition to training tens of thousands of people on case management, preventive treatment for pregnant women, and IRS operations (see Appendix 2 for more details).

Close collaboration and synergies with other donors engaged in malaria control efforts have also been a hallmark of PMI from the outset of the Initiative. For example, PMI

The President's Malaria Initiative Strategy for 2015–2020

PMI's Strategy for 2015–2020 takes into account the progress over the past decade and the new challenges that have arisen, setting forth a vision, goal, objectives, and strategic approach for PMI through 2020, while reaffirming the longer-term goal of a world without malaria. Malaria prevention and control remains a major U.S. foreign assistance objective, and this strategy fully aligns with the U.S. Government's vision of ending preventable child and maternal deaths and ending extreme poverty.

The U.S. Government shares the long-term vision of affected countries and global partners of a world without malaria. This vision will require sustained, long-term efforts to drive down malaria transmission and reduce malaria deaths and illnesses, leading to country-by-country elimination and eventual eradication by 2040–2050. The U.S. Government's goal under the PMI Strategy 2015–2020 is to work with PMI-supported countries and partners to further reduce malaria deaths and substantially decrease malaria morbidity, toward the long-term goal of elimination. Building upon the progress to date in PMI-supported countries, PMI will work with national malaria control programs (NMCPs) and other 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.**

To achieve these objectives, PMI will take a strategic approach that emphasizes the following five areas:

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**

These areas of focus are informed by PMI's experiences to date, which include building on the successes that countries have achieved with the support of PMI and other partners, incorporating the lessons learned from implementation thus far and addressing directly the ongoing and new challenges that could prevent further progress toward malaria control and elimination.

2 Roll Back Malaria Progress & Impact Series, Focus on Mainland Tanzania, 2012.

IN FY 2015, PMI

has provided financial and technical assistance for the distribution of more than 80 million long-lasting ITNs and 34 million ACTs that were procured by other donors.

PMI's contributions, together with those of host governments and other partners, have been instrumental in improving coverage of malaria control interventions. In the 19 focus countries where at least 2 comparable nationwide household surveys have been conducted since PMI activities were launched:

- Household ownership of at least one ITN increased from a median of 25 percent to 69 percent.
- Usage of an ITN the night before the survey increased from a median of 18 percent to 54 percent among children under five years of age.
- Usage of an ITN the night before the survey increased from a median of 17 percent to 48 percent among pregnant women.

In all 17 focus countries where IPTp is national policy:

- The proportion of pregnant women who received 2 or more doses of IPTp for the prevention of malaria increased from a median of 14 percent to 38 percent.

While enormous progress in ITN ownership and use has been recorded in PMI focus countries, these improvements have not been uniform. Some countries are nearing or exceeding intervention targets while others still are scaling up. In particular, median coverage of pregnant women with at least two doses of IPTp in PMI focus countries has increased more slowly. To further bolster the number of pregnant women receiving SP, PMI continues to support countries to implement WHO's recommendation to provide SP at every scheduled antenatal care visit after the first trimester.

In addition to supporting the rollout of ITNs and IPTp, PMI has been a global leader in supporting countries to implement IRS activities. With PMI's contributions, the number of people protected with IRS has increased from 2 million in 3 countries to more than 16 million across 13 PMI focus countries in FY 2015.

Since PMI's launch, the Initiative has recognized that effective case management is an essential cornerstone of malaria prevention and control. Throughout PMI focus countries, RDTs and ACTs are now widely available, and health workers have been trained in their use. Over the last decade, PMI

has supported the scale-up of diagnostic testing for malaria at the health facility and community levels to ensure that all patients with malaria are properly identified and receive a quality-assured and recommended antimalarial. The proportion of suspected malaria cases confirmed with a laboratory test and treated with a recommended antimalarial has increased in nearly every PMI focus country. Most PMI focus countries are also scaling up quality assurance systems for case management, with six countries having achieved national scale in FY 2015. PMI has also supported the rollout of integrated community case management (iCCM) for malaria, pneumonia, and diarrhea. To date, all 19 PMI focus countries receive PMI support for iCCM efforts and, as a result of the combined efforts of PMI, ministries of health, partners, and other donors, iCCM programs in 5 countries have reached national or near-national scale.

ADAPTING TO CHANGING EPIDEMIOLOGY AND INCOPORATING NEW TOOLS

The scale-up of malaria control interventions has resulted in reduction not only in malaria mortality, but also malaria morbidity in a number of PMI focus countries. A subset of these countries is now developing plans to eliminate malaria nationally or sub-nationally. In other countries, high-level coverage with multiple interventions has resulted in wide geographic variability in malaria burden. This changing epidemiology has prompted some countries to adopt a targeted approach to malaria control with strategies that are rolled out at the sub-national level or are applied to specific population groups. This allows for programmatic efficiencies ensuring that resources are appropriately aligned to address the need for malaria control across and within PMI focus countries. These approaches include focal IRS, enhanced case finding and investigation, and outbreak response. For example, during FY 2015:

- PMI supported focal spraying in **Ethiopia, Rwanda, Senegal, Zambia,** and **Zimbabwe**, which covered a total of nearly 1.6 million houses and protected more than 5 million people who were at the highest risk of malaria in a given area.

- In**Cambodia, Rwanda, Senegal,** and **Zanzibar**, PMI supported pilot efforts for reactive case detection, which involves investigating contacts of malaria cases in order to identify possible additional infections.

- PMI provided support to **Uganda** during a malaria outbreak in the north of the country. As a result of these efforts, excess mortality was prevented, and malaria death rates were much lower than anticipated.

Malaria control is now at a key juncture. To achieve the long-term global vision of *A World without Malaria*, new tools and new approaches to improve the coverage and use of those tools will be needed. For example, PMI supports the NMCPs in **Mali** and **Senegal** to implement seasonal malaria chemoprevention (SMC), a recommended approach to prevent malaria among young children in areas with highly seasonal malaria transmission. In both countries, PMI provides funding for key aspects of the campaigns including training and supervision of health workers, procurement of SMC drugs, and monitoring and evaluation of program implementation and impact. PMI support for SMC during FY 2015 helped protect nearly 900,000 children from malaria.

PMI complements U.S. Government agencies' investments in upstream malaria research and new tools development including investments in malaria vaccines, new antimalarial drugs, and new vector control tools by supporting operational research. PMI's operational research activities are focused on helping to improve program implementation and policy development, test the feasibility of new tools and implementation approaches, and identify and overcome bottlenecks and document best practices toward achieving full-scale implementation.

IMPROVING COUNTRY CAPACITY TO COLLECT AND USE INFORMATION

The success of malaria control efforts in PMI focus countries can in part be attributed to the high priority placed on collecting and using data to inform policies and program planning and implementation and to monitor the coverage and impact of those interventions. PMI investments in data collection have included support for national household surveys, supply chain logistics related surveys, entomological and net monitoring, and health management information systems (HMIS). For example,

- Since PMI's launch in 2005, 80 nationally representative household surveys have been conducted with PMI's support across the 19 focus countries in Africa. These surveys have provided essential information to monitor changes in coverage of key interventions – such as insecticide-treated mosquito net ownership and use – and to measure impact, particularly all-cause child mortality and malaria parasitemia prevalence.

- The capacity of countries to monitor entomological indicators has substantially improved with PMI's support. All 19 PMI focus countries in Africa currently conduct regular entomological monitoring. PMI supports a total of approximately 130 entomological monitoring sites, which


BK Kapela/PMI

"Billions of our fellow human beings are at risk of dying from diseases that we know how to prevent. Many children are just one mosquito bite away from death. And, that is a moral outrage. It is a profound injustice. It is literally a matter of life and death, and now, the world must act. We cannot leave people behind."

– President Barack Obama
United Nations General Assembly, September 27, 2015

measure mosquito density and behavior, as well as 190 insecticide resistance monitoring sites.

- PMI is working closely with partner countries to support deployment of computerized platforms for health information systems such as the District Health Information System-2 (DHIS-2) to make data collection, analysis, and reporting more efficient and improve its quality. Eleven of the 19 PMI focus countries in Africa have fully scaled implementation of the DHIS-2 for their HMIS.

- To monitor the availability of malaria commodities (ACTs, RDTs, and ITNs) at health facilities and address stockouts, PMI has conducted 190 end-use verification surveys with government counterparts in a total of 16 PMI focus countries.

MITIGATING RISK AGAINST THE CURRENT MALARIA CONTROL GAINS

Insecticide resistance: Two of the main vector control interventions supported by PMI, ITNs and IRS, rely on a limited number of WHO-recommended insecticides from only four insecticide classes (with only one class, pyrethroids, available for use in ITNs). As countries scale up their ITN and IRS programs, increased insecticide selection pressure is placed on mosquito populations, which can accelerate the development, selection, and spread of resistance to insecticides. Therefore, it is imperative that national programs continue to conduct entomological monitoring, including testing for the presence of insecticide resistance.

From 2008 to 2015, the number of PMI-supported insecticide resistance monitoring sites in Africa has increased from 12 to approximately 190. As a result, vector resistance to pyrethroids has now been observed in all 19 PMI focus countries and resistance to carbamate insecticides in 16 PMI focus countries in Africa. The emergence of insecticide resistance has prompted changes in insecticides used for IRS in all PMI focus countries that have spray programs. For example, during the past fiscal year, **Ethiopia** and **Mozambique** conducted IRS using organophosphates for the first time, while eight countries (**Benin, Ghana, Madagascar, Mali, Senegal, Tanzania, Zambia,** and **Zimbabwe**) continued its use.

ITN durability: While the current global recommendation is to replace ITNs every 3 years, some studies have shown that certain ITNs may physically deteriorate more quickly under certain field conditions and that this is strongly dependent on behavioral and environmental conditions.

To better understand the effective life of ITNs and identify the causes of premature ITN deterioration, PMI launched a series of studies in 2008 to assess the physical durability and insecticide retention of various net brands in nine countries (**Angola, Benin, Kenya, Malawi, Mozambique, Nigeria, Rwanda, Senegal,** and **Zambia**). These studies demonstrated that the physical durability of nets was highly variable from country to country with some countries showing significant net failure in as little as 2 years. As a result of these studies, some net manufacturers changed their production processes to make their ITNs more durable.

PMI used the lessons learned from these studies to develop a standardized methodology for monitoring ITN durability. In 2015, PMI supported a number of countries (including **Benin, Kenya, Senegal, Madagascar,** and **Mozambique**) to implement durability monitoring and began planning for implementation support in others. Over the next few years, as countries conduct new ITN distribution campaigns, support will be provided for durability monitoring in additional PMI focus countries.

Antimalarial drug resistance: Although there is currently no evidence of artemisinin resistance outside of the Greater Mekong Subregion (GMS), carefully performed monitoring of antimalarial efficacy in sub-Saharan Africa is now even more critical to ensure that emergence of resistance to ACTs in new areas is detected early and appropriate responses are mobilized. If widespread drug resistance and ACT treatment failures were to emerge in Africa, this would pose a severe threat to malaria control and could potentially reverse many of the dramatic reductions in malaria morbidity and mortality achieved over the last decade. PMI continues to support a therapeutic efficacy surveillance (TES) network of 46 sentinel sites in the GMS to ensure that monitoring of first-line antimalarial drugs and potential alternatives, as appropriate, are carried out every 2 years in accordance with WHO guidelines. During 2014 and 2015, PMI also provided support for planning and/or implementation of TES in 14 PMI focus countries in Africa and all countries in the GMS.[3]

Combatting fake and substandard medicines: Fake and substandard malaria medicines continue to be a major global threat to effective malaria case management. These poor quality and counterfeit treatments are thought to be a contributor to malaria deaths. As a major procurer of ACTs, PMI employs a stringent quality assurance and quality control strategy to monitor the quality of drugs procured by PMI for use in PMI focus countries. To help reduce the

3 TES was supported by other global malaria partners in two countries. In a third country, Liberia, TES was delayed by the Ebola emergency.

availability of counterfeit drugs in informal private sector outlets and marketplaces, PMI is collaborating with the U.S. Agency for International Development's (USAID's) Office of the Inspector General and teaming up with local police, customs agents, national medicines regulatory authorities, and drug sellers to identify fake and substandard medicines and remove them from the market. In addition, PMI partners with national medicines regulatory authorities in PMI focus countries in Africa and the GMS to help strengthen local capacity to conduct market surveillance including sampling and testing of quality of drugs found in the local marketplace and strengthening national drug quality laboratories' capacities to test the quality of drug samples collected from public and private outlets.

BUILDING CAPACITY AND HEALTH SYSTEMS

Since its inception more than a decade ago, PMI has recognized that the long-term sustainability of malaria control and elimination depends on the strength of endemic countries' own health systems and their human capacity. In addition to providing assistance to countries to roll out malaria-specific activities, PMI also helps build national capacity in a variety of cross-cutting areas that benefit both malaria and other health programs. This support includes building health worker capacity, strengthening pharmaceutical and supply chain management systems, building infrastructure and technical capacity for laboratory and routine monitoring and evaluation systems, supporting health system financing efforts, and strengthening management and leadership skills of national malaria control programs. PMI efforts to strengthen health systems have included:

- Substantial investments in capacity building for healthcare workers at the facility and community levels. In FY 2015, PMI supported training of more than 77,000 health workers in malaria case management and more than 54,000 clinicians and laboratory technicians in procedures for diagnostic testing for malaria. Furthermore, PMI supports integrated training of healthcare workers on the implementation of focused antenatal care services, including prevention of malaria in pregnancy using IPTp with SP. In FY 2015, more than 31,000 health workers were trained in IPTp delivery with PMI support. In addition, PMI has supported training for more than 36,000 people in IRS implementation.

- Providing technical assistance and programmatic support for forecasting malaria commodity requirements (e.g., diagnostic tests and drugs), conducting quality testing of those commodities, strengthening supply chain management systems, and improving the tracking of those commodities in all PMI focus countries in Africa, improve the availability of commodities, and to protect their quality and safety. Between 2011 and 2015, the percent of PMI focus countries with adequate stocks of ACTs and RDTs at the central level increased from 15 percent for ACTs and 10 percent for RDTs to more than 65 percent and 60 percent, respectively.

- Supporting pilot efforts for health system financing in support of malaria outcomes, including contributing to implementation of health insurance schemes, health policy reform efforts, and performance-based financing approaches. During FY 2015, PMI supported the scale-up of the national health insurance scheme in **Ghana** to expand access and use of health services, including those for malaria. PMI also provided technical support for **Tanzania's** government-led performance-based financing activity, which contributes to incentives to facilities that document provision of high-quality malaria services. Monitoring and evaluation of the contributions of these efforts to malaria outcomes is ongoing.

- Through support to the U.S. Centers for Disease Control and Prevention's (CDC's) Field Epidemiology and Laboratory Training Program, PMI helped build a cadre of ministry of health staff with technical skills in the collection, analysis, and interpretation of data for decision-making and epidemiologic investigations in 11 PMI focus countries in Africa (**Angola, Democratic Republic of Congo [DRC], Ethiopia, Ghana, Kenya, Mozambique, Nigeria, Rwanda, Tanzania, Uganda,** and **Zambia**) and one PMI program in the GMS (Burma). Globally, more than 100 trainees have been supported to date.

GLOBAL AND U.S. GOVERNMENT PARTNERSHIPS

Partnerships at the country and global levels remain central to the continued success of PMI's malaria control efforts. The U.S. Government through PMI and its contributions to the Global Fund remains one of the leading donors in the fight against malaria. These investments are strategically targeted to support each focus country's malaria control strategy, and activities are coordinated with a wide range of partner organizations. These include multilateral and bilateral institutions such as the Global Fund, WHO, and UNICEF; private foundations such as the Bill & Melinda Gates Foundation, United Nations Foundation, and Malaria No More; and other U.S. Government programs (includ-

ing Department of Defense and the Office of the Global AIDS Coordinator, etc.). Furthermore, PMI has supported implementation of malaria activities through more than 200 nonprofit organizations, approximately one-third of which are faith-based.

Examples of PMI's engagement with partners during FY 2015 include:

- PMI contributed to the development and launch of two key documents, the Roll Back Malaria Partnership's *Action and Investment to defeat Malaria 2016–2030 (AIM) – for a malaria-free world* and WHO's *Global Technical Strategy for Malaria 2016–2030*. As outlined in the PMI Strategy 2015–2020, the U.S. Government shares the long-term vision of *A World without Malaria* as articulated in both documents (see Sidebar, page 7).

- Support for the Roll Back Malaria (RBM) Partnership's transition process. At the RBM Board's request, the U.S. Global Malaria Coordinator, Admiral Tim Ziemer, and the Zimbabwean Minister of Health, his Excellency Dr. David Parirenyatwa, are co-leading this process. A new RBM Board and governance structure was established in the first quarter of 2016.

- PMI partnered with other U.S. Government-supported global health programs, including the Peace Corps. With financial support from PMI, 814 Peace Corps volunteers in 11 PMI focus countries (**Benin, Ethiopia, Ghana, Madagascar, Malawi, Mozambique, Rwanda, Senegal, Tanzania, Uganda,** and **Zambia**) worked on joint malaria prevention activities with NMCPs, implementing partners, and PMI in-country teams, reaching more than 224,000 beneficiaries.

A WORLD WITHOUT MALARIA

While there is much progress to be celebrated in the fight against malaria, this scourge continues to exact an unacceptable toll on the world's most vulnerable populations. Despite historic gains, WHO reported that there were still an estimated 214 million new cases of malaria and approximately 438,000 malaria-attributed deaths worldwide in 2015 alone. The overwhelming majority of these cases and deaths occurred among young children in sub-Saharan Africa. An estimated 838 children still die from malaria every day. These statistics are a sober reminder that, in the years ahead, the global community must continue to build on the progress that has been achieved and remain vigilant to avoid a resurgence of malaria. Ridding the world of malaria is an ambitious but achievable goal. PMI, with the global malaria community, is committed to redoubling efforts, sustaining financial resources, and vigorously accelerating the scale-up of malaria prevention and treatment measures.

Achieving our bold long-term vision of *A World without Malaria* will face serious challenges, including emerging resistance to artemisinin drugs, widespread availability of substandard and counterfeit malaria treatments, resistance to key insecticides, inadequate disease surveillance systems, waning country and donor attention as malaria burden drops, and unexpected crises such as the Ebola and Zika outbreaks. Progress has not been uniform throughout Africa and, in some countries, malaria control interventions will need to be scaled up further before substantial reductions in malaria burden can be expected. In contrast, other countries have progressed to a point where malaria is no longer a leading public health problem.

As we make the case for eliminating malaria, we also must consider the economic rationale. Malaria places an economic burden on countries and has wide-ranging effects such as reducing school attendance and lowering worker productivity, in addition to the significant out-of-pocket spending on malaria treatment by households. Thus, fighting malaria not only saves lives, but also directly supports the achievement of broader development goals. A cost-benefit analysis shows that the return on investing to achieve the 2030 malaria goals ranges from 28:1 to 40:1 globally, and is 60:1 in sub-Saharan Africa, underscoring the transformative potential for growth.[4] Furthermore, continuing the fight against malaria will be central to achieving many of the Sustainable Development Goals (SDGs), including SDG 1 to end poverty in all its forms and SDG 3 to ensure healthy lives and promote well-being for all.

The U.S. Government, through PMI, stands as a steadfast partner in the global fight against malaria, working together with host country governments and the broader malaria partnership to maintain the momentum for malaria elimination. As PMI looks to the future and the implementation of PMI's Strategy for 2015–2020 (see box), the U.S. Government remains firmly dedicated to fighting malaria and saving lives.

4 Roll Back Malaria Partnership, Action and Investment to defeat Malaria (AIM) 2016-2030: for a Malaria-Free World.

The President's Malaria Initiative:
A Decade of Progress

PMI EXPANDS TO ADDITIONAL FOCUS COUNTRIES:

FUNDING FOR PMI COUNTRY SUPPORT:

2005	2006	2007	2008	2009
	$30M	$154M	$296M	$300M

2005

President George W. Bush launches PMI, a major 5-year, $1.265 billion expansion of U.S. Government resources for malaria control.

USAID
FROM THE AMERICAN PEOPLE
PRESIDENT'S MALARIA INITIATIVE
CDC

2006

First-ever White House Summit on Malaria is convened.

WHITE HOUSE SUMMIT ON MALARIA

. . . So we are acting, and we're leading. And with partners across the world, we are helping the people of Africa turn the tide against malaria. The goal of defeating malaria is a challenging goal, yet it can be done. It's not going to require a miracle; it just requires a smart, sustained, focused effort.

– President George W. Bush
White House Summit on Malaria
December 14, 2006

2008

The U.S. Congress passes the Tom Lantos and Henry J. Hyde Global Leadership against HIV/AIDS, Tuberculosis, and Malaria Act.


One hundred Tenth Congress of the United States of America

2009

The U.S. Government Malaria Strategy 2009–2014 is launched with a goal to work with partners to halve the burden of malaria in 70 percent of the at-risk populations of sub-Saharan Africa.

Leadership means a wise application of military power and rallying the world behind causes that are right. It means seeing our foreign assistance as part of our national security, not charity. … When we help African countries feed their people and care for the sick, that prevents the next pandemic from reaching our shores. Right now, we are on track to end the scourge of HIV and AIDS, and we have the capacity to accomplish the same thing with malaria.

– President Barack Obama
State of the Union
January 12, 2016

2010 — $500M

2011 — $578M

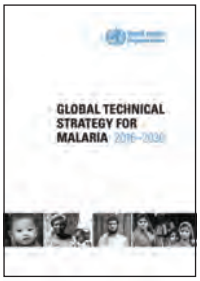
PMI commissions an external evaluation to review its performance, which found that PMI is a successful, well-led initiative.

2012 — $604M

The White House launches the PMI Strategy 2015–2020, with a goal to work with PMI-supported countries and partners to further reduce malaria deaths and substantially decrease malaria morbidity, toward the long-term goal of elimination.

2013 — $608M

The Roll Back Malaria Partnership's Action and Investment to defeat Malaria 2016–2030 – for A Malaria-Free World and WHO's Global Technical Strategy for Malaria 2016–2030 are launched.



2014 — $619M

WHO and UNICEF report that the Millennium Development Goal of halting and reversing malaria incidence by 2015 has been achieved.

2015 — $619M

WHO's World Malaria Report for 2015 estimates that more than 6.2 million malaria deaths were averted over the 2000–2015 period – most of them in children under the age of five.

1 Outcomes and Impact: A Decade of Progress

The U.S. Government shares the long-term vision of affected countries and global partners of a world without malaria. This vision will require sustained, long-term efforts to drive down malaria transmis sion and reduce malaria deaths and illnesses, leading to country-by-country elimination and eventual eradication by 2040–2050. The U.S. Government's goal is to work with PMI-supported countries and partners to further reduce malaria deaths and substantially decrease malaria morbid ity, toward the long-term goal of elimination.

President s Malaria Initiative Strategy 2015–2020

BK Kapella/PMI

THIS report marks 10 years since President George W. Bush launched the President's Malaria Initiative (PMI). Beginning in 3 countries, PMI now supports malaria control activities in 19 countries in sub-Saharan Africa and the countries of the Greater Mekong Subregion (GMS).

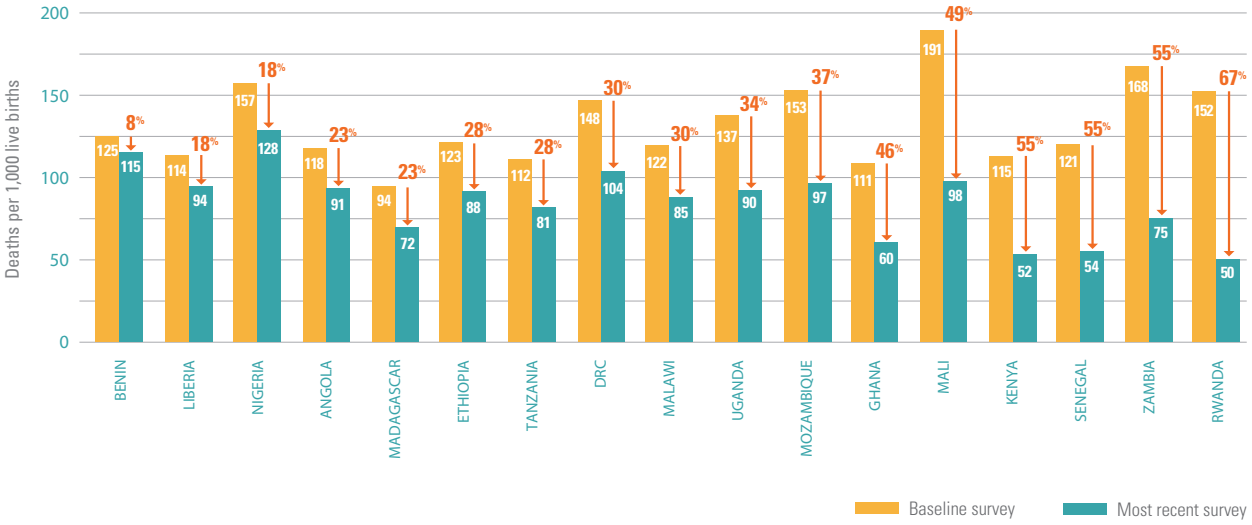
PMI's approach pairs support for the procurement of essential commodities – insecticides and equipment for indoor residual spraying (IRS), insecticide-treated mosquito nets (ITNs), artemisinin-based combination therapies (ACTs), rapid diagnostic tests (RDTs), and laboratory equipment and supplies – with technical and programmatic support to scale up those tools. Furthermore, PMI strengthens partner countries' capacity to deliver services and builds human resource capacity within ministries of health staff. PMI focuses on scaling up proven, cost-effective malaria control interventions, including ITNs, intermittent preventive treatment for pregnant women (IPTp), malaria case management, and IRS in targeted areas and monitoring and measuring progress of those efforts. It supports social and behavior change communication strategies to increase the uptake of malaria interventions and contribute to reductions in morbidity and mortality. Operational research is carried out to identify and develop evidence to address key implementation bottlenecks, document best practices for scaling up, and determine the microeconomic impact of malaria control efforts.

PMI supported countries – with assistance from PMI, the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund), other multilateral and bilateral partners, non-governmental organizations, and private sector and research partners, along with their own domestic resources – have achieved significant expansion of malaria control interventions.

A DECADE OF PROGRESS

As a result of these collective efforts, the past 10 years have seen the most dramatic decreases in malaria morbidity and mortality since modern malaria control began. And, the prospect of malaria elimination and eradication as soon as 2040–2050 has been put forward by the global malaria community as an aspirational goal. A number of countries have set their sights on eliminating malaria from their countries

Figure 2: Reductions in All-Cause Mortality Rates of Children Under Five Years of Age in PMI Focus Countries



Note: The PMI focus countries included in this figure have at least two data points from nationwide household surveys that measured mortality in children under the age of five. These data are drawn from Demographic and Health Surveys, Multiple Indicator Cluster Surveys and from Malaria Indicator Surveys with expanded sample sizes. Percentage reductions are calculated using under-five mortality rates from the baseline and most recent survey conducted. Refer to Figure 1 in Appendix 3 for more detail including survey source and year.

within the first half of this century; the leaders of all six countries in the GMS have committed to eliminating malaria by 2030.

Global progress on malaria control since 2000 has been unequivocal. The World Health Organization estimates that more than 6.2 million malaria deaths were averted worldwide between 2000 and 2015, primarily among children under five years of age in sub-Saharan Africa. Global malaria mortality has declined by an estimated 48 percent and malaria incidence by 37 percent.[1] The greatest progress occurred after 2005, when PMI programs were operational and making contributions alongside partner countries and other donors to malaria control efforts.

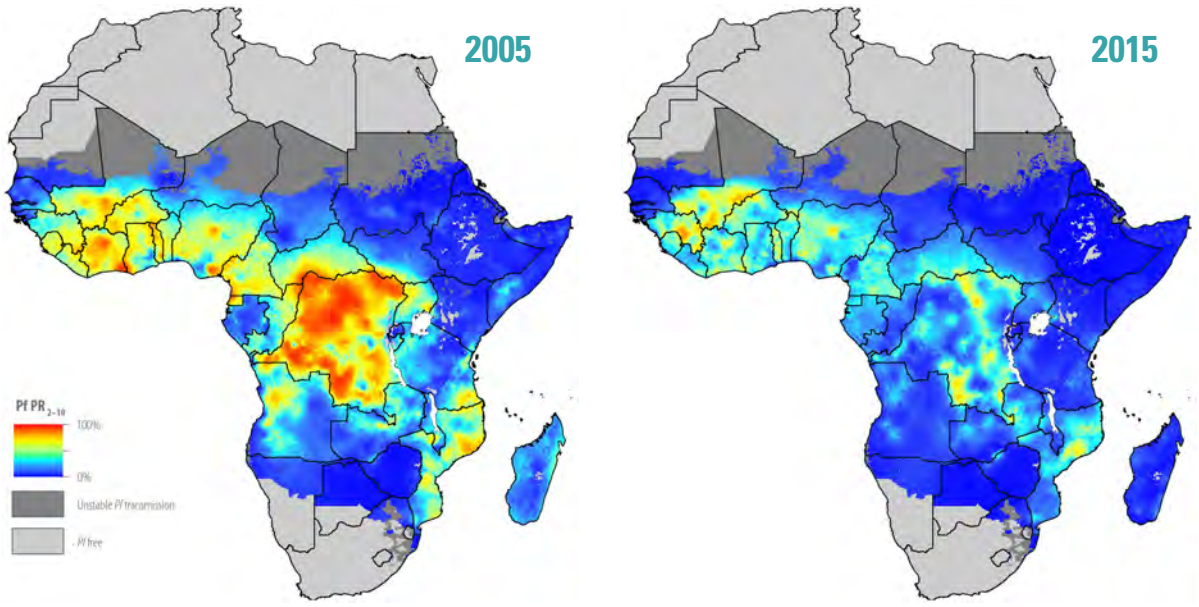
Based on these results, the World Health Organization and UNICEF reported that the Millennium Development Malaria Goal of halting and reversing malaria incidence by 2015 has been achieved. Reductions in malaria infections and deaths contribute – directly and indirectly – to reductions in child mortality. The Millennium Development Goals Report 2015 estimates that the reduction in mortality in children under five years of age in sub-Saharan Africa was over five times faster during the period 2005–2013 than it was during 1990–1995. In PMI focus countries, documented reductions in all-cause child mortality range from 8 percent (in Benin) to 67 percent (in Rwanda) (see Figure 2).[2] In some countries, the reductions were not just seen in mortality, but also in malaria morbidity. PMI is carefully estimating the contribution of malaria control efforts to declines in mortality in PMI focus countries through in-depth impact evaluations conducted in collaboration with Roll Back Malaria (RBM) partners. This historically unprecedented progress in global malaria control is due to the significant and well-coordinated investments by national governments and donors, support from technical agencies and national institutions, and the hard work and dedication of health workers, nongovernmental organizations, and affected communities – with U.S. Government leadership in the malaria fight playing an undeniably significant role.

1 World Health Organization, 2015 World Malaria Report.

2 While reductions in all-cause child mortality may be the result of both malaria and non-malaria related child health interventions, PMI relies on this indicator to measure the impact of malaria control interventions in accordance with the recommendations of the Roll Back Malaria Monitoring and Evaluation Reference Group. All-cause child mortality captures both the direct and indirect effects of malaria.

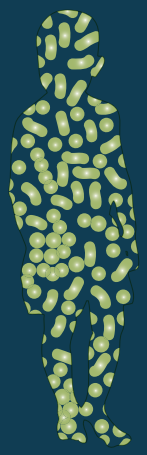
Lilia Gerberg/PMI

Figure 3. Estimated *P. falciparum* Infection Prevalence among Children Aged 2–10 years (PfPR2-10)

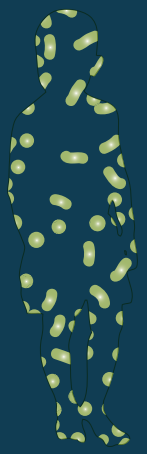


Source: Malaria Atlas Project (http://www.map.ox.ac.uk/)

Among the indicators monitored by PMI is the percent of children less than five years of age with malaria parasitemia in national household surveys. Changes in parasitemia prevalence can be an indicator of long-term trends in malaria burden, particularly in high-burden countries. Of the 13 PMI focus countries in sub-Saharan Africa for which there are at least 2 measurements in serial national household surveys, 10 showed reductions in parasitemia prevalence. This trend is mirrored across sub-Saharan Africa, where the proportion of children aged 2–10 years infected with malaria parasites was halved from 33 percent to 16 percent in endemic areas between 2000 and 2015. Three quarters of this change occurred after 2005 (see Figure 3).



Of 13 PMI focus countries in Africa
with national household surveys,
10 showed reductions
in the proportion of young children
with malaria parasites



2 Achieving and Sustaining Scale of Proven Interventions

PMI will continue its strong support to universal coverage of at-risk populations with ITNs, IPTp, and case management, and targeted high-level cover age of IRS. Whether countries are still scaling up core malaria control interventions or have largely achieved scale, sustaining and building on prior achievements must be central to PMI's efforts in the coming years.

– President s Malaria Initiative Strategy 2015–2020

Ademola Olaniran

Vector Control – Insecticide-Treated Mosquito Nets

LONG-LASTING insecticide-treated nets are the most commonly used tool for malaria prevention worldwide. High ownership and consistent use of ITNs reduces the incidence of uncomplicated malaria episodes by an estimated 50 percent and all-cause mortality in children under five by 20 percent, particularly in high burden countries.[1] When a community has a high level of ITN use among people of all ages, the risk of malaria infections can be reduced even among people not using an ITN.

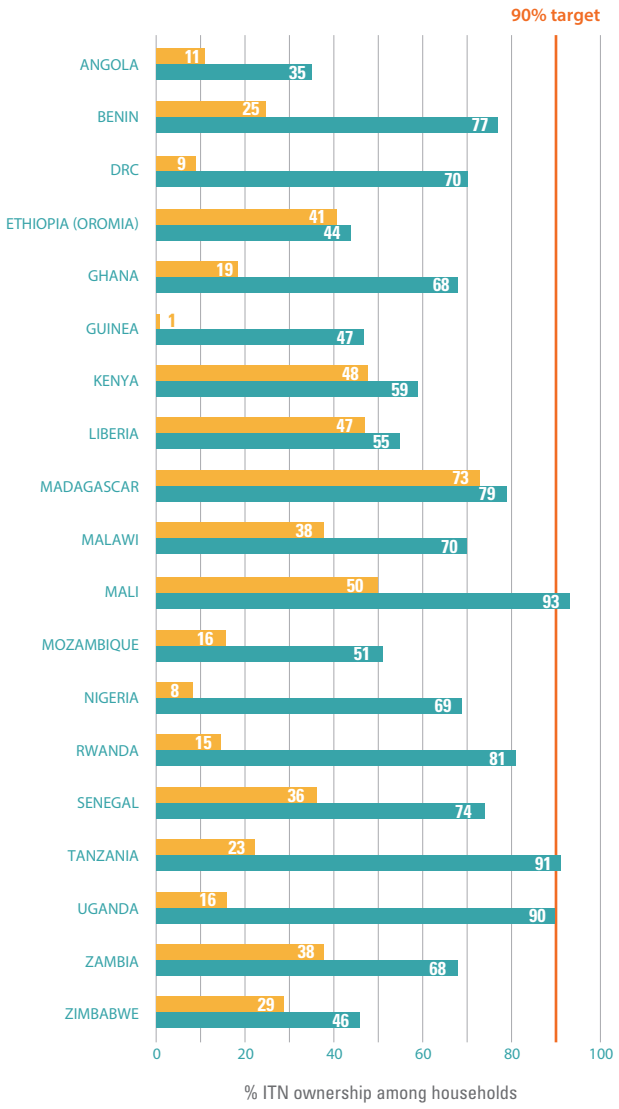
The President's Malaria Initiative's ITN strategy is guided by the World Health Organization (WHO) 2007 position statement which recommends universal coverage of the entire population at risk for malaria with effective vector control interventions, primarily long-lasting ITNs and indoor residual spraying. PMI supports countries to achieve and maintain universal coverage (commonly defined as at least one ITN for every two people at risk) with long-lasting ITNs through mass campaigns and continuous distribution channels, such as antenatal and child immunization clinics at health facilities, and via the private sector.

In FY 2015, PMI procured 42.3 million ITNs, the largest number of nets procured in one year since the launch of the Initiative. PMI's contributions represent approximately 20 percent of the 206 million ITNs that were delivered globally in 2015, second only to the Global Fund to Fight AIDS, Tuberculosis and Malaria. Cumulatively, PMI has procured more than 197 million ITNs over the past decade. Over the same time period, PMI has helped protect up to 420 million people from malaria infection with ITNs, by supporting the distribution of more than 213 million nets in PMI focus countries (including 133 million ITNs procured by PMI and an additional 80 million procured by other donors but distributed with PMI resources) (see Appendix 2). Regardless of the source of ITN procurement in PMI focus countries, PMI provides significant technical assistance for ITN distribution, use promotion, and ITN program monitoring and evaluation efforts.

In the 10 years since PMI began, there has been impressive progress in ITN ownership and use across PMI focus

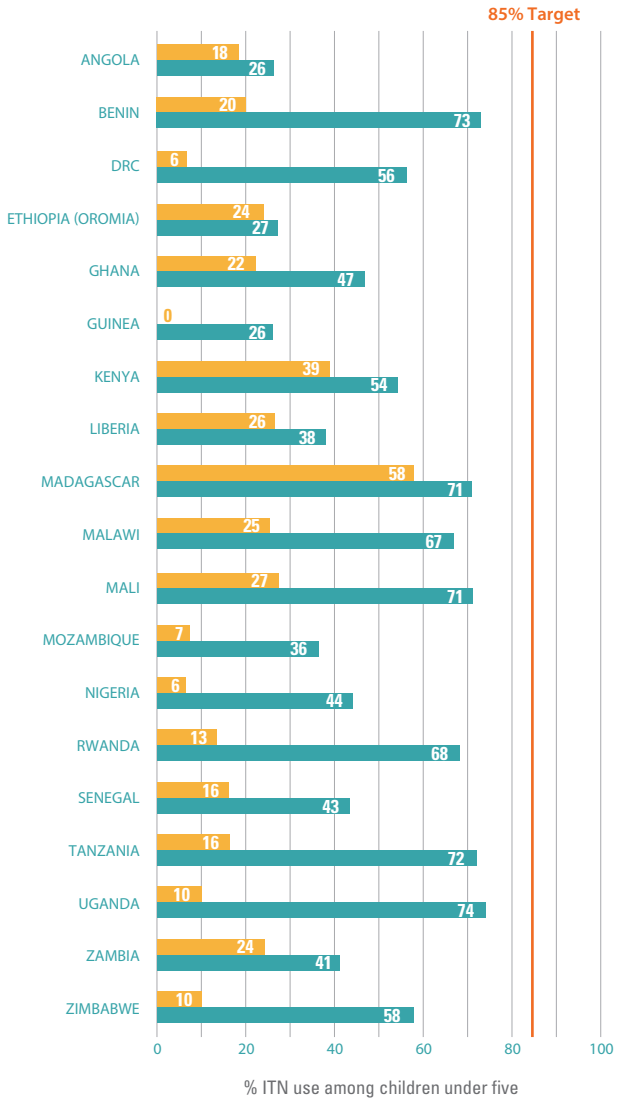
1 Lengeler, C. Insecticide-treated Bed Nets and Curtains for Preventing Malaria (Review). In: The Cochrane Library, Issue 2. 2009. Chichester: Wiley.

Figure 4. Household Ownership of at Least One ITN in PMI Focus Countries



Note: Household ownership is defined as the percentage of households surveyed that owned at least one ITN. Data shown are from nationwide household surveys. Refer to Appendix 3 (Figure 2) for more detail.

Figure 5. ITN Use among Children Under Five in PMI Focus Countries



Note: ITN use is defined as the percentage of children under age five who slept under an ITN the night before the survey. Data shown are from nationwide household surveys. Refer to Appendix 3 (Figure 3) for more detail.

countries. Overall, ITN ownership, measured through serial household surveys, has increased from a median baseline of 25 percent to 69 percent (range: 35 percent to 93 percent), and ITN use in children under five has increased from 18 percent to 54 percent (range: 26 percent to 74 percent) (see Appendix 3).

While some countries are nearing or exceeding targets for ITN ownership (90 percent) and use (85 percent) (**Benin, Madagascar, Mali, Rwanda, Tanzania,** and **Uganda**), others still are scaling up (see Figures 4 and 5). Overall, 12 countries have reached or exceeded 60 percent household ownership of ITNs.

To help ensure that the benefits of ITNs are fully realized, PMI tailors approaches to increasing ITN access and promoting ITN use according to a country's systems and epidemiology. Data suggest that in many countries, the main limiting factor to ITN use remains inadequate access to sufficient ITNs to protect all household members; thus, PMI remains committed to increasing the number of ITNs available to at-risk populations in order to improve use. In addition to procuring ITNs to help fill known commodity gaps, PMI supports periodic mass distribution campaigns in all countries and also strengthens continuous ITN distribution channels, as described in more detail below. To complement the procurement and distribution of ITNs, PMI supports social and behavior change communication activities to maintain high net ownership and ensure that ITNs are used correctly and consistently. Furthermore, PMI monitors net durability and insecticide effectiveness in addition to ITN ownership and use.

ACHIEVING HIGH NET OWNERSHIP – MASS DISTRIBUTION CAMPAIGNS

Mass campaigns continue to be the major distribution channel for nets, enabling countries to achieve equitable, universal ITN coverage quickly. Campaigns are also an opportunity to disseminate and reinforce social and behavior change messaging around net ownership, use, and care. All PMI focus countries in sub-Saharan Africa have completed at least one national or sub-national campaign between 2009 and 2015. In FY 2015, working with partner country counterparts, PMI supported mass campaigns in 12 countries (**Angola, Democratic Republic of the Congo [DRC], Ghana, Kenya, Liberia, Madagascar, Malawi, Mali, Mozambique, Nigeria, Tanzania,** and **Uganda**). Highlights include:

- In**Ghana**, PMI provided technical assistance for successful implementation of the 2015 mass distribution campaign. Specifically, in the Brong Ahafo and Western Regions, PMI supported training of 281 sub-district supervisors to validate the community population data that enabled correct prepositioning of ITNs. Additional training and logistical support was provided to ensure that high quality, standardized monitoring of distribution activities was in place as 2.8 million ITNs procured by the Global Fund were distributed in these two regions.

- In **Kenya**, PMI procured and distributed 3.8 million nets to support the government's effort in achieving universal ITN coverage through an ongoing, rolling mass distribution in 23 endemic and epidemic-prone counties. With completion of the mass campaign at the end of 2015, Kenya anticipates that the ownership coverage will improve progress toward meeting the universal coverage target of at least one ITN per two persons per household in at-risk areas.

- In **Madagascar**, PMI and the Global Fund worked closely with the government to procure and distribute 10.5 million nets, covering a combined total of 92 districts during a mass distribution campaign in fiscal year (FY) 2015. Of these, PMI supported distribution of 6.3 million ITNs, covering 51 health districts in the north, northeast, east, and southeast coasts and protecting up to 12.5 million people. The coordinated efforts of the Global Fund and PMI in support of the Government of Madagascar's national ITN goals helped to maintain the net coverage achieved during previous campaigns.

- In **Malawi**, PMI worked closely with the government counterparts and the Global Fund to distribute more than 1 million ITNs in a mass distribution campaign in 6 of the country's 29 districts. In addition to technical assistance to the national malaria control program (NMCP), PMI supported registration of households to ensure correct numbers of ITNs were distributed. An analysis of the national health management information system shows that these 6 districts experienced a 24 percent decrease in malaria cases in peak season compared to no decrease in districts not yet covered by the campaign; this translates to nearly 150,000 cases averted in the first 6 months of 2015 alone.

MAINTAINING HIGH NET OWNERSHIP – CONTINUOUS DISTRIBUTION

Continuous distribution remains an important method of maintaining high ITN coverage over time. PMI works with countries to assess infrastructure, resources, and cultural norms to determine the most appropriate combination of ITN distribution channels to maintain high coverage effectively and equitably. The most common ITN distribution channels

are health facility-based distribution to pregnant women through antenatal care (ANC) services and to children through Expanded Program on Immunization (EPI) programs. However, even together, these targeted channels will not be sufficient to maintain universal coverage of ITNs over time. Additional distribution channels are necessary.

In previous years, PMI supported pilot studies of additional ITN distribution channels, such as school- and community-based distributions, and has found that these channels can contribute to maintaining high ITN ownership levels without oversupplying ITNs. During FY 2015, PMI supported school-based ITN distributions in four countries (**Ghana, Nigeria, Senegal,** and **Tanzania**). The school-based distribution channel is appropriate in geographic areas where the school attendance rate is high. It is flexible (i.e., by adding or subtracting classes) and has the potential to bring large numbers of ITNs into communities without oversupplying.

In FY 2015, all PMI focus countries supported ITN distribution through at least one continuous distribution channel. Examples include:

- In**Senegal**, PMI expanded its support for a multi-channel routine distribution system for long-lasting ITNs through health facilities, schools, community-based organizations, and the private sector, distributing a total of 498,286 ITNs in 2015. All of these ITN distribution channels operate in every district, and PMI's support has included net procurement as well as transportation and monitoring of activities via supervision visits.

- Under the leadership of the NMCP, PMI is supporting the scale-up of a new school-based ITN distribution effort in **Tanzania**. In FY 2015, PMI procured and supported distribution of 500,000 ITNs through the third annual School Net Program (SNP), covering three regions in the south of Tanzania: Lindi, Mtwara, and Ruvuma. Household surveys following each of the first two rounds of SNP showed significantly higher access to ITNs in the population in the districts with SNP in the Southern Zone after two rounds of net delivery (65 percent) relative to those without SNP in the comparison districts in the Lake Zone (38 percent). Based on these results PMI will work with the government to expand the SNP in 2016 to include regions in the Lake Zone.

- In FY 2015 in **Zimbabwe**, PMI supported a routine distribution pilot that began in four districts (Mt. Darwin, Mazowe, Makonde, and Hurungwe) using four ITN distribution channels: ANC, EPI, community (via Village Health Workers), and elementary school distribution (targeting third and sixth graders). With PMI support, a total of 92,794 ITNs were distributed via the pilot channels during the first 8 months.

- In**Guinea**, PMI supported the government to launch routine distribution of ITNs through ANC and EPI services in 14 districts. A total of 167,896 ITNs were distributed in 152 public and 27 private facilities, and 5 municipal health centers in the supported districts and communes. As a result, routine net distribution brought more nets into the community and may have encouraged health facility attendance, which had been negatively impacted by the Ebola outbreak.

ITN RESEARCH AND PUBLICATIONS

PMI remains committed to furthering the research and understanding of how to take ITN programs successfully to scale. From 2008 to the end of 2015, PMI has supported 23 ITN-related operational research studies, extensive secondary data analysis, and ongoing policy development work that has resulted in the publication of more than 30 peer-reviewed journal articles related to the distribution, ownership, and use of ITNs. This work has enhanced the knowledge base for improving the quality and effectiveness of ITN programs and has helped ensure that global ITN policies remain current and effective. Numerous evidence-based tools have also been produced to facilitate the programmatic implementation of ITN programs. This body of work has directly impacted country-level ITN programs worldwide. Examples include:

- A 2010 publication recommended a new method – developed with PMI support – for calculating the number of nets to procure in order to reach universal coverage; this resulted in global policy change from purchasing 1 net for every 2 people to 1 net for every 1.8 people.[2] It is estimated that more than 40 million additional ITNs were procured as a direct result of the WHO policy change prompted by this publication.

- PMI funded a cluster-randomized trial of door-to-door hang-up visits in **Uganda** to assess their impact on improved net use. The study concluded that there was no effect of the hang-up visits on net use across the three arms of the study.[3] As a result, PMI no longer funds door-to-door hang-up visits in focus countries in areas where net use was already reasonably robust or where previous mass campaigns had taken place.

2 Kilian, A, Boulay M, Koenker H, Lynch M. How Many Mosquito Nets Are Needed to Achieve Universal Coverage? Recommendations for the Quantification and Allocation of Long-lasting Insecticidal Nets for Mass Campaigns. *Malaria Journal*. 2010. 9:330

3 Kilian A, Balayo C, Feldman M, Koenker H, Lokko K, Ashton RA, et al. The Effect of Single or Repeated Home Visits on the Hanging and Use of Insecticide-Treated Mosquito Nets following a Mass Distribution Campaign – A Cluster Randomized, Controlled Trial. *PLoS ONE*. 2015. 10 (3)

Brant Stewart/RTI

Vector Control – Indoor Residual Spraying

Indoor residual spraying is a powerful tool for combatting malaria in locations where the primary mosquito vectors rest indoors, in areas of insecticide resistance, and as a supplement to long-lasting insecticide-treated mosquito nets to further reduce malaria burden. Through door-to-door application of insecticide to the interior walls of houses, IRS's primary mechanism of action is to kill mosquitoes that come into contact with these sprayed surfaces and thus prevent the transmission of malaria.

Working in partnership with NMCPs, PMI's IRS program investments have varied in size and geographic reach, from protecting approximately 2 million residents in 3 countries in FY 2006 to protecting more than 16 million residents in 13 countries in FY 2015. During this past fiscal year, more than 4 million houses were sprayed, and an overall coverage rate of greater than 93 percent of structures targeted for spraying was achieved.

With financial and technical support from PMI, tens of thousands of individuals have been trained on IRS operations each year, building a large cadre of skilled workers throughout sub-Saharan Africa. In FY 2015 alone, more than 36,000 people were trained on aspects related to IRS implementation.

PMI provides a comprehensive package of support to partner ministries of health and NMCPs for IRS activities in many countries, including technical assistance and support for:

- Procurement and supply chain management
- Training and operations
- Community mobilization
- Monitoring and evaluation
- Entomological monitoring
- Environmental compliance

Over the past decade, PMI has contributed substantially to building the operational capacity of national governments and institutions to implement IRS, reducing the need for external technical assistance.

LEVERAGING PARTNERSHIPS TO EXPAND COVERAGE

PMI has successfully partnered with the U.K. Department for International Development (DFID) and the respective country NMCPs to expand IRS coverage in **Zambia** and **Uganda**. In Zambia, DFID funding to PMI contributed to Zambia IRS program operations in 2 provinces encompassing 10 districts in Luapula Province and 4 districts in Central Province, protecting an additional 848,369 people. In Uganda, DFID funding enabled PMI and DFID to support the government's expansion of operations to 5 high burden districts in the eastern region; an additional 823,528 people were protected as a result.

PMI is also working to sustain overall IRS coverage in the face of the need to use more costly insecticides through participation in a UNITAID proposal, which aims to expand access to and adoption of long-lasting IRS insecticides through provision of a subsidy on these more expensive products. This proposal is being led by the Innovative Vector Control Consortium, in partnership with PMI, Global Fund, and PATH and is expected to roll out in 2016 in several PMI focus countries: **Ethiopia, Ghana, Mali, Mozambique,** and **Zambia**. In FY 2015, PMI participated in extensive planning meetings with partners to develop the grant, which received UNITAID Board approval in January 2016.

TESTING NEW APPROACHES

In **Ethiopia**, many of PMI's supported spray areas are rural, dispersed, and hard to reach. Within this challenging context, PMI supported the Federal Ministry of Health in piloting a community-based approach to IRS operations. This model capitalizes on the strong village-level reach of Ethiopia's Health Extension Program, which places two Health Extension Workers (HEWs) in each village to provide a wide range of health services in rural areas. Under the community-based approach, HEWs, who are predominantly female, are responsible for organizing and executing all aspects of IRS in their communities, including training and supervising spray operators, community mobilization, ensuring environmental compliance standards are met, and data collection and reporting. This decentralized implemen-

tation model saves costs on transportation and mobilization, while also providing key opportunities for increasing women's participation in IRS supervisory roles. PMI carefully analyzed the quality, safety, and cost of this approach in six districts and concluded that community-based IRS is a feasible alternative to district-based IRS in Ethiopia and may be more sustainable in the long run. Variations on this community-based IRS model are being implemented in **Madagascar, Mali,** and **Tanzania**.

In addition, PMI has been piloting new approaches to reduce operational costs to make IRS as cost-effective as possible. In **Benin**, PMI worked with the government to shorten the length of the spray campaign and reduced transportation costs, a major driver of overall IRS costs. In **Ethiopia**, where residents' support for and awareness of IRS is high, PMI worked with national and local counterparts to eliminate costly door-to-door community mobilization without impacting coverage. PMI will assess the impact of these strategies and will roll them out in other countries as appropriate.

PROMOTING GENDER EQUITY IN IMPLEMENTING IRS PROGRAMS

PMI has made notable strides in working with NMCPs to ensure IRS programs are gender inclusive by working to:

- Transform negative stereotypes of women's roles in the work force
- Create a gender equitable working environment that promotes inclusion and acceptance
- Increase the number of women working in IRS programs, particularly in supervisory roles

Many negative stereotypes exist that prevent women from participating in spray operations, including the notion that women are not strong enough for this type of work. In collaboration with NMCPs, gender focal points have been identified and trained in each IRS country program to ensure that gender strategies are implemented as an integrated aspect of IRS operations and results have been documented. In **Senegal**, for example, the percent of women hired as seasonal IRS personnel increased from 20 percent in FY 2014 to 31 percent in FY 2015. Furthermore, due to the promotion of gender-inclusive strategies, the percentage of women hired in supervisory roles increased from 9 percent to 21 percent during that same period. Participation in IRS campaigns provides important economic opportunities. PMI is working with NMCPs to ensure that women have equal access to these positions, training, and income.

Malaria in Pregnancy

Malaria infection during pregnancy contributes to maternal and newborn morbidity and mortality. Approximately 125 million women living in malaria-endemic countries throughout the world become pregnant every year, more than 30 million of whom live in tropical areas of Africa where there is intense transmission of *Plasmodium falciparum*.[4] In these areas, malaria infection directly contributes to adverse outcomes in maternal and newborn health. An estimated 11 percent of neonatal deaths in malaria endemic African countries are due to low birth weight resulting from *P. falciparum* infections in pregnancy.[5]

Prevention has been shown to significantly reduce the risk of maternal anemia, low birth weight, and perinatal deaths. In line with WHO guidelines, PMI supports a multi-pronged approach to reducing malaria in pregnancy: (1) provision and promotion of insecticide-treated mosquito nets to pregnant women; (2) administration of intermittent preventive treatment during pregnancy with sulfadoxine-pyrimethamine (SP); and (3) prompt diagnosis and effective treatment of malaria and anemia among pregnant women. PMI supports the delivery of these activities through an integrated antenatal care platform and promotes collaboration between national malaria control programs and maternal and child health programs in PMI focus countries.

ITN USE AMONG PREGNANT WOMEN

ITNs are crucial to protect women and their fetuses throughout pregnancy, especially during the first trimester of pregnancy, when IPTp is not recommended. To ensure that pregnant women receive ITNs as early as possible in their pregnancy (and preferably before), PMI supports coverage of ITNs through mass campaigns as well as continuous routine distribution during ANC. ITN use among pregnant women, measured through national household surveys, continues to increase in most PMI focus countries and has increased from a median of 17 percent at baseline to 48 percent (range: 26 percent to 78 percent) in the most recent survey. Some PMI focus countries (**Mali, Rwanda, Tanzania,** and **Uganda**) are approaching the 85 percent ITN use target, while others are still scaling up (see Figure 6).

IPTP2 COVERAGE

The use of IPTp during pregnancy has been shown to significantly reduce low birth weight. To date, coverage of pregnant women with at least 2 doses of IPTp in PMI focus countries has increased from a baseline of 14 percent to 38 percent (range: 14 percent to 73 percent) (see Appendix 3). **Ghana** and **Zambia** continue to have the greatest success with IPTp coverage, reaching 68 percent and 73 percent coverage, respectively (see Figure 7).

- In **Ghana**, malaria in pregnancy currently accounts for 3.4 percent of maternal deaths, a reduction from 9.9 percent in 2010.[6] Between 2006 and 2014, Ghana has made impressive gains in increasing uptake of IPTp2, with coverage increased from 25 percent to 68 percent. Ghana's high rates of ANC attendance provide an effective platform for the delivery of comprehensive services during pregnancy, including frequent dosing of IPTp. A number of factors have contributed to the significant gains in IPTp uptake in Ghana over the past few years, including strong government leadership and coordination across two national programs (NMCP and the Reproductive and Child Health Department), coordinated donor and partner support, and technical assistance for program implementation.

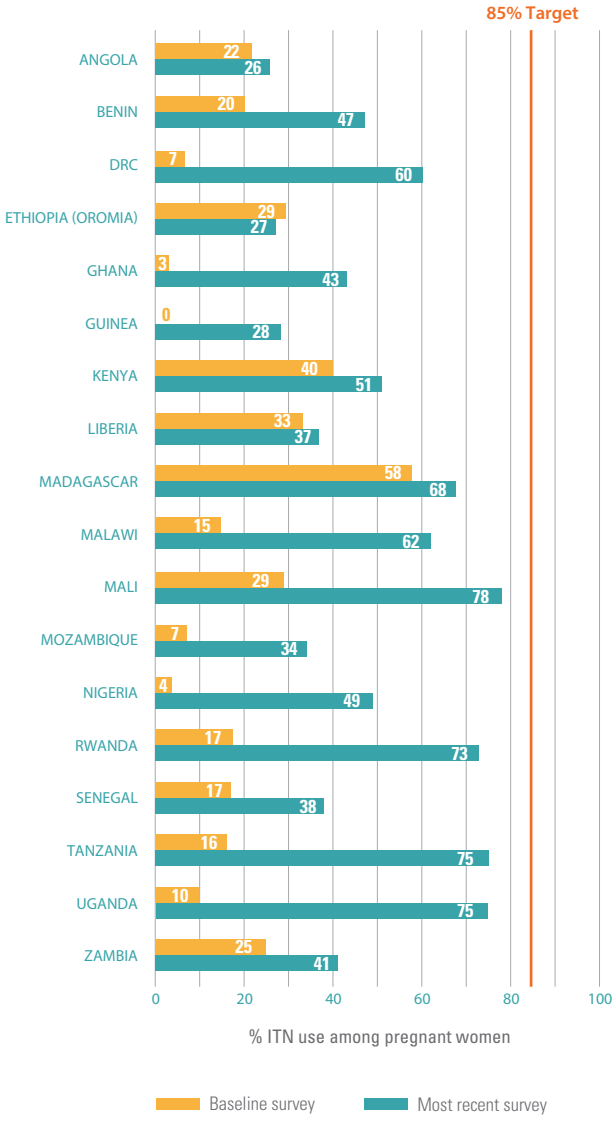
A critical element to provision of IPTp is adequate availability of SP at health facilities. In many PMI focus countries, ministries of health are able to purchase SP due to its wide availability and low cost. However, where gaps do exist, PMI has assisted to procure and distribute SP in order to ensure that pregnant women and their fetuses are protected. In FY 2015, PMI procured more than 21 million treatments of SP for IPTp programs in 9 PMI focus countries. Cumulatively, since the start of the Initiative, PMI has procured more than 58 million treatments of SP.

4 Dellicour S, Tatem AJ, Guerra CA, Snow RW, ter Kuile FO. Quantifying the Number of Pregnancies at Risk of Malaria in 2007: a Demographic Study. ***PLOS Med***. 2010;7:1, e1000221. doi:10.1371/journal. pmed.1000221.

5 Guyatt HL, Snow RW. Malaria in Pregnancy as an Indirect Cause of infant mortality in Sub-Saharan Africa. *Trans R Soc Trop Med Hyg*. 2001;95:569–76

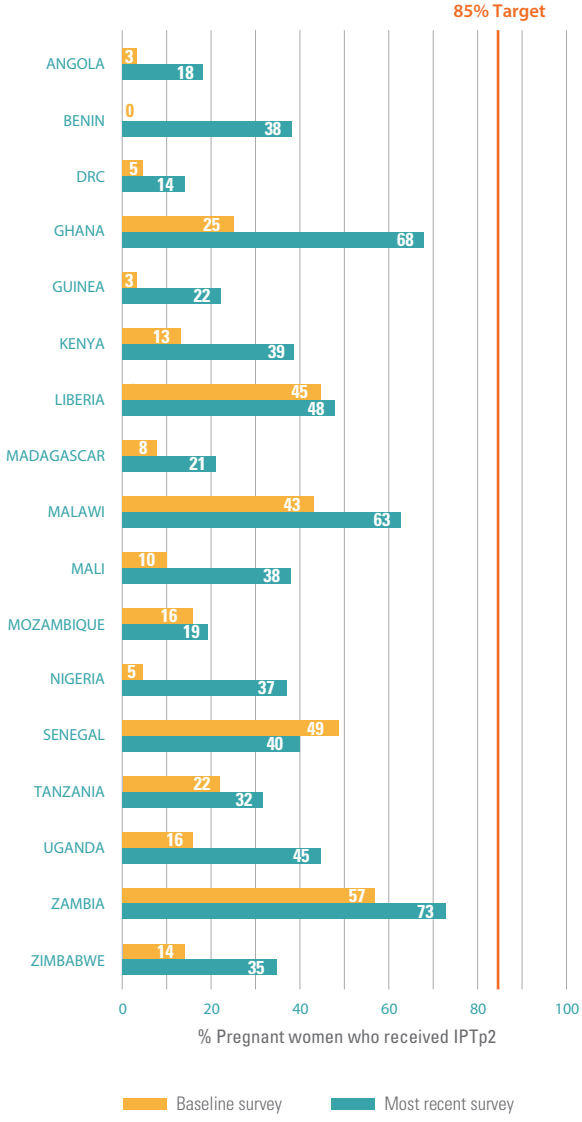
6 Ghana Health Services: http://www.ghanahealthservice.org/malaria/subcategory.php?nmcpscid=114&nmcpcid=85

Figure 6. ITN Use among Pregnant Women in PMI Focus Countries



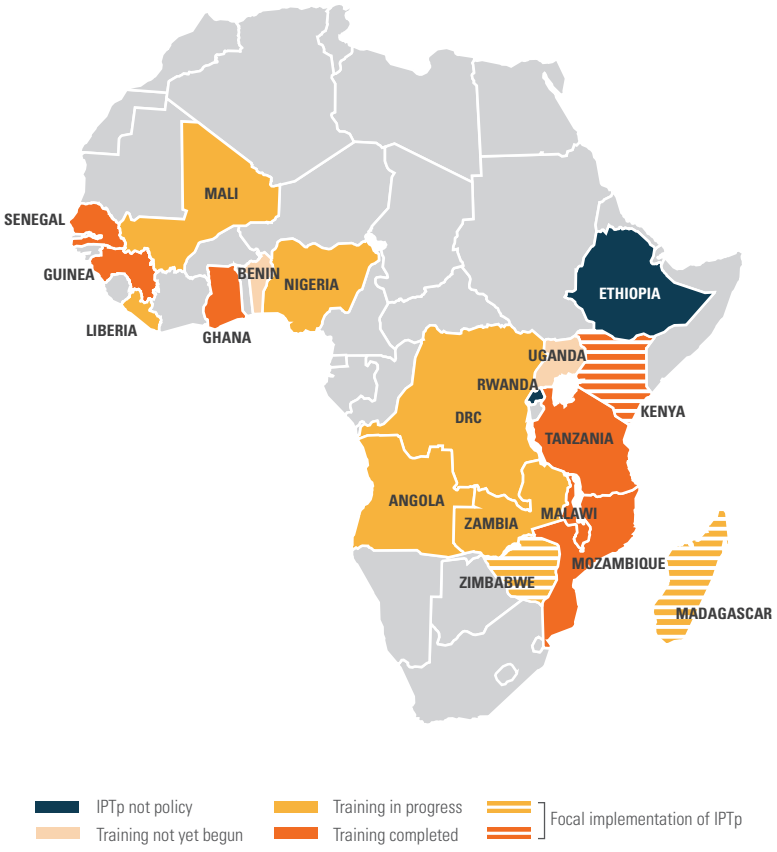
Note: ITN use is defined as the percentage of pregnant women who slept under an ITN the night before the survey. Data shown are from nationwide household surveys. Refer to Appendix 3 (Figure 4) for more detail.

Figure 7. IPTp2 Coverage in PMI Focus Countries



Note: IPTp2 is defined as at least two doses of SP during the last pregnancy with at least one dose given during an antenatal clinic visit. Data shown are from nationwide household surveys. Refer to Appendix 3 (Figure 5) for more detail.

Figure 8. Current Status of IPTp Revised Policy Implementation in PMI Focus Countries (2015)



Note: Most countries support national coverage of IPTp, but, with the reduction in malaria transmission, Kenya, Madagascar, and Zimbabwe (noted by the horizontal lines) have opted to implement IPTp in targeted areas where moderate to high malaria transmission remains.

UPDATED IPTP GUIDELINES ACCORDING TO WHO RECOMMENDATIONS

In 2012, WHO released new guidance recommending a minimum of three doses of IPTp during pregnancy, starting at each scheduled ANC visit after the first trimester, with doses administered at least 1 month apart. PMI has supported country efforts to revise policy documents, organize stakeholder workshops in-country to roll out the updated policy, and support health worker trainings. As a result of these efforts, all PMI focus countries implementing IPTp have updated their policies in line with this guidance.[7] In addition, PMI is working with ministries of health to ensure ANC registers are revised in order to capture data on IPTp3 (in addition to IPTp2) through health management information systems, as per the RBM Monitoring & Evaluation Reference Group's recommendation.

Figure 8 shows the current status of policy implementation. Of the 17 sub-Saharan Africa PMI focus countries where IPTp is included in the national malaria strategy, 7 have completed training in the revised IPTp policy guidelines, while training is in progress in 8 additional countries, and 2 countries are planning roll out of the policy.

- With strong support from PMI, **Uganda's** NMCP worked with the Reproductive Health program to create a MIP Technical Working Group, which reviewed and updated the necessary policy documents to adopt the 2012 WHO recommendations. PMI supported efforts to hold a stakeholder's workshop to present and finalize the updated documents, and the policy was approved in July 2015. This policy work has been complemented by investments in training, service delivery, supply chain management, and social and behavior change communications. According to the most recent Malaria Indicator Survey (MIS), Uganda has seen improvements in IPTp2 coverage, from 25 percent in 2011 to 45 percent in 2015.

- In **Guinea**, PMI supported the revision of MIP training manuals and guidelines to incorporate management of Ebola according to WHO recommendations. To ensure that SP was taken at ANC visits during the outbreak, PMI supported the procurement of gloves for infection control, in addition to water buckets and disposable cups to facilitate directly observed therapy. These materials were distributed to all ANC units in health centers and communal health facilities in the country.

7 IPTp is not implemented in Ethiopia, Rwanda, or the countries in the Mekong subregion.

Malaria Diagnosis and Treatment

Prompt, effective case management is a crucial component of reducing malaria morbidity and mortality and a cornerstone of malaria control. PMI supports universal diagnostic testing, and when a test is positive, immediate treatment with appropriate antimalarial drugs at health facility and community levels across all focus countries. The goal is to ensure that all patients with malaria are quickly identified and confirmed and that patients with confirmed malaria receive effective treatment without delay.

PMI works closely with ministries of health to build capacity for effective implementation of malaria case management providing support for all elements of a comprehensive program to diagnose and treat patients appropriately for malaria. Major activities include:

- Support for development of up-to-date case management policies, guidelines, and training and supervision materials
- Supply chain strengthening and procurement and distribution of essential equipment and commodities including rapid diagnostic tests and artemisinin-based combination therapies
- Support for training, supervision, and quality assurance systems for diagnostic testing and treatment
- Support for drug efficacy monitoring
- Support for development and implementation of social and behavior change communication to increase provider adherence to and patient demand for diagnostic testing and appropriate treatment
- Support for operational research to address bottlenecks and improve implementation of case management

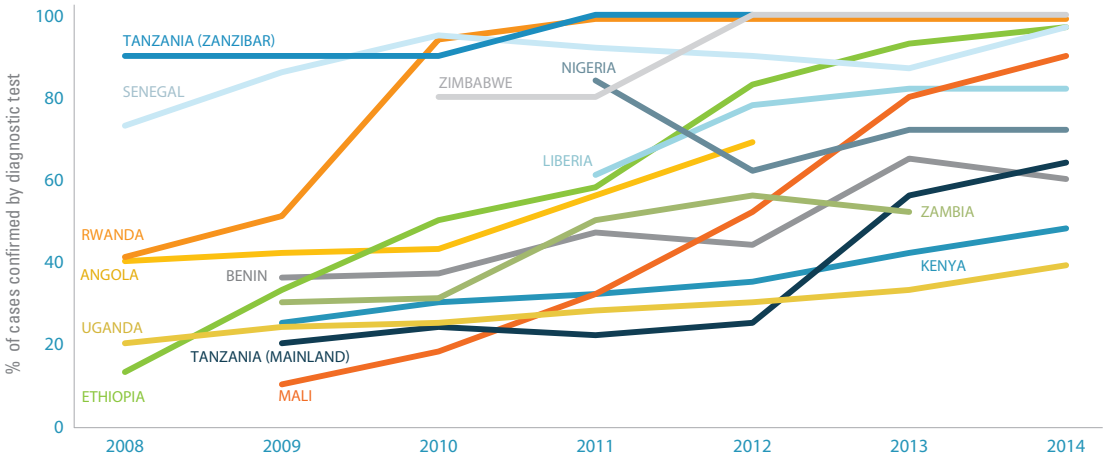
In FY 2015, PMI procured more than 54 million RDTs and 57 million ACTs. To date, PMI has procured more than 229 million RDTs and 376 million ACTs to support appropriate malaria case management in PMI focus countries. PMI's contributions complemented those of countries themselves as well as those of other donors.

SCALING UP MALARIA DIAGNOSTIC TESTING

Through the efforts of PMI, NMCPs, and partners, the proportion of malaria cases that are confirmed with laboratory tests and treated with a recommended antimalarial drug combination continues to increase in nearly all focus countries for which there are consecutive data points (see Figure 9). Prior to 2008, only Zanzibar confirmed more than 80 percent of its malaria cases with a diagnostic test. In response to the change in diagnostic guidelines by WHO in 2010, which called for universal confirmatory testing with microscopy or RDTs, PMI continued to support focus countries in their implementation of the new guidelines. By 2015, an additional 5 countries had exceeded 80 percent. Variance in progress can be a result of multiple factors, including data strikes, civil unrest, etc.

- In all the other PMI focus countries, scale-up of diagnostic testing is actively underway. For example, in mainland **Tanzania**, nationwide cascade training on RDT use for health services providers was undertaken in 2012. In FY 2015, 2,683 healthcare workers (at least one per public health facility in several high malaria burden regions) received intensive training in RDT performance and use of test results in clinical decision-making. These workers were equipped with job aids and went on to provide on-the-job training to their colleagues. Diagnostic quality assurance scale-up will continue in FY 2016 with similar activities in the remaining high burden regions of the country.
- In **Nigeria**, 2,262 health facility workers from 9 states were trained in RDT and microcopy with PMI support. In collaboration with the national malaria program and partners, PMI provided technical support for the training of additional health workers with funding from the Global Fund. In addition, through PMI support, a 10-day malaria microscopy training course received accreditation from the Medical and Laboratory Council of Nigeria.

Figure 9. Percentage of Reported Malaria Cases Confirmed by Diagnostic Test in 13 PMI Focus Countries



Source: HMIS, OTSS, and/or PMI Malaria Operational Plans

IMPLEMENTING MALARIA CASE MANAGEMENT

PMI supports ministries of health and NMCPs to update and roll out guidelines on the diagnosis and treatment of malaria on a national scale to ensure that all countries are following current WHO recommended practices.

- In FY 2015 in **Malawi**, PMI supported the training of 6,604 health workers (almost all the country's nurses and clinical officers) across the country on updated national guidelines for case management, which included the recently updated policy of using injectable artesunate for management of severe malaria. As a result, the proportion of participants with competencies in key case management skills – including recognizing symptoms of severe malaria, correctly interpreting RDT results, and managing malaria in pregnancy – rose to more than 80 percent.

- In**Guinea**, PMI in collaboration with the NMCP and other partners supported the revision of malaria case management protocols based on WHO recommendations for countries affected by Ebola. As a result, all community health workers in the 14 districts supported by PMI were oriented on the new guidelines and tools.

INCREASING ACCESS TO CARE THROUGH INTEGRATED COMMUNITY CASE MANAGEMENT

PMI supports the provision of public health services to people with limited or no access to facility-based care through integrated community case management (iCCM), an important component of the U.S. Government's efforts in ending preventable child and maternal deaths. Community health workers providing iCCM diagnose and treat malaria, pneumonia, and diarrhea using standardized treatment algorithms. PMI's support for iCCM is coordinated with the U.S. Agency for International Development's (USAID's) maternal and child health programs, as well as with support from other key partners, including UNICEF. Between FY 2007 and FY 2015, PMI support for iCCM expanded from 2 to all 19 focus countries in sub-Saharan Africa. With the combined efforts of PMI, ministries of health, partners, and other donors, the iCCM programs in **Senegal, Ethiopia, Rwanda, Madagascar,** and **Malawi** have reached national or near-national scale.

- In addition to the management of uncomplicated malaria, pneumonia and diarrhea, iCCM provides an important platform for early detection and appropriate referral of severe febrile illness, including provision of pre-referral treatment for malaria. In June 2015, PMI began support

for a pilot activity to assess the feasibility and acceptability of introducing rectal artesunate as a pre-referral treatment through iCCM in the Democratic Republic of Congo. The pilot is being implemented at 51 community care sites in 7 health zones and aims to include more than 400 children under five with severe malaria. Pre-intervention results showed that less than half of the community health workers had a good knowledge of the signs and symptoms of severe malaria. However, a large majority of the mothers accepted the use of rectal artesunate as a pre-referral treatment for their children. This pilot study will inform the NMCP on the best practices for rolling out rectal artesunate nationally.

STRENGTHENING QUALITY ASSURANCE/ QUALITY CONTROL (QA/QC) SYSTEMS FOR CASE MANAGEMENT OF MALARIA

A major focus of PMI's activities in malaria case management is strengthening the provision of quality-assured diagnostic and treatment services across focus countries. PMI promotes quality assurance of case management by providing support for strengthening expert diagnostic capacity at reference laboratories and through support for training and supervision activities at health facilities, including support for use of the PMI-developed approach of outreach training and supportive supervision (OTSS) visits that focus on diagnostic testing by laboratory technicians and treatment practices by clinicians. OTSS incorporates on-site training, mentoring, and troubleshooting with routine supervision that assesses health worker performance through direct observation, facility and record review, and re-checking of blood slides. WHO's recent update of its Malaria Microscopy Quality Assurance Manual now highlights OTSS as a best practice for building and maintaining QA at scale. Nearly all PMI focus countries are currently scaling up QA systems in case management, with six countries having achieved national scale in FY 2015 (see Figure 10). Examples of FY 2015 country activities include:

- In **Mozambique**, where scale-up of diagnostic QA is ongoing, 28 OTSS laboratory supervisors were trained in RDT use and in supervision, which included visits to health facilities to gain experience supervising health workers. These supervisors then went on to conduct on-site RDT refresher training for 1,149 health workers across 37 districts in 2 provinces. In addition, 3 rounds of clinical OTSS visits were conducted to reinforce health worker adherence to test results, the last of which found that 100 percent of facilities prescribed ACTs for observed patients with positive test results, and 84

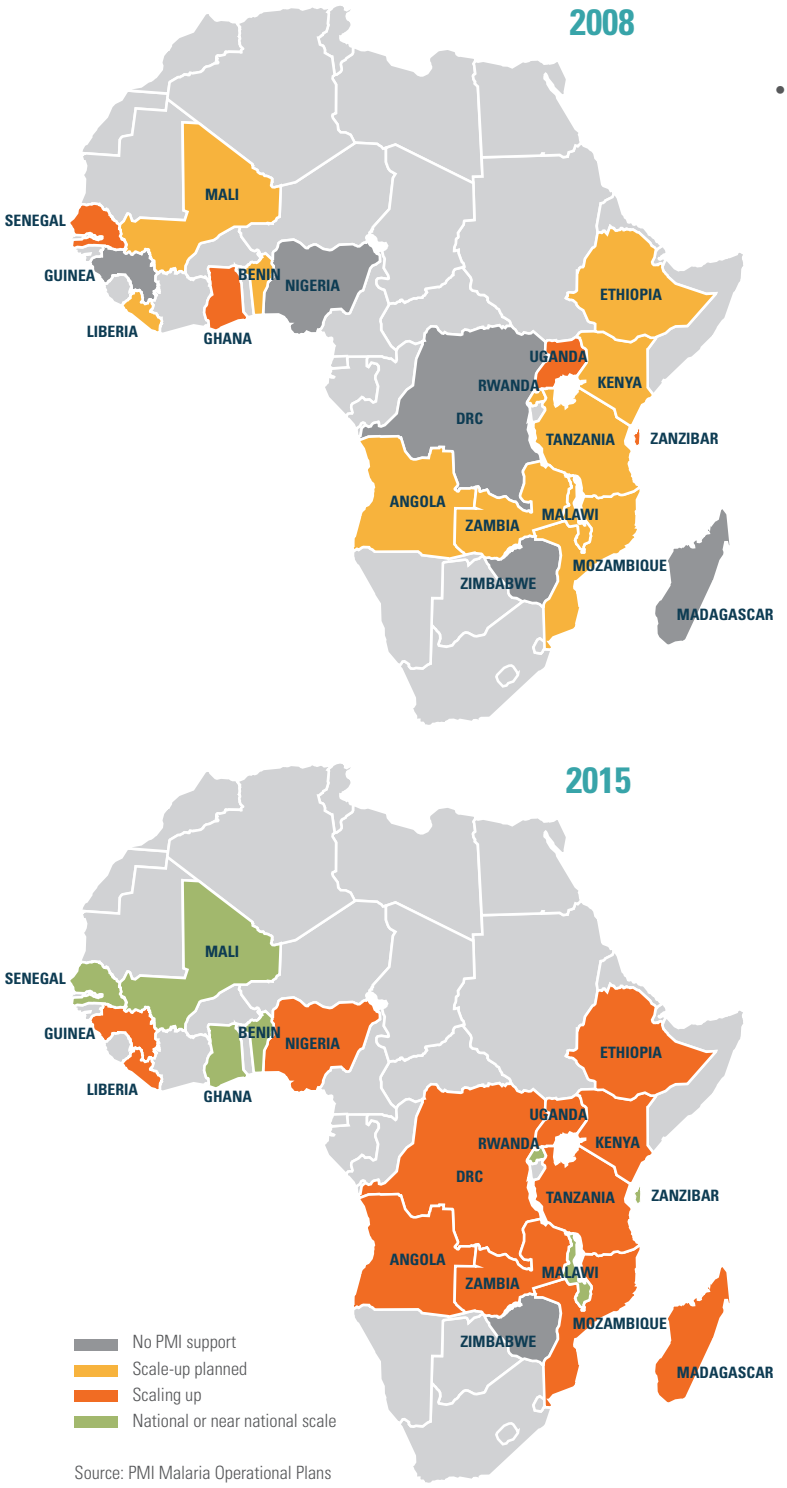

Todd Shapera/Photoshare

Community health workers extend access to care in Rwanda

In Rwanda, the comprehensive iCCM package includes treatment of malaria, pneumonia, diarrhea, plus coun seling on nutrition, family planning, and improved hygiene practices. Trained community health workers (CHWs) are responsible for performing RDTs to diag nose malaria and providing ACTs to confirmed cases at the community level. Currently, approximately 30,000 CHWs implement the iCCM package throughout the country s 30 districts, 7 of which receive support from PMI. In 2015, CHWs were responsible for managing 60 percent of all malaria cases in Rwanda.

In FY 2015, PMI supported the training of 5,314 CHWs on the use of RDTs and malaria case management (most of the CHWs were trained in previous years by PMI and other partners). These trained CHWs have played an important role in ensuring completeness of malaria reporting in the country by implementing an iCCM report that is incorporated into the national health management information system (HMIS). CHWs report case management data on a monthly basis through the community health worker report ing system (SIS COM). Both SIS COM and HMIS are managed at the national level by the MOH s Planning, Monitoring and Evaluation Unit and use the District Health Information System-2 (DHIS-2) platform, which has been adopted as the software platform for HMIS systems in almost all PMI focus countries. The data entry for HMIS and SIS COM is done at the health facility level, and data can be viewed at all levels of the system. Since the two systems function independently within the DHIS-2 platform, data can be aggregated or disaggregated as needed.

Figure 10. Scale-up of Quality Assurance: Diagnostics Supervision in PMI Focus Countries



Source: PMI Malaria Operational Plans

percent of facilities did not provide ACT prescriptions for patients with negative test results. This high level of adherence to test results is notable given the challenge globally of discouraging providers from prescribing ACTs when not indicated.

- In **Nigeria**, PMI supported the roll-out of the QA system for malaria microscopy diagnosis in seven states with training of technicians, tool deployment, health facility supervisory visits, and review meetings. The program is just starting to scale up, and more than 100 laboratory scientists at secondary health facilities have been trained on laboratory supervision and QA of malaria diagnosis. The trained laboratory scientists constitute the core of the QA system in the states and in FY 2015, conducted 420 quarterly supervisory visits to 100 health facilities.

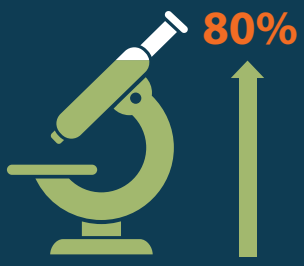
In PMI focus countries, ITN use in children under five has increased from a baseline of 18 percent to 54 percent in the most recent survey

ITN use by children has tripled

In FY 2015, PMI-supported IRS protected more than 16 million residents in 13 countries

Coverage of pregnant women with at least two doses of IPTp has increased from a baseline of 14 percent to 38 percent in the most recent survey

IPTp2 coverage with SP has more than doubled



The proportion of suspected malaria cases that are confirmed with laboratory tests continues to increase. By 2015, an additional five countries had exceeded 80 percent

3 Adapting to Changing Epidemiology and Incorporating New Tools

As countries' success in malaria control leads to changes in epidemiology and local strategies and targets evolve in response, PMI will increasingly need to adapt and tailor its approaches and support. This will include testing and scaling up new methods to access the hardest to reach and highest risk populations. … Adapting to the changing epidemiology of malaria also means recognizing that the effectiveness of current malaria tools may change. … New treatments and vector control tools, and possibly vaccines, are anticipated during this next phase.

– President s Malaria Initiative Strategy 2015–2020

Lina Kharn/Photoshare

ADAPTING TO CHANGING MALARIA EPIDEMIOLOGY

THE scale-up of malaria control interventions has resulted in reductions in not only malaria mortality, but also malaria morbidity in a number of PMI focus countries. A subset of these countries is now developing plans to eliminate malaria nationally or sub-nationally. In other countries, high level coverage with multiple interventions has resulted in wide geographic variability in malaria burden. This changing epidemiology has led some countries to adopt a targeted approach to malaria control with strategies that are rolled out at the subnational level only or that only apply to specific population groups. This approach allows for programmatic efficiencies ensuring that resources are appropriately aligned to the need for malaria control across and within PMI focus countries. Examples of these PMI-supported targeted interventions include the following:

Focal indoor residual spraying

There are two ways to target coverage when implementing indoor residual spraying: blanket spraying and focal spraying. With blanket spraying, all houses within a targeted area (e.g., entire districts or regions) are sprayed. Focal spraying involves spraying selected, discrete geographic areas within an area targeted for IRS and relies on precise environmental, epidemiological, and entomological information on households within an area. The goal of focal IRS is to cover epidemiological "hotspots," which experience regular increases in confirmed malaria cases or transmission activity in comparison to surrounding areas. A major advantage of this approach is that it concentrates spraying in the highest risk areas, thereby allowing efficient use of limited resources. As national programs achieve greater gains in improving routine epidemiological and entomological data collection, thus improving the granularity of their surveillance data, they may begin to use those data to shift from blanket to focal spraying.

During FY 2015, PMI supported focal spraying in **Ethiopia, Rwanda, Senegal, Zambia,** and **Zimbabwe**, which covered a total of nearly 1.6 million houses and protected more than 5 million people while PMI supported IRS with the more standard approach of blanket spraying in 8 countries (see Appendix 2 for more detail).

Enhanced case finding and investigation

As countries move toward elimination, identifying and tracking every malaria case becomes more critical. Furthermore, once cases are identified, follow-up actions, including investigation of household or work contacts to identify possible additional infections are recommended during the elimination phase. PMI is supporting pilots of this approach, called reactive case detection, in areas of **Cambodia, Rwanda, Senegal**, and **Zanzibar** that are targeted for elimination. In addition, PMI is testing other strategies to reduce malaria transmission by actively identifying fever cases in the community and providing testing and treatment for malaria, as appropriate.

During FY 2015, examples of PMI-supported activities include:

- In**Senegal**, PMI collaborated with Peace Corps and the NMCP to scale up the proactive community treatment (ProACT) program, which consists of weekly visits to every household in the community to identify and test fever cases and provide treatment to those testing positive for malaria. In FY 2015, ProACT was rolled out in Kedougou District, with 43 district health staff and 135 community health volunteers trained on the model. During the transmission season, 10,141 people were tested, with 8,071 found to have malaria and provided with treatment. An evaluation has been undertaken under the leadership of the NMCP and with active participation of district, regional, and other stakeholders. One of the main findings is that access in malaria diagnostic and treatment has improved with an increased number of people being appropriately tested and treated. It was recommended that the approach be expanded to other regions; the ProAct program has been already extended throughout the entire Kolda Region.

- PMI has supported **Zanzibar's** malaria case notification system since it was instituted in 2012. Under this system, household investigations of every confirmed malaria case should ideally be conducted within 24 hours of notification from the health facility where the case was detected. The overall functioning of the notification system is robust: 63 percent of confirmed cases are reported within 24 hours of diagnosis, and 87 percent of cases result in a household investigation. This reactive case detection approach is conducted by District Malaria Surveillance Officers who visit the case household to interview and test household members as well as those in neighboring households. They provide social and behavior change communications materials on the need for early testing and adherence to treatment. They also ascertain ITN use and provide coupons for free ITNs, as needed. Of the 4,803 malaria cases reported in Zanzibar during 2015, 84 percent (n=4,031) were detected through passive surveillance at health facilities and 16 percent (n=750) through reactive case detection. Data from the case notification system are being used to map transmission foci at the village level. PMI supports aspects of the system including costs for supervision visits from the NMCP, and purchase of malaria commodities such as RDTs and long-lasting ITNs that are provided to affected households as needed.

Strengthening outbreak response

As countries successfully control ongoing transmission of malaria, they are often confronted by malaria outbreaks when environmental factors are conducive (e.g., above average rainfall), when preventive interventions are withdrawn or interrupted, or if there are large population movements or civil disturbances, such as refugee crises. In those countries, PMI has provided support to build the capacity to rapidly detect and respond to outbreaks to reduce death and stop the outbreak from spreading to other areas or populations.

During FY 2015, PMI provided support to **Uganda** during an outbreak of malaria in the north of the country. Specifically, PMI trained 8,000 village health teams and provided more than 300,000 doses of ACTs for community-level mass fever treatment. At the same time, these village health teams implemented community- and household-level social and behavior change communications activities to encourage ITN use and promote early diagnosis and treatment. PMI supported enhanced malaria case surveillance at reference health facilities in the affected region to monitor malaria trends and strengthen reporting to the central level. In addition to the enhanced surveillance, district task forces were activated to implement and coordinate the malaria epidemic response. PMI supported the response to the outbreak, which included mobilizing village health teams who: 1) conducted house-to-house visits in identified communities; 2) identified and presumptively treated uncomplicated fever cases in the community; 3) referred severe cases to health facilities; 4) provided information on ITN use; 5) followed up treated malaria cases on Days 2 and 3 post-treatment to ensure treatment compliance and net use; and 6) submitted weekly reports to the health facility. As a result of these efforts, excess mortality was prevented, and malaria death rates based on HMIS data were much lower than anticipated.

INCORPORATING NEW TOOLS

Malaria control is now at a key juncture. To achieve the long-term global vision of a world without malaria, new tools and new approaches to improve the coverage and use of those tools will be needed. PMI remains committed to supporting research on these new tools and to answering key operational research questions in cooperation with research partners around the globe, NMCPs, and other U.S. Government agencies, such as the U.S. Centers for Disease Control and Prevention (CDC), and the National Institutes of Health (NIH) (within the Department of Health and Human Services [HHS]), as well as the Department of Defense.

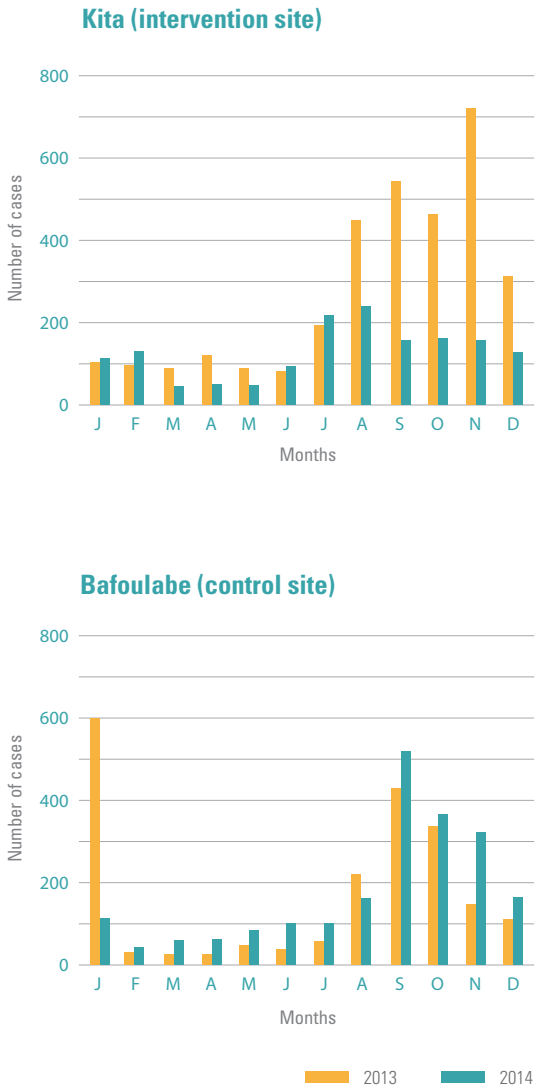
Seasonal malaria chemoprevention

Seasonal malaria chemoprevention (SMC) is a recommended approach to prevent malaria among young children in areas with highly seasonal malaria transmission. SMC involves the administration of a curative dose of antimalarial drugs (amodiaquine plus sulfadoxine-pyrimethamine [AQ+SP]) at monthly intervals to children aged 3–59 months without malaria symptoms. PMI currently supports **Mali** and **Senegal's** NMCPs to implement SMC. In both countries, PMI provides funding for key aspects of the campaigns including training and supervision of health workers, procurement of SMC drugs, and monitoring and evaluation of program implementation and impact.

- In**Senegal**, PMI has provided technical assistance for the implementation of SMC as well as procured SMC drugs for the last 3 years (FY 2013, FY 2014, and FY 2015), resulting in protection from malaria for approximately 600,000 children per year in 4 regions. Between 2013 and 2014, sentinel sites in the SMC zone reported a 50 percent decline in the number of malaria cases among children under the age of five and a 60 percent reduction among children aged 5–9 years. All malaria cases were confirmed by using either RDT or microscopy. Over the same period, two regional hospitals in the SMC zone reported a 72 percent decline in severe malaria cases and a 79 percent decline in malaria-attributed deaths among children under the age of five.

- Similarly, in **Mali**, during FY 2014 and FY 2015, PMI-procured SMC drugs protected more than 100,000 and 295,000 children, respectively. PMI conducted an operational research study to investigate the programmatic feasibility of implementing SMC. The study showed that initial enrollment in SMC was high for the first 3 rounds (84 percent of children under five years of age), but waned to 66 percent by the fourth month.[1] However,

Figure 11. Comparison of Number of Confirmed, Uncomplicated Malaria Cases in SMC Intervention and Control Sites in Mali



1 Data courtesy of Mali's National Malaria Control Program and the Malaria Research and Training Center, University of Bamako, Mali.

among enrolled children, almost 100 percent adhered to the drug regimen. The study showed that between 2013 and 2014 the intervention site (Kita) reported declines in the number of malaria cases among children under five as compared with the control area (Bafoulabe) (see Figure 11). Furthermore, there was a 65 percent decline in parasite prevalence as well as a 53 percent reduction in severe anemia in the SMC intervention site as compared to the control site. In addition to illustrating that there were fewer malaria cases in 2014 in Kita than in Bafoulabe, the figure shows the seasonal patterns of malaria in both sites. Based in part on the preliminary findings of the OR study, Mali will expand the SMC program nationwide in 2016 with additional support from the Global Fund and the Government of Mali.

Supporting operational research to improve malaria control implementation and impact

PMI complements U.S. Government agencies' investments in upstream malaria research by supporting operational research. PMI's operational research activities are focused on helping to improve program implementation and policy development, test the feasibility of new tools and implementation approaches, identify and overcome bottlenecks, and document best practices toward achieving full-scale implementation. PMI also provides support for operational research across all intervention areas to test methods to preserve intervention effectiveness in the face of insecticide and anti-malarial drug resistance or implementation challenges and to assess how to adapt to changes in malaria epidemiology. PMI provides support for operational research carried out in collaboration with NMCPs, local investigators, and institutions in partner countries, thus strengthening in-country capacity to undertake research. PMI's Strategic Guidance for Operational Research and list of priority research activities serve to facilitate the identification and prioritization of operational research questions that are a priority for PMI and consistent with the priorities of the global and national malaria research community.

In line with PMI's updated Strategy for 2015–2020, future operational research supported by PMI will continue to address bottlenecks in achieving and maintaining coverage of proven interventions while also informing malaria control efforts as malaria epidemiology changes, new risks and challenges arise, and new tools are introduced to combat them.

To date, PMI has funded 96 operational research studies and contributed to more than 100 peer-reviewed publications.[2] In FY 2015, PMI-supported operational research resulted in peer-reviewed scientific publications showing that ITNs remained effective in **Malawi** despite the presence of pyrethroid resistance, reducing malaria incidence in children by 30 percent. Another publication demonstrated that household level net hang-up visits after ITN distributions in areas with high knowledge of ITNs, such as **Uganda**, may not be necessary to achieve high net usage. Preliminary results from an SMC study in **Mali** (described earlier) also provide useful operational information, suggesting that mode (i.e., door-to-door) of delivery has more of an effect on SMC uptake than direct observation of treatment. These results will contribute to more efficient and effective roll-out of the intervention.

2 See http://pmi.gov/how-we-work/cross-cutting-technical-areas/operations-research for details

Since the Initiative began,
PMI has supported

96

operational research studies
and more than

100

peer-reviewed publications

4 Improving Countries' Capacity to Collect and Use Information

As malaria burden drops, control efforts will need to be increasingly targeted to the remaining high-risk areas and populations. Reaching those most at-risk populations can only be achieved if countries have the capacity to identify them. Information gathered through routine disease reporting and health management information systems in PMI-supported countries will become increasingly central to malaria program planning, management, and evaluation.

– President s Malaria Initiative Strategy 2015–2020

Cameron Taylor/Photoshare

THE success of malaria control efforts in PMI focus countries can in part be attributed to the high priority placed on collecting and using data to inform policies and program planning and implementation and to monitor the coverage and impact of those interventions. PMI investments in data collection have included support for national household surveys, supply chain logistics related surveys, entomological and net monitoring, antimalarial resistance monitoring, and health management information systems.

PMI provides support for national household surveys, which are conducted approximately every 3 years to monitor changes in coverage of key malaria control interventions (such as insecticide-treated mosquito net ownership and use) and to measure impact, particularly all-cause child mortality (ACCM) in children under five years of age, malaria parasitemia, and anemia. Since PMI's launch in 2005, 80 nationally representative household surveys have been conducted with PMI's support across the 19 focus countries in Africa. These surveys have provided essential information that has confirmed progress in both scaling-up coverage of key interventions and significantly reducing ACCM.

National surveys were primarily designed as a vehicle to monitor trends over time. In fact, the intermittent frequency of these surveys and their lack of sub-national focus make them less useful to NMCPs for targeting interventions to various epidemiological zones and populations and to rapidly react to changes in malaria epidemiology. PMI has, therefore, increased focused investments on improving the completeness and quality of routine health management information and disease surveillance systems to provide countries with real-time information on malaria burden that can be disaggregated to the district and eventually village, level. Such well-functioning systems will be essential for countries as they move toward malaria elimination.

In addition to monitoring disease burden, PMI investments in data collection have also included investments in building systems and human capacity for entomological monitoring for therapeutic efficacy surveillance (TES) and for monitoring the durability of ITNs. PMI has also invested in strengthening logistics management information systems (LMIS) and implementation of end-use verification surveys,

Since its launch in 2005, PMI has supported

80 nationally representative household surveys

across the 19 PMI focus countries in Africa

which enable countries to monitor availability of stocks of essential malaria commodities at the warehouse level and at the point of care (see Chapter 5 for more about TES and durability monitoring and Chapter 6 regarding LMIS).

CONDUCTING DISEASE SURVEILLANCE: ROUTINE HEALTH MANAGEMENT INFORMATION SYSTEMS

PMI investments in data collection include building in-country capacity to collect and use data from HMIS for routine decision-making at both national and sub-national levels. These efforts are a critical element to improving the capacity of malaria control programs to monitor progress and rapidly adapt their programs to better target their interventions as malaria epidemiology changes with successful scale-up of control measures. Currently, the capacity of these systems and their users varies greatly among PMI focus countries. PMI supports efforts to strengthen HMIS focused on the primary elements of the information cycle, namely: data collection, processing, analysis, presentation, interpretation, and use.

PMI is working closely with partner countries to support deployment of computerized platforms for health information systems such as the District Health Information System-2 (DHIS-2) to make data collection, management, analysis, and reporting more efficient and improve its quality. Eleven of the 19 PMI focus countries in Africa have fully scaled implementation of the DHIS-2 for their HMIS. Examples of PMI-supported activities include:

- Since FY 2011, PMI has provided support for activities aimed at strengthening **Benin's** national routine malaria information system (RMIS) using the DHIS-2 platform. During the period FY 2012 to FY 2015, the completeness of data submitted from public health facilities to the RMIS more than doubled from 38 percent to 95 percent. PMI strengthened the capacity of RMIS data managers by supporting activities such as data validation workshops, routine supervision, and development of routine data quality assessment tools. With PMI's support, the management of the RMIS has now fully transitioned to the NMCP, which oversees data reporting, quality control, validation, and publication of a quarterly malaria bulletin. In this past year, as the country shifted to a new web-based DHIS-2 platform, PMI provided hands-on technical training to health zone doctors.

- In **Ghana**, PMI has provided logistical and technical assistance for the development of the District Health Information Management System (DHIMS). Data are now reported electronically at the district level utilizing the DHIS-2 platform. Over the period 2013 to 2015, the timeliness of data submitted improved from 60 percent to 84 percent, while data completeness improved from 88 percent to 98 percent. During FY 2015, PMI supported trainings on data quality improvement for DHIMS for 400 hospital and district health information officers. In addition, 90 health information officers, at district and regional levels, were trained in data utilization, which contributed to improvements in data quality.

- In **Guinea**, PMI supported the redesign of the data collection forms used by health facilities and simplified the transmission of monthly malaria reports from the districts to the central level. The redesigned reporting form was initially rolled out in the 19 PMI-supported districts and reporting rates in these districts more than tripled from an estimated 30 percent in 2012 to an average of 96 percent in 2013. Based on this initial success, the NMCP has adopted the same process in the remaining 19 districts, which has resulted in a unified nationwide reporting process for malaria. As of October 2015, the average reporting rate was 92 percent at the national level.

- In **Nigeria**, PMI has provided logistical and technical assistance for the development of the HMIS at the federal level, as well as in the 11 PMI-supported states. Data collection tools, especially the malaria indicators, were standardized and harmonized and reported electronically at the local government authority level within the DHIS-2 platform. As a result, routine malaria data are more accurate and reliable from the health facility level to the local government authority and state levels, and data are analyzed and used for planning and decision-making. Over the period 2012–2015, monthly reporting rates have increased 3-fold from 19 to 62 percent at the national level, and, in the 11 PMI-supported states, reporting rates improved from 13 percent to 78 percent. Furthermore, during FY 2015, PMI supported training on data utilization for 1,524 health information officers in the 11 PMI-supported states.

MONITORING MALARIA CONTROL INTERVENTIONS

Entomological monitoring

PMI's investments have resulted in a substantial improvement in country capacity to implement entomological monitoring. All 19 PMI focus countries in Africa currently conduct regular entomological monitoring with PMI support. PMI supports a total of approximately 130 entomological monitoring sites, which measure mosquito

Jordan Burns/PMI

Improving the quality of malaria data in Angola

Located in the central highlands of Angola, Huambo Province has a population of approximately 1.9 million people. PMI has been working in partnership with the provincial health department since 2007 to reduce the burden of malaria, supporting staff to improve the quality of malaria data that are reported monthly at health facilities.

Starting in 2013, PMI supported training for 790 health workers and 122 municipal supervisors and data clerks on the principles of Good Data Management. Furthermore, PMI has facilitated 900 technical support supervision visits to all health facilities and 104 visits to all municipal malaria departments. During these su pervision visits, PMI-supported partners and provincial supervisors verify the accuracy of monthly health facil ity reports against the registers that are maintained at the health facility. Calculation errors are identified and corrected, and health workers are trained on-the job on how to correctly fill in malaria reports, identify counting errors, and undertake data quality verifica tion and control. This support has resulted in substan tial improvements in data quality; the percentage of health facilities with monthly malaria reports that matched health facility patient registers increased from 76 percent in 2013 to 91 percent in 2015.

These findings are echoed by Freitas Mwangala, the Malaria Supervisor for Bailundo Municipality, who said, We are grateful for the technical and logistical support that has been provided. It has enabled us to reach distant and remote health facilities, which often face the biggest challenges related to malaria data management. In so doing, we have succeeded in ad dressing gaps in our malaria data quality, and we are now confident that our reports are much better than two years ago.

density, behavior, species mix, and sporozoite rates, and 190 insecticide resistance monitoring sites (see Chapter 5 for more details about insecticide resistance).

In order to improve the collection of entomological data in PMI focus countries in Africa, PMI convened two regional entomology trainings in **Ethiopia** and **Ghana** in FY 2015. Vector control personnel from NMCPs and/or local university staff from 13 PMI focus countries participated and gained hands-on practice with mosquito collection techniques and insecticide resistance tests. Participants also discussed the use of entomological data to guide policy.

PMI also supported capacity strengthening activities in **Burma**, including a training jointly supported by the Japan International Cooperation Agency, which trained NMCP staff on specialized laboratory testing procedures to identify, monitor, and manage insecticide resistance among malaria vector mosquitoes. In Thailand, PMI supported the NMCP to conduct entomological and epidemiological surveillance in Tak Province along the Thai-Burma border, where malaria cases are consistently reported. With PMI support, the use of strategic information such as epidemiological and entomological data will help to inform more targeted interventions.

Furthermore, PMI has supported the rollout of entomological monitoring databases using the Disease Data Management System developed by the Liverpool School of Tropical Medicine and Innovative Vector Control Consortium. These databases will enable the compilation of country entomology data to provide a comprehensive picture of the vector population in order to drive decision-making around vector control interventions, including better targeting of vector control interventions and monitoring impact. In FY 2015, PMI supported installation of this database in **Ethiopia, Ghana,** and **Mali**.

Improving health service data collection using an Electronic Data System

PMI supported the introduction of an electronic data system (EDS) for collection and analysis of data during OTSS for malaria case management in five countries (**Ghana, Malawi, Mozambique, Tanzania**, and **Zambia**). The EDS, which uses the standard DHIS-2 platform, gathers information collected during supervisory visits to health facilities using a tablet computer and auto-generates scores for immediate review and feedback by supervisors on areas for improvement. The scoring algorithm also facilitates a more efficient and effective supervision schedule by prioritizing

high-volume, lower-performing health facilities for more frequent supervisory visits than low-volume, high performing facilities that may not need to be visited as often.

The EDS also has been successfully scaled up for private providers in **Cambodia** with PMI support, where it was used for supervision and collection of surveillance data from 410 private sector clinics and pharmacies in FY 2015. With its current rollout in the public sector in Africa, this system will be crucial in assisting African countries to effectively direct resources and achieve maximum impact. In **Malawi**, the first application of EDS at national scale during FY 2015 has already resulted in a reduction in missing data and identification of areas for improvement such as observation and on-site mentoring of health workers. Analyses comparing checklist completion rates before and after EDS implementation revealed an improvement in data completeness for several key indicators such as adherence to negative test results and performance of microscopy and RDTs.

End-use Verification surveys for malaria commodities

PMI supports the end-use verification tool (EUV) in PMI focus countries to monitor the availability of malaria commodities at health facilities. Information on ACT, RDT, and ITN stocks in clinics and hospitals is collected to identify and rapidly address stock-outs and also to uncover localized weaknesses in the supply chain that require additional support. To date, PMI in collaboration with government counterparts has conducted 190 EUV surveys in a total of 16 PMI focus countries.

In **Zimbabwe**, the EUV is implemented using mobile phones equipped with software that allows a rapid, point-in-time view of the availability of commodities at a large sample of health facilities across the country's 10 provinces. Fifteen rounds of quarterly EUV surveys have been conducted since Zimbabwe became a PMI focus country in 2011. Because the data collected are immediately transmitted to a central server where they are downloaded and analyzed, critical decisions and actions can be taken immediately to address any challenges identified such as stock imbalances and availability of drugs that do not adhere to standard treatment guidelines. For example, in 2015, the EUV demonstrated that at least one ACT presentation was available in 92–100 percent of facilities surveyed, and RDTs were available at 86–97 percent of health facilities surveyed.

5 Mitigating Risk against the Current Malaria Control Gains

History tells us that our current success in malaria control can easily be reversed by failure of our existing tools. PMI will continue to support efforts to monitor and address both drug and insecticide resistance. PMI also has been a global leader in its efforts to assist countries to identify and eliminate poor quality and counterfeit malaria drugs from within their borders.

– President s Malaria Initiative Strategy 2015–2020

Brant Stewart/RTI

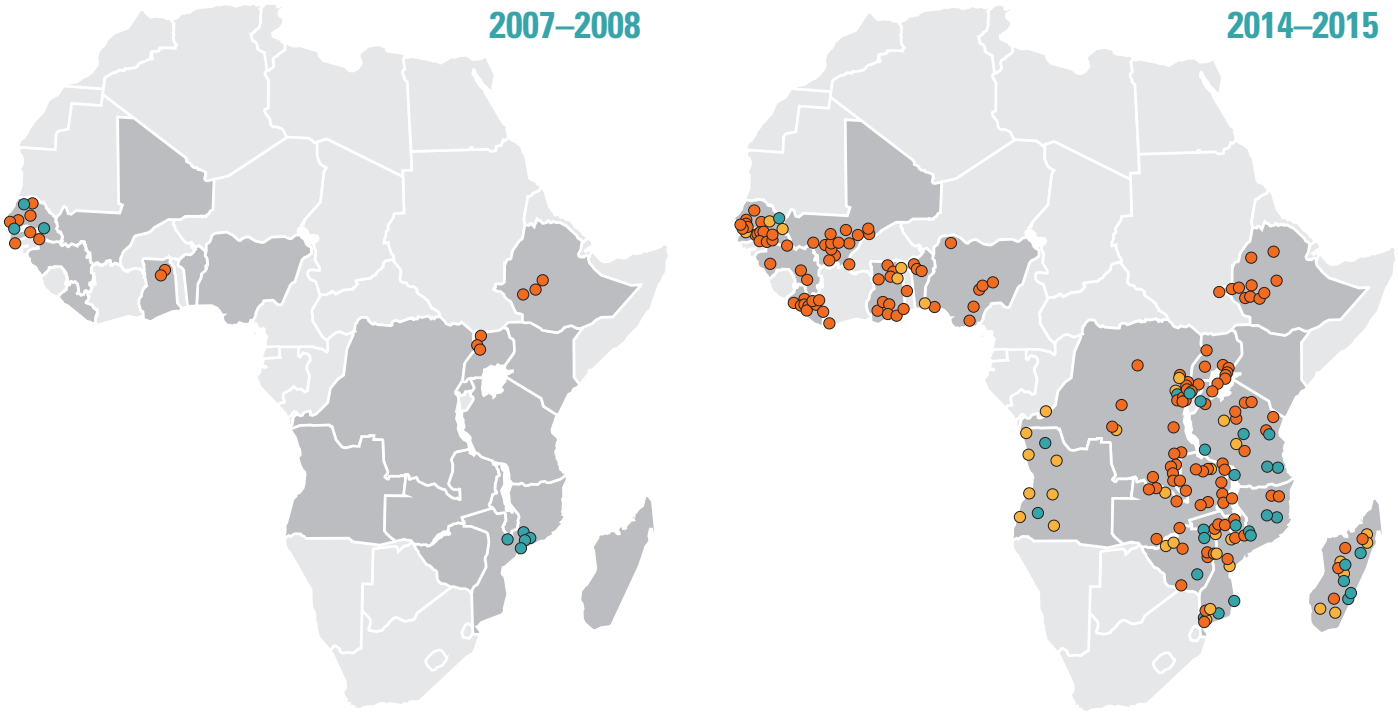
DETECTING AND RESPONDING TO INSECTICIDE RESISTANCE

TWO of the main vector control interventions supported by the President's Malaria Initiative, insecticide-treated nets and indoor residual spraying, rely on a limited number of World Health Organization (WHO) recommended insecticides from only four insecticide classes (with only one class, pyrethroids, available for use in ITNs). As countries scale up their ITN and IRS programs, increased insecticide selection pressure is placed on mosquito populations, which can accelerate the development, selection, and spread of resistance to insecticides. Therefore, it is imperative that national programs continue to conduct entomological monitoring, including testing for the presence of insecticide resistance, and develop resistance management strategies.

All PMI focus countries conduct entomological monitoring in support of ITN and/or IRS programs. Monitoring projects are designed to assess the quality of these programs, the residual efficacy of the insecticides used, and the impact of these interventions on entomological and epidemiological indicators. PMI focus countries also conduct national insecticide resistance surveillance and are expanding testing to look at the intensity of resistance as well as geographic distribution. From 2008 to 2015, the number of PMI-supported resistance monitoring sites in Africa has increased from 12 to approximately 190 (see Figure 12). As a result, vector resistance to pyrethroids has now been detected in all 19 PMI focus countries and resistance to carbamate insecticides in 16 PMI focus countries in Africa. The emergence of insecticide resistance has prompted changes in insecticides used for IRS in all PMI focus countries that have spray programs. During the past fiscal year, **Ethiopia** and **Mozambique** conducted IRS using organophosphates for the first time, while eight countries (**Benin, Ghana, Madagascar, Mali, Senegal, Tanzania, Zambia,** and **Zimbabwe**) did so for the second or more year in a row.

With respect to ITNs, even in the face of pyrethroid resistance, they still provide a physical barrier, and there is little epidemiological evidence to date that public health effectiveness of ITNs has been compromised. Nonetheless,

Figure 12. Expansion of PMI-supported Insecticide Resistance Monitoring Sites in Africa



Note: Each dot represents one insecticide resistance monitoring site.

PMI is concerned that at some point pyrethroid resistance intensity will begin to undermine the effectiveness of ITNs and so continues to monitor ITNs and plans to pilot next generation nets as they are recommended by the WHO Pesticide Evaluation Scheme.

In FY 2015, PMI in conjunction with the Global Fund to Fight AIDS, Tuberculosis and Malaria supported the first full year of insecticide resistance monitoring at 20 sentinel sites in **Ghana**. PMI is one of the main contributors to the National Insecticide Resistance Monitoring Partnership, which brings together researchers and partners within Ghana to generate and monitor resistance data from all 10 regions in the country. Preliminary results from resistance monitoring in 2015 confirmed evidence of resistance to pyrethroids and DDT and continued efficacy of the organophosphate compound, pirimiphos-methyl.

MONITORING ITN DURABILITY

The current global recommendation is to replace ITNs every 3 years. However, some studies have shown that certain ITNs may physically deteriorate more quickly under certain field conditions and that ITN longevity is strongly dependent on behavioral and environmental conditions, factors that vary significantly across malaria-affected areas worldwide.

In order to understand the effective life of ITNs and identify the causes of premature ITN deterioration, PMI launched a series of studies in 2008 to assess the physical durability and insecticide retention of various net brands in nine countries (**Angola, Benin, Kenya, Malawi, Mozambique, Nigeria, Rwanda, Senegal,** and **Zambia**). These studies demonstrated that the physical durability of nets was highly variable from country to country, with some coun-

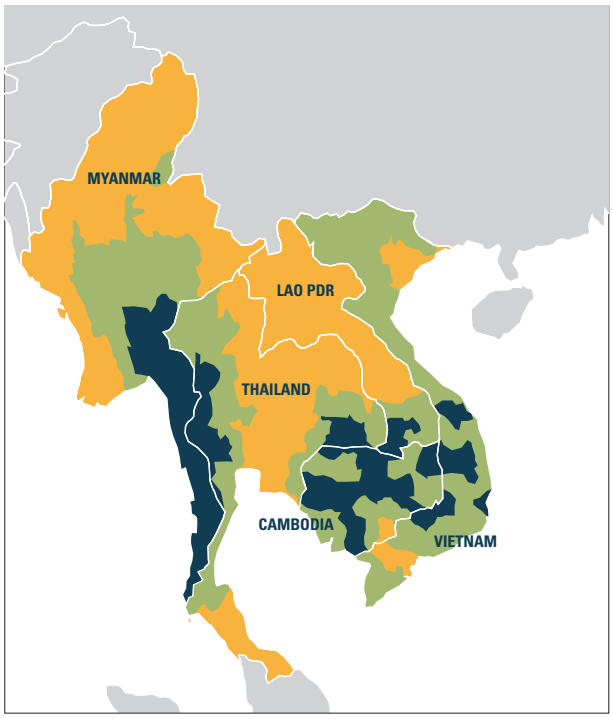
PMI supports

190
resistance monitoring sites in Africa

46
sentinel sites within a regional therapeutic efficacy surveillance network in the GMS

represents 10 sites

Figure 13. Artemisinin Resistance in the Greater Mekong Subregion



Source: World Health Organization

tries showing significant net failure (physical failure, not chemical failure) in as little as 2 years. As a result of these studies, some net manufacturers changed their production processes to make their ITNs more durable.

PMI used the lessons learned from these studies to develop a standardized methodology for monitoring ITN durability. In 2015, PMI supported a number of countries (including **Benin, Kenya, Madagascar, Mozambique**, and **Senegal**) to implement durability monitoring and began planning for implementation support in others, including **Burma, DRC, Malawi, Nigeria,** and **Zimbabwe**. Over the next few years, as countries conduct new ITN distribution campaigns, support will be provided for durability monitoring in additional PMI focus countries.

ADDRESSING ANTIMALARIAL DRUG RESISTANCE

Starting in 2006, the U.S. Agency for International Development-supported therapeutic efficacy surveillance in the **Greater Mekong Subregion** began to identify a growing number of patients who continued to have parasites in their blood the day after completing a 3-day course of artemisinin-based combination therapy. Further investigation revealed that this Day 3 positivity was an early warning sign of developing resistance to artemisinin. Although initially all patients cleared their infection, in subsequent years these TES studies began to show a growing number of treatment failures to ACTs, which, therefore, necessitated treatment with other antimalarials. These treatment failures initially occurred along the Thai-Cambodian border area and have more recently been detected in other locations in the GMS (see Figure 13). With the launch of PMI in the Greater Mekong Subregion in 2011, support for TES has continued.

In 2014, researchers at the *Institut Pasteur* in **Cambodia** identified mutations to the K-13 gene of the malaria parasite DNA that correlated with clinical evidence of artemisinin resistance. Subsequent testing of blood samples from PMI-supported TES sites has identified patients infected with K-13 mutant malaria parasites throughout the GMS, indicating that artemisinin resistance is now present throughout the region.

PMI continues to support a TES network of 46 sentinel sites in the GMS to ensure that monitoring of first-line antimalarial drugs and potential alternatives, as appropriate, are carried out every 2 years in accordance with WHO guidelines. PMI also supports regular review of these data in each country to inform national malaria treatment guidelines and sharing of these data among countries in the region.

In FY 2015, based on the results of TES and with technical assistance from PMI, **Thailand's** malaria treatment policy was changed to include dihydroartemisinin-piperaquine, which is being deployed in the seven border provinces with documented delayed parasite clearance to the existing ACT regimen. PMI also provided pivotal technical support to Cambodia's malaria control program to update their malaria treatment policy, which for the first time recommends different first-line treatments in different parts of the country. This policy was based on evidence collected from PMI-supported TES sites and other studies that showed markedly different resistance patterns in different parts of the country. Likewise, the findings from TES were used as the basis to update the national malaria treatment guideline in Burma.

Emergence of artemisinin resistance resulting in the failure of ACTs to treat malaria in Africa would be a severe threat to malaria control, potentially reversing many of the dramatic reductions in malaria morbidity and mortality achieved over the last decade. Although there is currently no evidence of artemisinin resistance outside of the GMS, carefully performed monitoring of antimalarial efficacy in sub-Saharan Africa is now even more critical to ensure that emergence of resistance to ACTs in new areas is detected early and appropriate responses are mobilized.

During 2014 and 2015, PMI also provided support for planning and/or implementation of TES in 14 PMI focus countries in Africa and all countries in the GMS.[1]

In FY 2015, the PMI **Angola** team responded to a suspected case of artemisinin resistance, first reported in 2014, by adding a TES site in the region where the suspected case of resistance had been detected. PMI supported a 3-arm, 600 participant trial, conducted in collaboration with WHO, and also supported testing of samples collected in this trial for K-13 mutations and other molecular markers associated with malaria treatment failures. Fortunately, K-13 mutants were not found in samples collected from these sites. PMI is also supporting analyses of molecular markers of drug resistance from samples collected during recent TES activities in **Guinea, Kenya, Senegal, Madagascar,** and **Mali** with PMI support.

COMBATTING FAKE AND SUBSTANDARD MEDICINES

Fake and substandard malaria medicines continue to be a global threat to effective malaria case management. These poor quality and counterfeit treatments are thought to be a contributor to the malaria deaths. As a major procurer of ACTs, PMI employs a stringent quality assurance and quality control strategy to monitor the quality of drugs procured by PMI for use in PMI focus countries. To help reduce the availability of counterfeit drugs in informal private sector outlets and marketplaces, PMI is collaborating with USAID's Office of the Inspector General and teaming up with local police, customs agents, national medicines regulatory authorities, and drug sellers to identify fake and substandard medicines and remove them from the market.

For example, PMI is working closely with USAID's Office of the Inspector General in support of the its *Make a Difference* social behavior communications change campaign to mobilize consumers and vendors of medicines to be vigilant in identifying and reporting the distribution of fake or stolen medicines. In FY 2015, PMI initiated an outreach program to work with governments to warn consumers and health providers about the dangers of fake and substandard medicines and how to protect themselves from their negative impact. PMI directly supported communications campaigns on this issue in **Benin** and worked closely with the Government of **Nigeria** to plan for a comprehensive national campaign to support the government's system to track and trace medications. With input and participation from the ministries of health of six African countries, PMI supported the development of a toolkit that will help countries to design and implement their own communication campaigns to educate the public about issues of quality for malaria medicines and change their malaria medicine purchasing and use behavior. This toolkit will be piloted in Akwa Ibom State in Nigeria during FY 2016.

In addition, PMI partners with national medicines regulatory authorities in PMI focus countries in Africa and the GMS to help strengthen local capacity to conduct market surveillance including sampling and testing of quality of drugs found in the local marketplace and strengthening national drug quality laboratories' capacities to test the quality of drug samples collected from public and private outlets. The following are highlights of PMI-supported activities from FY 2015:

- In **Ethiopia**, PMI, in collaboration with the U.S. President's Emergency Plan for AIDS Relief (PEPFAR), helped the national reference laboratory under the Ethiopian Food, Medicine and Health Care Administration and Control Authority to achieve International Organization for Standardization (ISO)-17025 accreditation (the most important standard for calibration and testing laboratories globally). This internationally recognized milestone in

1 TES was supported by other global malaria partners in Ghana and Mozambique. In Liberia, TES was delayed by the Ebola emergency.

quality assurance is a significant marker of a higher-level quality system. Compliance with this ISO standard is a measurable indicator in overall health system strengthening and indicates capacity to carry out drug quality testing among other capacities.

- With a very active local pharmaceutical manufacturing market, PMI has helped the Food and Drugs Authority in **Ghana** strengthen their post-marketing drug quality surveillance activities. Over time, the ability of the Ghanaian Food and Drugs Authority to implement a robust and thorough program has enabled the detection of both substandard and counterfeited antimalarial medicines. This has led to product recall, seizures, and enforcement actions by the Ghanaian Food and Drugs Authority in collaboration with local law agencies. Specifically, failed batches were recalled, and legal action was taken against the distributors of any unregistered products found in the market.

- PMI supported the **Nigeria** Central Drug Quality Laboratory of the National Drug Regulatory Agency to acquire ISO-17025 accreditation. In FY 2015, the **Nigeria** Drug Authority sampled and tested more than 800 antimalarial medicines collected from around the country and reported 3.6 percent of products among the sampled drugs had failed. In response, a review was conducted of the existing systems already in place by the National Agency for Food and Drug Administration and Control's Pharmacovigilance/Post Marketing Surveillance Directorate to address counterfeit or substandard medicines from the market, and the Agency worked with PMI implementing partners to undertake recommended interventions to strengthen these systems.

Furthermore, PMI is collaborating with the Global Fund and other partners to replace poor quality malaria treatments with quality-assured ACTs in private sector markets in targeted countries. Starting in 2003, **Cambodia** initiated a "public-private mix" program with support from the Global Fund that provided participating private sector outlets including clinics, pharmacies, and drug shops with quality-assured ACTs and RDTs. Participating private providers also were trained on correct diagnosis and treatment of malaria and provided with registers and job aids. Currently, more than 376 private providers participate in this program. In 2015, PMI added strategic support to ongoing Global Fund support to institute routine supervision of participating private providers to monitor and improve the quality of these malaria case management services and to implement an electronic malaria case reporting system. Preliminary data from the first year of implementation of PMI-supported activities show that the percentage of private providers that achieved a Class A rating (indicating the highest quality) increased from 33 percent to 51 percent. In addition, 99.6 percent of patients receiving care in targeted facilities who tested positive for malaria were correctly prescribed quality-assured ACTs for treatment of malaria.

Ana Paula/Abilio National Institute of Health

6 Building Capacity and Health Systems

A guiding principle of PMI, from its outset, has been to build capacity to enable countries to implement their own programs rather than building parallel or stand-alone systems. A significant portion of PMI's support to countries is focused on building human capacity, including engaging communities to participate in malaria control, and addressing gaps in country health systems in the key areas of supply chain management, training and supervision of health workers, and monitoring and disease surveillance systems.

– President s Malaria Initiative Strategy 2015–2020

Brant Stewart/RTI

SINCE its inception a decade ago, the President's Malaria Initiative has recognized that the long-term sustainability of malaria control and elimination depends on the strength of endemic countries' own health systems and their human capacity. Therefore, PMI is committed to strengthening health systems in focus countries, with emphasis on:

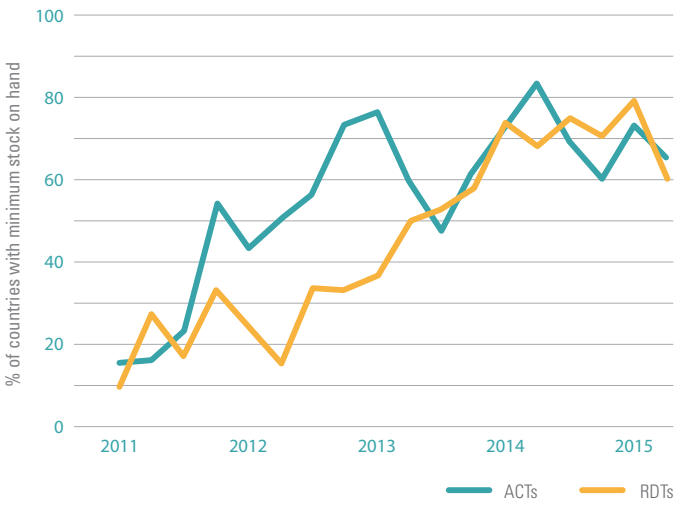
- Building capacity of health workers
- Strengthening pharmaceutical and supply chain management systems
- Building infrastructure and technical capacity for routine monitoring and evaluation and laboratory systems (see Chapters 2 and 4)
- Supporting health system financing efforts
- Strengthening management and leadership skills of national malaria control programs

PMI recognizes the need for strong capacity at all levels of the malaria control program from the national to district levels. PMI will continue to build capacity of ministries of health and national malaria control programs to provide service delivery training and supervision, to expand the availability and quality of laboratory services, to improve commodity forecasting and supply chain management, and to collect and use quality malaria data.

BUILDING CAPACITY OF HEALTHCARE WORKERS

PMI has made substantial investments in building the capacity of healthcare workers at the facility and community levels. In FY 2015, PMI supported training of more than 77,000 health workers in malaria case management and more than 54,000 clinicians and laboratory technicians in procedures for quality diagnostic testing for malaria. Furthermore, PMI supports integrated training of healthcare workers on the implementation of focused antenatal care services, including prevention of malaria in pregnancy using IPTp with SP. In FY 2015, more than 31,000 healthcare workers were trained in IPTp delivery with PMI support. Examples of FY 2015 capacity building activities supported by PMI include:

Figure 14. Availability of Malaria Commodities (ACTs and RDTs) at Central Medical Stores in PMI Focus Countries



Note: The PMI focus countries included in this figure have at least two data points from nationwide household surveys that measured IPTp 2 coverage for pregnant women, defined as the percentage of women who received at least two doses of SP during their last pregnancy, with at least one dose given during an antenatal clinic visit. IPTp is not part of the national policy in Ethiopia and Rwanda.

- PMI continued to support **Benin's** NMCP to increase capacity and improve the performance of health facility laboratories and technicians by evaluating performance at 118 facilities across all 34 heath zones and providing targeted re-training in diagnostic and supervisory skills to maintain high quality standards. PMI provided training updates for staff from 30 laboratories in the standard operating procedures on malaria diagnosis, evaluated microscopes in 124 health facilities, and strengthened the skills of 37 laboratory supervisors. Supervisory visits conducted in the past year show that, at the time of the visit, 92 percent of health facilities had diagnostics commodities in stock, and 97 percent had a functional microscope. At the community level, PMI supported training for 1,000 community health workers in rapid diagnostic test use and supported CHWs in northern Benin to test 34,254 children with fever, of whom 29,405 tested positive and were treated with artemisinin-based combination therapies.

- In **Ghana**, to support the NMCP's plans to maintain adherence to the updated 2015 WHO care and treatment guidelines and to continually improve health workers' malaria skills, PMI supported case management training in all facilities in all 10 regions, training a total of 13,151 health workers (2,766 at the health facility level and 10,385 community level). In order to help improve case management among over-the-counter chemical sellers (OTCMS), a PMI-funded project trained 9,834 OTCMS on appropriate dispensing of malaria drugs. These activities are important in Ghana, where more than 25 percent of children with fever receive care at private pharmacies and OTCMS.

STRENGTHENING PHARMACEUTICAL AND SUPPLY CHAIN MANAGEMENT SYSTEMS

All malaria control interventions are dependent on the availability of key commodities. It is for this reason that PMI invests approximately 40 percent of its overall budget on the procurement of these essential products. Having a predictable supply of essential drugs, diagnostics, insecticide-treated nets, insecticides, and other supplies also requires supply chain systems that deliver those commodities to where they are needed. Thus, PMI has provided significant support to strengthen those systems to:

- Select appropriate drugs and commodities
- Quantify drug and commodity requirements
- Ensure quality of drugs and other commodities

- Develop and implement logistics management information systems
- Strengthen stock management systems
- Build health worker capacity in logistics management

Improved country capacity to track commodities has led to better stock management and forecasting, resulting in more reliable stock levels at central warehouses and at health facilities. Between 2011 and 2015, the percent of PMI focus countries with adequate stocks of ACTs and RDTs increased from 15 percent for ACTs and 10 percent for RDTs to more than 65 percent and 60 percent, respectively (see Figure 14).

- In **Ethiopia**, the malaria supply chain has suffered from a lack of investment, infrastructure, supply chain expertise, as well as poor visibility on system performance. To help remedy this situation, PMI has been supporting integration of malaria commodities into the Integrated Pharmaceutical Logistics System, which currently distributes HIV, family planning, and tuberculosis products. In FY 2015, project staff conducted 2,786 supportive supervision visits to more than 800 hospitals, health centers and health posts. During each visit, project staff collected data on availability of malaria products and provided technical support (resupply, redistribution, and emergency ordering) to address problems identified. Data from the three most recent end-use verification surveys during FY 2015 demonstrate improvements in stock availability of RDTs and chloroquine (for treatment of *P. vivax*), with RDT stockouts lasting for 3 days or longer during the previous 3 months falling from 62 percent to 0 over a 6-month period.
- In **Nigeria**, PMI collaborated with other program areas to build the capacity of government officials in the 11 focus states to enable these staff to lead the states' Logistic Management Coordination Units. These units are comprised of state government workers and representatives from donors and implementing partners. The units manage quantification, logistic data collection, and analysis for health commodities in each state and provide a platform for PMI and state governments to streamline commodity distribution and leverage available resources within focus states. This unit succeeded in helping the malaria program to obtain bi-monthly stock status reports from focus states. These reports help to track performance of the logistic delivery system and reduce response time to stockouts.


Center for Communication Programs/Courtesy of Photoshare

Building and maintaining capacity for malaria treatment in the context of Ebola in Guinea

The west Africa Ebola-virus-disease epidemic disrupted the entire healthcare system in affected countries. Because of the overlap of symptoms of Ebola and malaria, the delivery of malaria care was particularly vulnerable to the indirect effects of the Ebola epidemic. A December 2014 survey of public health facilities in Guinea found that untreated and inappropriately treated malaria cases led to excess malaria mortality and more fever cases in the community, impeding the Ebola response.[1]

Within this challenging context, PMI worked to ensure malaria case management activities continued as health systems were stretched in their response efforts. In Guinea, PMI supported the training of more than 1,000 healthcare workers in public and private health centers and hospitals on revised case management protocols, including assessing fever cases for Ebola risk factors and referring cases if malaria treatment did not result in improvement; infection prevention and waste management protocols; and correct use of data collection tools for reporting information on caseloads and commodity stock levels. The new protocols for malaria prevention and management were incorporated into institutional curricula and teaching modules used at universities and medical and pharmacy colleges including departments of parasitology, infectious diseases, obstetrics and gynecology, pediatrics, and public health. To increase access to care, PMI also supported malaria case management training of 2 new community health workers per health center in 14 districts, including resumption of RDT use, pre-referral treatment, referral of severe cases to treatment centers, and treatment of malaria in pregnancy. A total of 256 new community health workers were trained and equipped in the targeted districts.

1 Plucinski MM, Guilavogui T, Sidikiba S, Diakité N, Diakité S, Dioubaté M, Bah I, Hennessee I, Butts JK, Halsey ES, McElroy PD, Kachur SP,Aboulhab J James R, Keita M. Effect of the Ebola-Virus-Disease Epidemic on Malaria Case Management in Guinea, 2014: a Cross-sectional Survey of Health Facilities. *The Lancet*. September 2015.

In FY 2015, PMI supported training for more than

77,000 health workers in malaria case management

54,000 health workers in procedures for diagnostic testing for malaria

31,000 health workers in IPTp

36,000 people in IRS implementation

represents 10,000 people

- PMI has been providing support to the Pharmaceutical Services Unit and the Medical Stores Department in Mainland **Tanzania** and Zanzibar to establish the electronic logistics management information system. The Mainland system was rolled out in FY 2014 and the Zanzibar system in FY 2015. The electronic system has enabled Tanzania to transition from a paper-based system to an automated one, allowing for more timely access to order information and stock status across the levels of the health system. Mainland reporting rates to this electronic system exceeded 90 percent in 2015.

SUPPORTING HEALTH SYSTEM FINANCING EFFORTS

Health financing is one of the six WHO health systems strengthening building blocks. PMI supports health financing activities, including contributing to implementation of health insurance schemes, health policy reform efforts, and performance-based financing approaches when linked to malaria outcomes. Examples of FY 2015 activities are:

- PMI continued to provide support for the scale-up of the primary healthcare capitated package of services administered by **Ghana's** National Health Insurance Scheme to expand access and utilization of health services nationwide, including malaria services. An effective and well-functioning national health insurance program with appropriate reimbursement incentives remains critical to continued progress in reducing malaria-related mortality in Ghana. In FY 2015, efforts focused on improving efficiencies in the policies, clinical monitoring, and reimbursement systems that support provision of appropriate malaria case management services through facility insurance reimbursement linked to adherence to malaria treatment guidelines. This included support for clinical audits of provider adherence to malaria treatment protocols.

- PMI provided support for **Tanzania's** government-led results based financing activity, including technical input into selection of performance indicators and development of quality monitoring tools. Support aims to incentivize improvements in quality provision of malaria services including adherence to standard intermittent preventive treatment for pregnant women and case management treatment guidelines as well as increasing availability of stable supplies of malaria commodities. PMI support is provided for performance payments to health facilities for provision of high quality malaria services and to those entities involved in supply chain for on-time provision of key malaria commodities. A quality checklist is utilized quarterly to evaluate the final incentive paid to each facility based on demonstration of performance improvements across a set of quantitative and qualitative indicators including key malaria performance indicators. Seventy-five percent of the incentive paid is used for facility level improvements, and 25 percent is distributed among employees.

STRENGTHENING MANAGEMENT AND LEADERSHIP SKILLS OF NATIONAL MALARIA CONTROL PROGRAMS

Successful country-owned and country-led malaria control programs are only possible when country programs possess appropriately skilled human resources and the necessary infrastructure to plan, implement, and monitor progress of their malaria control activities. Thus, country ownership is at the core of PMI's strategic and implementation approach. PMI carries out annual planning visits with NMCPs and their partners to collaboratively develop annual PMI Malaria Operational Plans that directly support national malaria control strategies and priorities.

Furthermore, through support to the U.S. Centers for Disease Control and Prevention's Field Epidemiology and Laboratory Training Program, PMI helps build a cadre of ministry of health staff with technical skills in the collection, analysis, and interpretation of data for decision-making, policy formulation, and epidemiologic investigations in 11 PMI focus countries in Africa (**Angola, DRC, Ethiopia, Ghana, Kenya, Mozambique, Nigeria, Rwanda, Tanzania, Uganda,** and **Zambia**) and one PMI program in the **Greater Mekong Subregion (Burma)**, supporting more than 100 trainees globally to date.

7 Global and U.S. Government Partnerships for Ensuring Success

PMI supports coordination at global level of key partners – including multilateral and bilateral institutions, affected countries, nonprofit and faith-based organizations, private sector partners, and academia and research institutions – through the RBM Partnership and other working groups and task forces to share lessons learned and best practices and ensure that investments are complementary.

– President s Malaria Initiative Strategy 2015–2020

Ademola Olaniran

THE President's Malaria Initiative relies on strong partnerships at the country, regional, and international levels to support national malaria control programs to expand the impact of malaria control activities. PMI works closely with the government of each focus country and with a variety of local and international partners to ensure that investments are strategically aligned with the country's overall malaria control plan, while leveraging financial and technical support from other partners. Some of PMI's most important partners in this effort include:

- Multilateral and bilateral organizations
- Other U.S. Government agencies and initiatives
- Private sector partners
- Foundations
- Community-based organizations
- Global and regional malaria coordinating bodies

MULTILATERAL AND BILATERAL COLLABORATION

Global Fund to Fight AIDS, Tuberculosis and Malaria: PMI works closely with the Global Fund at the country and global level to coordinate investments for malaria control to maximize impact. The U.S. Government is the Global Fund's largest financial contributor, and PMI is represented on the U.S. delegation to the Global Fund Board. PMI and Global Fund technical and management staff meet regularly to ensure coordinated technical approaches and policies. PMI focus countries have received substantial malaria financing from the Global Fund, and this source of funding will remain critical for most countries going forward. Because the Global Fund is a financing mechanism with no country-based technical personnel, PMI field teams help facilitate communication among key stakeholders, alert Global Fund staff on critical developments, and assist with reviewing and reporting progress. The PMI team works with national malaria control programs to facilitate implementation of Global Fund malaria grants and often provides technical assistance for the Global Fund-supported malaria implementation efforts. Under the new funding model, PMI staff participated actively in the country dialogue and development of the country concept notes, and PMI staff are represented on the Global Fund Grant Technical Review Panel and the Grant Approvals Committee. PMI, along with other partners, works closely with the Roll Back Malaria Partnership Harmo-

AIM & GTS: PMI works with partners to develop global strategies

During 2015, PMI contributed to the development and launch of two key documents, participating in consultative meetings and providing technical review. Roll Back Malaria Partnership's *Action and Investment to defeat Malaria 2016–2030 (AIM) – for a Malaria-Free World* expands on the successful strategies presented in the WHO's first *Global Malaria Action Plan* and serves as a call for collective action to all partners engaged in the fight against malaria. The *Global Technical Strategy for Malaria 2016–2030* was adopted by the World Health Assembly in May 2015. It was developed in close alignment with the AIM document to ensure shared goals and complementarity. Both documents share the 2016–2030 timeline of the Sustainable Development Goals and provide direction toward 2030 malaria goals and targets. The U.S. Government shares the long-term vision of a world without malaria shared by both the AIM and the Global Technical Strategy, as reflected in the PMI Strategy 2015–2020.

nization Working Group and partner country NMCPs to coordinate and address bottlenecks to Global Fund malaria grant implementation across all malaria endemic countries, contributing to provision of malaria support well beyond PMI supported countries.

Roll Back Malaria Partnership: PMI is an active member of the RBM Partnership, providing financial and technical support for numerous RBM activities, serving on the Partnership's Board of Directors and participating in many of its technical and coordination working groups, including the Harmonization Working Group, the Malaria Advocacy Working Group, the Malaria in Pregnancy Working Group, the Monitoring and Evaluation Reference Group, and the Vector Control Working Group. These working groups serve as important fora to convene diverse malaria partners from across the globe to promote best practices, disseminate lessons learned, discuss key programmatic challenges, and devise shared solutions.

PMI has supported RBM in developing a number of consensus statements. Most recently, PMI supported development of the RBM Vector Control Working Group and Malaria in Pregnancy Working Group *Consensus Statement Not to Reallocate ITNs from ANC to Mass Distribution*, the Malaria in Pregnancy Working Group *Consensus Statement on Folic Acid Supplementation During Pregnancy*, and a *Technical Brief on Controlling Maternal Anemia and Malaria Ensuring Pregnant Women Receive Effective Interventions to Prevent Malaria and Anemia: What Program Managers and Policymakers Should Know*.

In 2015, the RBM Board initiated a process to re-evaluate and reorganize the RBM Partnership to better meet the challenges of malaria elimination as outlined in the AIM plan. The U.S. Global Malaria Coordinator, Admiral Tim Ziemer, was asked by the Board to co-lead this process, along with the Zimbabwean Minister of Health, his Excellency Dr. David Parirenyatwa, and a new RBM Board and governance structure was established in the first quarter of 2016.

Alliance for Malaria Prevention: PMI is an active member of the Alliance for Malaria Prevention (AMP) Partnership and financially supports AMP to provide expert in-country and distance technical assistance to help countries successfully plan and execute complex ITN distribution campaigns. PMI also participates on AMP's internal working groups to address important issues related to distributing ITNs, including operational research, monitoring and evaluation, emerging issues, and country support. In 2015, U.S. Government

financial support catalyzed AMP assistance to 17 countries through 29 in-country missions and distance support, which contributed to ensuring that more than 41.5 million nets were successfully distributed to the targeted recipients.

World Health Organization: PMI provides targeted financial support to WHO headquarters in Geneva as well as to WHO regional offices in Africa, South East Asia, and the Americas. At the central level, PMI provides financing to the WHO Global Malaria Program to support defined activities that will help PMI focus countries achieve their objectives including activities related to vector control, malaria diagnosis policy development, antimalarial drug resistance surveillance, and monitoring and evaluation.

Furthermore, during 2015, PMI supported the secondment of a U.S. Centers for Disease Control and Prevention subject matter expert to the WHO Global Malaria Program with a focus on surveillance and monitoring and evaluation. In addition to financial support to WHO, PMI staff play key roles on multiple WHO groups and committees:

- ***Vector Control:*** PMI staff provide technical input on targeting interventions and insecticide resistance monitoring. In addition, PMI contributes insecticide resistance data into global databases, and to the World Malaria Report. This ongoing engagement ensures that PMI-funded research and ongoing monitoring and evaluation of field activities continue to inform global and national malaria prevention policies and ensures that state-of-the-art practices have the full endorsement and backing of the global community. Furthermore, PMI has also played an active role in a multi-stakeholder effort to streamline development, evaluation, and procurement of new vector control technologies, such as durable wall liners and new classes of insecticides.

- ***Supply Chain and Quality Assurance:*** PMI continued to work with Foundation for Innovative New Diagnostics (FIND) to ensure quality control of PMI-procured rapid diagnostic tests. PMI relies on FIND to provide pre-shipment lot testing for all PMI-financed RDTs. This helps ensure only good quality products are sourced and distributed. In addition, FIND serves as a source of technical information and advice that together with WHO-GMP, helps inform PMI's ongoing diagnostic policy and technical discussions.

- ***Case Management:*** PMI has continued to provide leadership in case management at the global level in areas ranging from advocacy for harmonization of RDT formats, to simplifying health worker training to providing evidence for the importance of supportive supervision for quality assurance of diagnostic testing. Recent PMI staff contributions to global documents include the 2014 WHO policy brief on malaria diagnostics in low transmission settings, the 2014 *Malaria Journal* article, "Harmonization of malaria rapid diagnostic tests: best practices in labelling, including instructions for use," and the 2016 WHO Malaria Microscopy Quality Assurance Manual.

United Nations Children's Fund (UNICEF): PMI works closely with UNICEF on key child health initiatives:

- ***Integrated Community Case Management:*** PMI coordinates closely with UNICEF at the global level, through the iCCM Task Force, to promote best practices for iCCM. This includes key support for the Task Force Secretariat. UNICEF, PMI, and the WHO continue to support the expansion of iCCM in many PMI focus countries including **Democratic Republic of Congo, Malawi, Mozambique**, and **Nigeria**. Additionally, PMI and UNICEF jointly support iCCM in five high priority health zones in **Benin**. PMI works closely with UNICEF to support integrated community health interventions through more than 500 health huts in **Senegal** and coordinates with UNICEF on joint training for case management in **Nigeria**. Furthermore, in **Guinea**, PMI and UNICEF trained 17 national trainers and providing hygiene kits to 68 trained CHWs performing malaria prevention and case management activities to re-enforce Ebola infection prevention (see Chapter 2 for more about iCCM).

- ***Seasonal Malaria Chemoprevention:*** Since 2012, PMI has provided support for SMC in **Senegal**, in line with WHO's recommendation to support SMC in the West African Sahel. UNICEF supports SMC implementation in one region, while PMI supports similar operations in the remaining three regions. When the suppliers of AQ+S, the drugs used for SMC, were not able to meet demand, PMI coordinated with UNICEF, WHO, other global partners, and the supplier of these medicines to address the bottlenecks in the manufacturing process and ensure that there were sufficient treatments to enable implementation. In **Mali**, PMI continues to work closely with the Government of Mali, UNICEF, *Médecins Sans Frontières*, World Vision, as well as other national non-governmental organizations to train and supervise health workers and distribute SMC drugs (see Chapter 3 for more about SMC).

UNITAID: PMI collaborates with global malaria partners to work with countries to access UNITAID-funded initiatives. FY 2015 efforts include:

- ***Case management:*** PMI worked with the UNITAID-funded Medicines for Malaria Venture-led (MMV) initiative to strengthen global coordination around pre-referral and definitive treatment of severe malaria in children. In collaboration with UNICEF and MSF, PMI and MMV planned a February 2016 stakeholders meeting on improving outcomes of severe malaria by increasing access to pre-referral treatment, which included participants from seven malaria-endemic countries, WHO, the Global Fund, and other partners.

- ***IRS:*** In an effort to mitigate insecticide resistance, PMI is partnering with the Innovative Vector Control Consortium, the Global Fund, Abt Associates, and the Gates Foundation funded PATH Malaria Control and Elimination Partnership in Africa on the UNITAID-funded Next Generation Indoor Residual Spraying Project. The overall aim of the project is to accelerate and expand access to and adoption of new, long-lasting, non-pyrethroid insecticide formulations that address the broad emergence of insecticide resistance at lower cost due to market shaping efforts.

United Kingdom Department for International Development: PMI and DFID continue to collaborate for enhanced impact and coverage, partnering to jointly support NMCP malaria priorities. Partnership has taken the form of DFID channeling funds to PMI, for PMI to carry out procurement of commodities on their behalf or to allow for implementation by a single partner in select countries. In FY 2015, with funds transferred to PMI by DFID, PMI procured 2 million RDTs and an assortment of essential medicines for **Zambia**. Also during FY 2015, PMI procured 388,400 ITNs with DFID funds in **Uganda**. In addition, PMI expanded IRS coverage in Zambia and Uganda in partnership with DFID (see Chapter 2 for details).

COORDINATING PROCUREMENT AND DISTRIBUTION WITH OTHER DONORS

In six PMI focus countries (**Cambodia, Guinea, Malawi, Mali, Nigeria**, and **Tanzania**) during FY 2015, PMI assisted with the distribution of 6.9 million ITNs and 1.2 million ACTs that were procured by other donors or the host government. PMI continues to work with other donor agencies, including Global Fund and UNICEF, to forecast global malaria commodity demands, to align our procurement processes where possible and to coordinate to ensure commodity needs are met. Also, PMI provided *Médecins Sans Frontières* antimalarials for their mass drug administration campaign for malaria during the Ebola outbreak in Liberia to ensure that activities were not delayed.

OTHER U.S. GOVERNMENT-SUPPORTED HEALTH EFFORTS

PMI works closely with other U.S. Government health programs, both on the ground in focus countries and at the headquarters level to synchronize PMI's work with other U.S. Government investments in global health and maximize the combined impact and avoid duplication. PMI's efforts to decrease the burden of malaria represent a major contribution to the broader goals of USAID's global health commitment to ending preventable child and maternal deaths and the Agency's goal of ending extreme poverty. They also contribute to CDC's global health strategy for a world where people live healthier, safer, and longer lives through science, policy, partnership, and evidence-based public health action. During FY 2015, PMI partnered with other U.S. Government-supported global health programs, including:

- ***Peace Corps:*** During FY 2015, with financial support from PMI, 814 Peace Corps volunteers in 11 PMI focus countries (**Benin, Ethiopia, Ghana, Madagascar, Malawi, Mozambique, Rwanda, Senegal, Tanzania, Uganda**, and **Zambia**) worked on joint malaria prevention activities with NMCPs, implementing partners, and PMI in-country teams, reaching more than 224,566 beneficiaries. Peace Corps volunteers trained 4,290 health workers in net distribution, home-based care, diagnostics, and reporting. They also trained more than 10,500 community mobilizers to conduct social behavior change communication on malaria prevention and prompt care seeking and more than 1,500 teachers on incorporating malaria prevention into their lesson plans. Furthermore, Peace Corps volunteers helped to distribute more than 68,900 ITNs.

- ***U.S. President's Emergency Plan for AIDS Relief:*** In FY 2015, PMI and PEPFAR continued to coordinate activities in the 14 countries where both programs are present. For example, in **Mozambique** and **Tanzania** PMI and PEPFAR have worked collaboratively to strengthen the supply chain management system and support the rollout of the new District Health Information System-2, which will be a crucial step toward receiving timely, quality data on malaria and other health indicators. In **Uganda**, the PEPFAR team has developed and implemented an integrated monitoring checklist where malaria activities are recorded during PEPFAR monitoring visits in the field. In

Angola, PMI is collaborating with PEPFAR to strengthen the supply chain management system, provide financial and technical support to the municipal decentralization process to carry out the Health Provincial Development Plan, and co-finance the 2015–2016 DHS.

- ***U.S. Department of Defense:*** PMI benefits from expertise in entomology from the U.S. Navy, which provides subject matter expertise in vector control and insecticide-resistance management at both the country level and at PMI headquarters. Members of the Armed Forces Pest Management Board routinely participate in PMI monthly entomology strategy and coordination meetings, and Navy entomology staff are seconded to CDC for supporting PMI activities. In **Liberia**, during the Ebola outbreak in FY 2015, PMI's collaboration with the U.S. Naval Medical Research Unit No. 3 focused on Ebola case detection and testing. In **Cambodia**, the Armed Forces Research Institute of Medical Sciences and the Naval Medical Research Unit – Asia work with PMI in assisting the NMCP to apply research evidence into national policy on malaria.

- ***Global Health Security Agenda (GHSA):*** The GHSA is a joint effort by the U.S. Government, other nations, international organizations and public and private stakeholders, to accelerate progress toward a world safe and secure from infectious disease threats by preventing, detecting, and rapidly responding to infectious disease outbreaks. PMI contributes to key elements of global health security including antimicrobial resistance, national laboratory system, real-time surveillance, and workforce development. PMI-supported community level programs provide first point of care and referral for epidemic diseases as well as a platform for response to public health emergencies. In FY 2015, PMI participated in joint missions in **Ethiopia, Liberia**, and **Tanzania** to plan U.S. Government global health investments and ensure complementarity with PMI efforts.

PRIVATE SECTOR PARTNERSHIPS

PMI works with private and commercial sector partners to ensure that private resources are being invested into appropriate and effective interventions to leverage efforts for increased impact and to ensure coordination with government strategies and plans. Historically, this has primarily involved partnering with large companies who wish to protect their workforce through vector control and who support corporate social responsibility activities. In FY 2015, examples of private sector partnerships included:

U.S. Government contributions to WHO's recommendation for universal access to malaria diagnostics

The World Health Organization recommends that treatment of malaria be based on diagnostic confirmation of parasites in patients with suspected malaria. However, accurate diagnosis through microscopic examination of blood slides has been difficult to scale up and maintain in remote parts of Africa. More than 200 types of RDTs exist on the global market, but quality varies widely, necessitating periodic evaluation and comparison of RDT performance using a well-characterized set of samples. Since 2007, the CDC's Malaria Branch has been the single evaluation site for the annual WHO-FIND RDT product testing. The results of this product quality testing guides RDT procurement for PMI, the Global Fund, WHO, NMCPs, and many other bilateral and multilateral organizations. During the sixth round of product testing (2014–2015), 41 products from 22 manufacturers were tested. A seventh round began in November 2015 with results to be disseminated in 2017.


UNICEF
Roll Back Malaria Partnership
U.S. President's Emergency Plan for AIDS Relief
Alliance for Malaria Prevention
Malaria No More
U.S. Department of Defense
Faith-Based Organizations
Bill & Melinda Gates Foundation
World Health Organization
United Kingdom Department for International Development
Global Fund to Fight AIDS, Tuberculosis and Malaria
Private Sector
Community-Based Organizations
United Nations Foundation
Peace Corps
Clinton Health Access Initiative
UNITAID

- Over the past 2 years, private firms in **Tanzania**, in collaboration with the Ministry of Health and Social Welfare and PMI's implementing partner, have invested in protecting their staff against malaria through education, protection, and advocacy activities as part of the Malaria Safe Companies Initiative. For example, Total Tanzania provided education messages to 6,482 primary school students and trained 100 Total employees on key malaria messages. To date, 52 Malaria Safe companies have distributed more than 45,000 insecticide-treated mosquito nets to their employees.

- The Government of **Ethiopia** recently established public-private partnerships in health units in the Federal Ministry of Health, engaged representatives from the private health sector in development of new licensing and quality standards, included the private health sector as one of the six "pillars" in the country's new vision for primary health care, and recognized new private health facility associations. PMI, in collaboration with PEPFAR, has supported private-public partnerships in order to improve private sector case management of malaria and other illnesses. Working together with the regional health bureaus and 83 private health facilities in 4 regional states, including Oromia, PMI supported increased access to quality malaria services, including diagnostic testing and free antimalarial treatment, to clients in the private sector.

- In**Zimbabwe**, PMI collaborates with the Triangle Sugar Estates in the southern part of the country on entomological surveillance. The sugar estates, NMCP, National Institute for Health Research Laboratory, and PMI implementing partners coordinate prevention and training activities. In FY 2015, PMI supported training staff from the sugar estates, together with Ministry of Health and Child Care officials, in entomological surveillance, and the sugar estates assist the Ministry of Health and Child Care with transport when conducting entomological surveillance at the estates and surrounding communities.

- Since the launch of PMI in **Angola**, ExxonMobil Foundation has worked in partnership with the U.S. Government and has provided $6 million to date to support case management and human capacity building efforts through PMI-supported non-governmental organizations in eight provinces. In the past year, 1,269 laboratory technicians were trained with Exxon Mobil funding.

FOUNDATIONS

PMI works closely with several foundations, including the Bill & Melinda Gates Foundation, the Clinton Health Access Initiative, the United Nations Foundation, and Malaria No More, to advance the global malaria control agenda.

During FY 2015, PMI, along with the Bill & Melinda Gates Foundation and other global organizations, was a key stakeholder in the **Innovation to Impact (I2I) partnership**, which strives to transform the process of bringing new vector control tools to market by fostering innovation, effectiveness, efficiency, and quality assurance.

PMI also works with the Gates Foundation on malaria operational research and is jointly facilitating increased communication and coordination among the organizations that provide funding support for malaria operational research to promote better use of research findings for decision-making.

Furthermore, PMI works with the Gates Foundation to coordinate activities to address artemisinin resistant malaria in the **Greater Mekong Subregion**. The Gates Foundation's support to researchers and academic institutions in the Subregion complements PMI's investments in malaria control and elimination activities and has provided PMI with the needed information and evidence-base to better plan and target its investments in the GMS.

COMMUNITY-BASED ORGANIZATIONS

PMI has long-standing relationships with non-governmental organizations and faith-based community organizations, which often have the ability to reach remote, marginalized, and underserved populations in PMI focus countries. In order to effectively control malaria, it is important to work among these highly-affected groups that local government programs may not be reaching. Through support to community-based organizations, and in close coordination with NMCPs and local health authorities, PMI is improving community-level access to critical malaria prevention and treatment services while also building local capacity and ensuring program sustainability. To date, PMI has supported more than 200 local and international nonprofit organizations to deliver critical malaria services in all PMI focus countries.

- In **Burma**, PMI provided case management training and essential malaria commodities to four local non-governmental organizations and one community-based

organization to expand case detection and malaria services in remote, hard-to-reach ethnic minority areas in the north and northeast of the country along the Thai-Burma border.

- In**Ethiopia**, PMI supported the Health Development and Anti-Malaria Association, a local non-governmental organization, to conduct community level social and behavior change communications activities. The objective of the project is to conduct social behavior change communications activities that increase access to, adherence to, and use of malaria interventions in five districts of Amhara region. The project focuses on strengthening capacity of schools (students and teachers), faith-based organizations, and the communities in the intervention areas. It includes 125 primary schools (grade 5–8) and 128 churches located in 122 targeted kebeles (villages) of the five districts.

- During FY 2015, in **Guinea**, PMI signed grants with 5 local non-governmental organizations to support malaria activities in 14 districts as well as the 5 communes of Conakry. These non-governmental organizations were trained to support 85 field agents to increase social and behavior change communications activities at the community level, improve data collection, and improve community health workers' performance through close supervision. During the second half of FY 2015, the non-governmental organizations field agents conducted 4,783 group discussions and reached 79,317 people. They also organized 24 social mobilization events and reached 5,328 people with key messages on malaria prevention and treatment. In addition, PMI also supported the production of 1,000 posters on the topics of artemisinin-based combination therapy use and early care-seeking, which were distributed by the local non-governmental organization partners in all health centers, hospitals, and municipal health centers.

- In **Nigeria**, PMI supports the Nigerian Inter-Faith Action Association (an independent, interfaith, non-governmental organization that brings together a national network of Christian and Islamic leaders) to deliver critical messages on malaria prevention and control to their congregations at the grassroots level.

"Global malaria control is one of the great public health success stories of the past 15 years. It's a sign that our strategies are on target and that we can beat this ancient killer, which still claims hundreds of thousands of lives, mostly children, each year."

– Dr. Margaret Chan, Director-General of WHO

Appendix 1: PMI Funding FY 2006–FY 2015 (in US$)

	Country[1]	FY 2005 Jump-start Funding	FY 2006	FY 2007[2]	FY 2008[3]	FY 2009	FY 2010[4]	FY 2011[5]	FY 2012[6]	FY 2013[7]	FY 2014[9]	FY 2015[10]	Total
Round 1	Angola	1,740,000	7,500,000	18,500,000	18,846,000	18,700,000	35,500,000	30,614,000	30,750,000	28,547,000	29,000,000	28,000,000	**247,697,000**
	Tanzania	2,000,000	11,500,000	31,000,000	33,725,000	35,000,000	52,000,000	46,906,000	49,000,000	46,057,000	46,000,000	46,000,000	**399,188,000**
	Uganda	510,775	9,500,000	21,500,000	21,822,000	21,600,000	35,000,000	34,930,000	33,000,000	33,782,000	34,000,000	34,000,000	**279,644,775**
Round 2	Malawi		2,045,000	18,500,000	17,854,000	17,700,000	27,000,000	26,447,000	24,600,000	24,075,000	22,000,000	22,000,000	**202,221,000**
	Mozambique		6,259,000	18,000,000	19,838,000	19,700,000	38,000,000	29,241,000	30,000,000	29,023,000	29,000,000	29,000,000	**248,061,000**
	Rwanda		1,479,000	20,000,000	16,862,000	16,300,000	18,000,000	18,962,000	18,100,000	18,003,000	17,500,000	18,000,000	**163,206,000**
	Senegal		2,168,000	16,700,000	15,870,000	15,700,000	27,000,000	24,451,000	24,500,000	24,123,000	24,000,000	24,000,000	**198,512,000**
Round 3	Benin		1,774,000	3,600,000	13,887,000	13,800,000	21,000,000	18,313,000	18,500,000	16,653,000	16,500,000	16,500,000	**140,527,000**
	Ethiopia		2,563,000	6,700,000	19,838,000	19,700,000	31,000,000	40,918,000	43,000,000	43,772,000	45,000,000	44,000,000	**296,491,000**
	Ghana		1,478,000	5,000,000	16,862,000	17,300,000	34,000,000	29,840,000	32,000,000	28,547,000	28,000,000	28,000,000	**221,027,000**
	Kenya		5,470,000	6,050,000	19,838,000	19,700,000	40,000,000	36,427,000	36,450,000	34,257,000	35,000,000	35,000,000	**268,192,000**
	Liberia			2,500,000	12,399,000	11,800,000	18,000,000	13,273,000	12,000,000	12,372,000	12,000,000	12,000,000	**106,344,000**
	Madagascar		2,169,000	5,000,000	16,862,000	16,700,000	33,900,000	28,742,000	27,000,000	26,026,000	26,000,000	26,000,000	**208,399,000**
	Mali		2,490,000	4,500,000	14,879,000	15,400,000	28,000,000	26,946,000	27,000,000	25,007,000	25,000,000	25,000,000	**194,222,000**
	Zambia		7,659,000	9,470,000	14,879,000	14,700,000	25,600,000	23,952,000	25,700,000	24,027,000	24,000,000	24,000,000	**193,987,000**
Round 4	DRC						18,000,000	34,930,000	38,000,000	41,870,000	50,000,000	50,000,000	**232,800,000**
	Nigeria						18,000,000	43,588,000	60,100,000	73,271,000	75,000,000	75,000,000	**344,959,000**
	Guinea							9,980,000	10,000,000	12,370,000	12,500,000	12,500,000	**57,350,000**
	Zimbabwe							11,977,000	14,000,000	15,035,000	15,000,000	15,000,000	**71,012,000**
	Mekong[8]							11,976,000	14,000,000	3,521,000	3,000,000	3,000,000	**35,497,000**
	Burma									6,566,000	8,000,000	9,000,000	**23,566,000**
	Cambodia									3,997,000	4,500,000	4,500,000	**12,997,000**
	Headquarters		1,500,000	10,000,000	21,596,500	26,100,000	36,000,000	36,000,000	36,000,000	37,500,000	37,500,000	38,000,000	**280,196,500**
	PMI Total		**30,000,000**	**154,200,000**	**295,857,500**	**299,900,000**	**500,000,000**	**578,413,000**	**603,700,000**	**608,401,000**	**618,500,000**	**618,500,000**	**4,307,471,500**
	Jump-Start Total	**4,250,775**	**35,554,000**	**42,820,000**	**0**	**0**	**36,000,000**	**0**	**0**	**0**	**0**	**0**	**118,624,775**
	Total Overall	**4,250,775**	**65,554,000**	**197,020,000**	**295,857,500**	**299,900,000**	**536,000,000**	**578,413,000**	**603,700,000**	**608,401,000**	**618,500,000**	**618,500,000**	**4,426,096,275**

(1) This table does not include other U.S. Government funding for malaria activities from the U.S. Agency for International Development (USAID), the U.S. Centers for Disease Control and Prevention (CDC), the National Institutes of Health or the Department of Defense. (2) $25 million plus-up funds include $22 million allocated to 15 PMI focus countries ($19.2 million for Round 2 countries and $2.8 million for jump-starts in Round 3 countries). (3) Levels after USAID 0.81-percent rescission. (4) In FY 2010, USAID also provided funding for malaria activities in Burkina Faso ($6 million), Burundi ($6 million), Pakistan ($5 million), South Sudan ($4.5 million), the Amazon Malaria Initiative ($5 million), and the Mekong Malaria Programme ($6 million). (5) In FY 2011, USAID also provided funding for malaria activities in Burkina Faso ($5,988,000), Burundi ($5,988,000), South Sudan ($4,491,000), and the Amazon Malaria Initiative ($4,990,000). (6) In FY 2012, USAID also provided funding for malaria activities in Burkina Faso ($9,000,000), Burundi ($8,000,000), South Sudan ($6,300,000), and the Amazon Malaria Initiative ($4,000,000). (7) In FY 2013, USAID als o provided funding for malaria activities in Burkina Faso ($9,421,000), Burundi ($9,229,000), South Sudan ($6,947,000), and the Amazon Malaria Initiative ($3,521,000). (8) Starting in FY 2011, PMI funding to the Greater Mekong Subregion was programmed through the Mekong Regional Program. With FY 2013 funding, PMI began supporting activities in Burma and Cambodia directly. In addition, PMI continued to provide FY 2013 funding to the Mekong Regional Program for activities in the region outside of the PMI Burma and PMI Cambodia bilateral programs. (9) In FY 2014, USAID also provided funding for malaria activities in Burkina Faso ($9,500,000), Burundi ($9,500,000), South Sudan ($6,000,000), and the Amazon Malaria Initiative ($3,500,000). (10) In FY 2015, USAID also provided funding for malaria activities in Burkina Faso ($12,000,0000), Burundi ($12,000,000), South Sudan ($6,000,000), and the Amazon Malaria Initiative ($3,500,000).

Appendix 2: PMI Contributions Summary

The reporting timeframe for this PMI annual report is the 2015 fiscal year (October 1, 2014 to September 30, 2015). PMI counts commodities (ITNs, SP tablets, ACT treatments, RDTs) as "procured" once a purchase order or invoice for those commodities has been issued by the procurement service agent during the reporting fiscal year. Depending on the country, commodities are reported as "distributed" once they have reached the central medical stores or once they have transitioned beyond the central medical stores to regional warehouses, health facilities, or other distribution points.

1. INDOOR RESIDUAL SPRAYING

	People Protected by PMI-supported Indoor Residual Spraying (IRS)[1]										
	Country	**Year 1 (2006)**	**Year 2 (2007)**	**Year 3 (2008)**	**Year 4 (2009)**	**Year 5 (2010)**	**Year 6[2] (FY 2011)**	**Year 7[3] (FY 2012)**	**Year 8 (FY 2013)**	**Year 9 (FY 2014)**	**Year 10 (FY 2015)**
Round 1	Angola	590,398	612,776	992,856	485,974	650,782	650,782	689,668	676,090	419,353	57,380
	Tanzania	1,018,156	1,279,960	1,569,071	2,087,062	4,861,179	4,502,814	7,107,010	4,429,410	3,020,451	2,397,021
	Uganda	488,502	1,865,956	2,211,388	2,262,578	2,794,839	2,839,173	2,543,983	2,581,839	2,565,899	3,086,789[5]
Round 2	Malawi	_	126,126	106,450	299,744	364,349	364,349	321,919	0	0	0
	Mozambique	_	2,593,949	1,457,142	2,263,409	2,945,721	2,945,721	2,825,648	2,716,176	2,181,896	2,327,815
	Rwanda	_	720,764	885,957	1,329,340	1,365,949	1,571,625	1,025,181	990,380	705,048	1,248,678
	Senegal	_	678,971	645,346	661,814	959,727	887,315	1,095,093	690,029	708,999	514,833
Round 3	Benin	_	_	521,738	512,491	636,448	426,232	652,777	694,729	789,883	802,597
	Ethiopia	_	3,890,000	5,921,906	6,484,297	2,064,389	2,920,469	1,506,273	1,629,958	1,647,099	1,665,997
	Ghana	_	_	601,973	708,103	849,620	926,699	941,240	534,060	570,572	553,954
	Kenya	_	3,459,207	3,061,967	1,435,272	1,892,725	1,832,090	2,435,836	0[4]	0	0
	Liberia	_	_	_	163,149	420,532	827,404	876,974	367,930	0	0
	Madagascar	_	_	2,561,034	1,274,809	2,895,058	2,895,058	2,585,672	1,781,981	1,588,138	1,766,806
	Mali	_	_	420,580	497,122	440,815	697,512	762,146	850,104	836,568	494,205
	Zambia	_	3,600,000	4,200,000	6,500,000	4,056,930	4,056,930	4,581,465	2,347,545	1,805,174	1,478,598[6]
Round 4	Nigeria	_	_	_	_	_	_	346,115	346,798	0	0
	Zimbabwe	_	_	_	_	_	_	_	1,164,586	1,431,643	334,746
	TOTAL	**2,097,056**	**18,827,709**	**25,157,408**	**26,965,164**	**27,199,063**	**28,344,173**	**30,297,000**	**21,801,615**	**18,270,723**	**16,729,419**

(1) A cumulative count of the number of people protected is not provided because many areas have been sprayed on more than one occasion. (2) Angola, Malawi, Mozambique, Madagascar, and Zambia implemented spray rounds during the first quarter of FY 2011 and these activities are therefore also reported in the Year 5 (2010) column. (3) During FY 2012, USAID also provided support for an IRS campaign in Burkina Faso, which protected 115,538 people. (4) In FY 2013, PMI did not carry out IRS activities in Kenya due to a policy change in the type of insecticide approved for IRS, which delayed the procurement of the insecticide and thus the timing of the spray operations. (5) In addition to these IRS activities supported with U.S. Government funds, an additional 823,528 people were protected in FY 2015 in Uganda with a donation from DFID. (6) In addition to these IRS activities supported with U.S. Government funds, an additional 522,226 people were protected in FY 2015 in Zambia with a donation from DFID.

	Houses Sprayed with PMI Support[1]									
	Country	**Year 1 (2006)**	**Year 2 (2007)**	**Year 3 (2008)**	**Year 4 (2009)**	**Year 5 (2010)**	**Year 6[2] (FY 2011)**	**Year 7[3] (FY 2012)**	**Year 8 (FY 2013)**	**Year 9 (FY 2014)**	**Year 10 (FY 2015)**
Round 1	Angola	107,373	110,826	189,259	102,731	135,856	135,856	145,264	141,782	98,136	14,649
	Tanzania	203,754	247,712	308,058	422,749	889,981	833,269	1,338,953	852,103	573,926	482,144
	Uganda	103,329	446,117	575,903	567,035	878,875	908,627	823,169	855,698	852,358	824,485[5]
Round 2	Malawi	_	26,950	24,764	74,772	97,329	97,329	77,647	0	0	0
	Mozambique	_	586,568	412,923	571,194	618,290	618,290	660,064	536,558	414,232	445,118
	Rwanda	_	159,063	189,756	295,174	303,659	358,804	236,610	230,573	173,086	304,199
	Senegal	_	169,743	153,942	176,279	254,559	240,770	306,916	207,116	204,159	130,170
Round 3	Benin	_	_	142,814	156,223	166,910	145,247	210,380	228,951	254,072	252,706
	Ethiopia	_	778,000	1,793,248	1,935,402	646,870	858,657	547,421	635,528	667,236	704,945
	Ghana	_	_	254,305	284,856	342,876	354,207	355,278	197,655	205,230	205,935
	Kenya	_	1,171,073	764,050	517,051	503,707	485,043	643,292	0[4]	0	0
	Liberia	_	_	_	20,400	48,375	87,325	99,286	42,708	0	0
	Madagascar	_	_	422,132	216,060	576,320	576,320	502,697	371,391	343,470	373,027
	Mali	_	_	107,638	126,922	127,273	202,821	205,066	228,985	228,123	133,527
	Zambia	_	657,695	762,479	1,189,676	1,102,338	1,102,338	916,293	460,303	432,398	311,204[6]
Round 4	Nigeria	_	_	_	_	_	_	58,704	62,592	0	0
	Zimbabwe	_	_	_	_	_	_	_	501,613	622,299	147,949
	TOTAL	**414,456**	**4,353,747**	**6,101,271**	**6,656,524**	**6,693,218**	**7,004,903**	**7,127,040**	**5,553,556**	**5,068,725**	**4,330,058**

(1) A cumulative count of the number of houses sprayed is not provided because many areas have been sprayed on more than one occasion. (2) Angola, Malawi, Mozambique, Madagascar, and Zambia implemented spray rounds during the first quarter of FY 2011 and these activities are therefore also reported in the Year 5 (2010) column. (3) During FY 2012, USAID also provided support for an IRS campaign in Burkina Faso, which sprayed 36,870 houses. (4) In FY 2013, PMI did not carry out IRS activities in Kenya due to a policy change in the type of insecticide approved for IRS, which delayed the procurement of the insecticide and thus the timing of the spray operations. (5) In addition to these IRS activities supported with U.S. Government funds, an additional 301,888 houses were sprayed in FY 2015 in Uganda with a donation from DFID. (6) In addition to these IRS activities supported with U.S. Government funds, an additional 98,340 houses were sprayed in FY 2015 in Zambia with a donation from DFID.

	IRS Spray Personnel Trained with PMI Support[1]									
	Country	**Year 1 (2006)**	**Year 2 (2007)**	**Year 3 (2008)**	**Year 4 (2009)**	**Year 5 (2010)**	**Year 6[2] (FY 2011)**	**Year 7[3] (FY 2012)**	**Year 8 (FY 2013)**	**Year 9 (FY 2014)**	**Year 10 (FY 2015)**
Round 1	Angola	350	582	2,104	585	834	834	0	691	671	187
	Tanzania	536	734	688	2,806	5,890	4,397	10,756	10,046	7,196	5,859
	Uganda	450	4,062	4,945	4,412	5,171	1,771	541	3,881	3,660	17,891[5]
Round 2	Malawi	_	300	309	462	929	929	885	765	1,140	0
	Mozambique	_	1,190	1,282	1,343	1,996	1,996	1,121	1,128	1,354	1,354
	Rwanda	_	655	2,091	2,276	2,088	2,357	1,986	1,925	1,501	2,005
	Senegal	_	275	706	570	1,024	911	1,097	933	933	893
Round 3	Benin	_	_	335	347	459	617	825	804	1,642	1,500
	Ethiopia	_	_	1,198	3,017	4,049	3,855	2,260	2,684	2,886	2,845
	Ghana	_	_	468	577	572	636	992	669	750	698
	Kenya	_	4,697	1,452	1,719	2,496	2,118	5,921	0[4]	0	0
	Liberia	_	_	_	340	480	793	802	292	0	0
	Madagascar	_	_	1,673	851	1,612	1,612	4,634	2,894	834	1,759
	Mali	_	_	413	424	549	816	872	853	911	582
	Zambia	_	1,300	1,413	1,935	2,396	2,396	929	926	822	1,012[6]
Round 4	Nigeria	_	_	_	_	_	_	351	381	0	0
	Zimbabwe	_	_	_	_	_	_	158	0	0	332
	TOTAL	**1,336**	**13,795**	**19,077**	**21,664**	**30,545**	**26,038**	**34,130**	**28,872**	**24,300**	**36,917**

(1) A cumulative count of the number of people trained is not provided because many areas have been sprayed on more than one occasion. Spray personnel are defined as spray operators, supervisors, and ancillary personnel. This definition does not include many people trained to conduct information and community mobilization programs surrounding IRS campaigns. (2) Angola, Malawi, Mozambique, Madagascar, and Zambia implemented spray rounds during the first quarter of FY 2011 and these activities are therefore also reported in the Year 5 (2010) column. (3) During FY 2012, USAID also provided support for an IRS campaign in Burkina Faso, which trained 332 people. (4) In FY 2013, PMI did not carry out IRS activities in Kenya due to a policy change in the type of insecticide approved for IRS, which delayed the procurement of the insecticide and thus the timing of the spray operations. (5) In addition to these IRS activities supported with U.S. Government funds, an additional 4,106 people were trained in FY 2015 in Uganda with a donation from DFID. (6) In addition to these IRS activities supported with U.S. Government funds, an additional 448 people were trained in FY 2015 in Zambia with a donation from DFID.

2. INSECTICIDE-TREATED MOSQUITO NETS

Insecticide Treated Mosquito Nets (ITNs) Procured and Distributed with PMI Support

ITNs Procured

ITNs Distributed

	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)	Year 7[1] (FY 2012)	Year 8[2] (FY 2013)	Year 9[3] (FY 2014)	Year 10[4] (FY 2015)	Cumulative[5]
Round 1	Angola	540,949	294,200	734,198	395,748	1,353,298	1,011,800	727,700	1,265,000	600,000	2,500,000	8,411,093
		540,949	0	339,440	446,348	294,169	630,000	207,000	798,000	894,529	1,015,457	5,165,892
	Tanzania	130,000	0	143,560	1,468,966	623,441	0	697,201	1,245,097	550,000	2,710,920	7,569,185
		130,000	0	113,560	1,498,966	623,441	0	697,201	1,245,097	500,000	494,407	5,302,672
	Uganda	376,444	1,132,532	480,000	765,940	1,009,000	709,000	1,200,000	5,000,000	1,752,577[6]	2,427,720[7]	14,144,213
		305,305	683,777	999,894	651,203	294,139	221,325	225,890	956,571	114,930	747,320	5,197,177
Round 2	Malawi	_	1,039,400	849,578	1,791,506	850,000	1,659,700	1,261,285	521,864	900,000	800,000	9,673,333
		_	211,995	849,578	851,436	457,822	1,142,938	1,768,951	1,011,915	477,261	527,776	7,131,402
	Mozambique	_	786,000	720,000	1,450,000	500,000	1,200,000	1,200,000	1,200,000	1,150,000	1,565,000	9,771,000
		_	565,000	842,802	930,000	500,000	1,494,277	1,200,000	1,328,379	1,200,000	1,570,875	9,524,170
	Rwanda	_	0	550,000	912,400	100,000	310,000	1,000,500	0	1,400,000	375,000	4,647,900
		_	0	0	500,000	962,400	0	806,100	604,400	0	1,400,000	4,272,900
	Senegal	_	200,000	790,000	408,000	1,025,000	2,880,000	500,000	1,362,550	1,218,900	1,003,600	9,388,050
		_	196,872	792,951	380,000	28,000	1,546,617	1,614,563	540,980	561,364	498,286	6,159,633
Round 3	Benin	_	221,000	385,697	875,000	634,000	905,000	510,000	1,420,000	1,420,000	800,000	7,170,697
		_	215,627	45,840	879,415	315,799	699,300	360,000	429,000	1,420,000	800,000	5,164,981
	Ethiopia	_	102,145	22,284	1,559,500	1,845,200	1,845,200	2,540,000	5,700,000	4,300,000	3,500,000	19,569,129
		_	102,145	22,284	559,500	1,000,000	1,845,200	2,510,746	3,600,000	3,560,624	3,552,000	16,752,499
	Ghana	_	60,023	350,000	955,000	2,304,000	1,994,000	1,600,000	2,600,000	1,340,000	1,160,000	10,889,023
		_	60,023	0	350,000	955,000	2,313,546	1,616,400	1,654,200	2,537,900	1,440,700	10,565,669
	Kenya	_	_	60,000	1,240,000	455,000	2,212,500	1,299,195	1,740,000	1,807,500	5,100,000	13,914,195
		_	_	60,000	550,000	690,000	2,589,180	35,090	1,298,259	1,034,262	2,127,033	8,063,024
	Liberia	_	197,000	0	430,000	830,000	650,000	0	0	250,000	288,850	2,295,850
		_	0	184,000	430,000	480,000	350,000	300,000	0	0	306,550	2,050,550
	Madagascar	_	_	351,900	1,875,007	1,715,000	0	2,112,000	2,729,750	3,749,450	3,145,250	15,678,357
		_	_	351,900	1,005,007	2,579,720	2,217,074	0	2,085,671	77,261	154,895	6,254,454
	Mali	_	369,800	858,060	600,000	2,110,000	3,037,150	600,000	3,076,850	2,000,000	1,350,000	12,461,860
		_	369,800	258,060	600,000	0	2,040,964	1,510,000	800,000	2,169,004	2,584,748	10,332,576
	Zambia	_	808,332	186,550	433,235	1,800,000	1,760,146	833,000	2,728,980	1,090,000[8]	800,000	9,040,243[9]
		_	550,017	444,865	433,235	400,000	1,760,146	833,000	0	1,448,055	1,090,000	6,959,318
Round 4	DRC	_	_	_	_	824,100	2,000,000	455,000	3,950,000	2,850,000	3,450,000	13,529,100
		_	_	_	_	589,553	314,111	2,113,864	142,306	1,284,770	723,003	5,118,642
	Nigeria	_	_	_	_	614,000	1,000,000	3,315,675	4,200,000	4,000,000	9,732,500	22,862,175
		_	_	_	_	0	614,000	204,635	2,496,730	2,357,149	9,019,215	14,691,729
	Guinea	_	_	_	_	_	_	800,000	779,900	180,000	235,000	1,994,900
		_	_	_	_	_	_	0	0	1,307,722	167,869	1,475,591
	Zimbabwe	_	_	_	_	_	_	457,000	699,500	888,000	339,500	2,384,000
		_	_	_	_	_	_	457,000	699,500	655,680	92,794	1,904,974
	Mekong	_	_	_	_	_	_	298,573	658,000	176,100	200,000	1,332,673
		_	_	_	_	_	_	0	118,059	94,201	207,554	419,814
	Burma	_	_	_	_	_	_	_	_	100,000	793,500	893,500
		_	_	_	_	_	_	_	_	254,560	400,342	654,902
	Cambodia	_	_	_	_	_	_	_	_	130,000	50,000	180,000
		_	_	_	_	_	_	_	_	69,542	122,811	192,353[10]
	TOTAL	**1,047,393**	**5,210,432**	**6,481,827**	**15,160,302**	**18,592,039**	**23,174,496**	**21,407,129**	**40,877,491**	**31,852,527**	**42,326,840**	**197,800,476**
		976,254	**2,955,256**	**5,305,174**	**10,065,110**	**10,170,043**	**19,778,678**	**16,460,440**	**19,809,067**	**22,018,814**	**29,043,635**	**133,354,922**

(1) During FY 2012, USAID also provided support for ITN activities in Burundi; 530,000 ITNs were procured. (2) During FY 2013, USAID also provided support for ITN activities in Burundi and Bukina Faso; 350,000 ITNs and 1,275,000 ITNs were procured in each country respectively. (3) During FY 2014, USAID also provided support for ITN activities in Burundi, Bukina Faso and South Sudan; 201,050 ITNs, 350,000 ITNs and 350,000 ITNs were procured in each country respectively. (4) During FY 2015, USAID also provided support for ITN activities in Burundi and South Sudan. In Burundi, 700,000 ITNs were procured and 737,800 ITNs were distributed. In South Sudan, 400,000 ITNs were procured and 350,000 ITNs were distributed. (5) The cumulative column takes into account the 3-month overlap between Year 5 (covering the 2010 calendar year) and Year 6 (covering the 2011 fiscal year). (6) In addition to these ITNs procured with U.S. Government funds, 1,047,378 ITNs were procured in FY 2014 for Uganda with a donation from DFID. (7) In addition to these ITNs procured with U.S. Government funds, 388,400 ITNs were procured in FY 2015 for Uganda with a donation from DFID. (8) Of this total, 600,000 ITNs were procured with PEPFAR funds. (9) In addition to these ITNs procured with U.S. Government funds, PMI procured ITNs for Zambia with a donation from DFID: one million ITNs were procured in FY 2011, 271,945 ITNs were procured in FY 2013, and 400,000 ITNs were procured in FY 2014. (10) The number of ITNs distributed exceeds ITNs procured because these distributed ITNs include some which were reported as procured under the Mekong row in previous years.

	ITNs Procured by Other Donors and Distributed with PMI Support											
	Country	**Year 1 (2006)**	**Year 2 (2007)**	**Year 3 (2008)**	**Year 4 (2009)**	**Year 5 (2010)**	**Year 6 (FY 2011)**	**Year 7[1] (FY 2012)**	**Year 8 (FY 2013)**	**Year 9 (FY 2014)**	**Year 10 (FY 2015)**	**Cumulative[2]**
Round 1	Angola	_	0	109,624	17,089	540,851	0	0	484,577	669,503	0	1,821,644
	Tanzania	_	0	350,000	117,400	871,680	615,010	1,077,840	0	108,502	170,359	3,310,791
	Uganda	_	369,900	0	0	2,431,815	125,017	0	3,503,651	19,959,762	0	26,274,145
Round 2	Malawi	_	_	0	10,700	9,600	20,000	0	0	444,580	1,823,353	2,308,233
	Mozambique	_	_	78,000	179,730	0	0	0	0	0	0	257,730
	Senegal	_	_	0	1,875,456	621,481	385,427	0	0	0	0	2,882,364
Round 3	Ethiopia	_	_	_	475,000	0	0	0	0	0	0	475,000
	Ghana	_	_	750,000	0	82,600	0	6,788,328	0	0	0	7,620,928
	Madagascar	_	_	_	290,636	3,204,647	2,772,824	0	0	0	0	3,495,283
	Mali	_	_	_	_	_	_	258,000	800,000	0	800,000	1,858,000
	Zambia	_	_	_	_	_	_	_	_	951,945	0	951,945
Round 4	DRC	_	_	_	_	3,966,000	0	0	2,700	75,267	0	4,043,967
	Nigeria	_	_	_	_	0	15,389,478	1,852,604	749,033	1,229,902	3,225,147	21,582,055
	Guinea	_	_	_	_	_	_	_	_	951,787	950,409	1,902,196
	Mekong	_	_	_	_	_	_	951,019	348,502	0	0	1,299,521
	Cambodia	_	_	_	_	_	_	_	_	_	650	650
	TOTAL	_	**369,900**	**1,287,624**	**2,966,011**	**11,728,674**	**19,307,756**	**10,927,791**	**5,888,463**	**24,391,248**	**6,969,918**	**80,084,452**

(1) During FY 2012, USAID also provided support for distribution of 327,000 Global Fund-procured ITNs in South Sudan. (2) The cumulative column takes into account the 3-month overlap between Year 5 (covering the 2010 calendar year) and Year 6 (covering the 2011 fiscal year).

3. MALARIA IN PREGNANCY

Sulfadoxine-pyrimethamine (SP) Treatments Procured and Distributed with PMI Support[1]

SP Treatments Procured

SP Treatments Distributed

	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)	Year 7[5] (FY 2012)	Year 8[6,7] (FY 2013)	Year 9[8,9] (FY 2014)	Year 10[11,12] (FY 2015)	Cumulative[14]
Round 1	Uganda	0	0	18,333	72,666	39,367	26,666	26,667	0	0	0	171,033
		0	0	2,556	45,780	40,063	26,666	0	0	0	0	107,270
Round 2	Malawi	_	_	_	_	_	_	_	2,070,333	2,070,333	0	4,140,667
		_	_	_	_	_	_	_	0	282,667	1,496,667	1,779,333
	Mozambique	_	_	0	0	3,645,052[2]	0	2,000,000	577,000	1,125,000	2,732,950	10,080,002
		_	_	0	0	0	3,645,052	0	2,000,000	1,702,000	1,366,667	8,713,719
	Rwanda	_	583,333	0	0	0	0	0	0	0	0	583,333
		_	583,333	0	0	0	0	0	0	0	0	583,333
Round 3	Benin	_	0	766,666	0	0	405,863	227,550	900,000	505,845	2,099,600	4,905,524
		_	0	0	307,121	150,000	309,546	227,550	227,550	450,200	503,342	2,075,309
	Ghana	_	_	0	0	25,000	0	0	900,000	900,000	3,000,000	4,825,000
		_	_	0	0	0	25,000	0	900,000	900,000	0	1,825,000
	Kenya	_	_	0	840,000	0	0	0	0	0	0	840,000
		_	_	0	840,000	0	0	0	0	0	0	840,000
	Liberia	_	_	0	78,666	85,333	85,333	79,667	331,667	0	156,667	732,000
		_	_	0	78,666	0	71,333	7,667	79,667	273,667	156,667	667,666
	Madagascar	_	_	_	_	_	_	_	_	750,000	0	750,000
		_	_	_	_	_	_	_	_	0	368,083	368,083
	Mali	_	_	1,000,000	0	0	0	531,000	633,333	1,800,000[10]	1,800,000[13]	5,764,333
		_	_	0	1,000,000	0	0	531,000	333,333	518,433	1,579,333	3,962,100
	Zambia	_	_	0	666,666	0	3,083,300[4]	0	0	0	0	3,749,966
		_	_	0	0	666,666	3,083,300	0	0	0	0	3,749,966
Round 4	DRC	_	_	_	_	2,470,000[3]	1,100,000	300,000	1,000,000	0	5,850,000	9,620,000
		_	_	_	_	1,370,000	0	223,683	563,786	508,904	1,194,699	3,861,072
	Nigeria	_	_	_	_	_	_	1,000,000	4,000,000	0	4,000,000	9,000,000
		_	_	_	_	_	_	0	498,200	535,162	3,488,300	4,521,662
	Guinea	_	_	_	_	_	_	108,333	280,000	0	621,000	1,009,333
		_	_	_	_	_	_	108,057	233,333	25,425	199,333	566,148
	Zimbabwe	_	_	_	_	_	_	220,000	189,267	787,500	927,000	2,123,767
			_	_	_	_	_	220,000	189,267	787,500	927,000	2,123,767
	TOTAL	_	**583,333**	**1,784,999**	**1,657,998**	**6,264,752**	**4,701,162**	**4,493,217**	**10,881,600**	**7,938,679**	**21,187,217**	**58,294,957**
		_	**583,333**	**2,556**	**2,271,567**	**2,226,729**	**7,160,897**	**1,317,957**	**5,025,136**	**5,983,958**	**11,280,091**	**35,744,429**

(1) Please note that one treatment consists of three tablets. (2) All treatments were procured with non-malaria U.S. Government funds. (3) Of this total, 1,370,000 treatments were procured with non-malaria U.S. Government funds. (4) In addition to the SP treatments procured with U.S. Government funds, 2,250,000 SP treatments were procured in FY 2011 for Zambia with a donation from DFID. (5) In FY 2012, 826,667 SP treatments were procured for Tanzania with funds from the Royal Embassy of the Kingdom of Netherlands. (6) In FY 2013, 2,308,800 SP tablets and 6,926,454 amodiaquine tablets were procured for Senegal for seasonal malaria chemoprevention for approximately 600,000 children. (7) During FY 2013, USAID also procured 1,376,000 SP treatments for South Sudan. (8) In FY 2014, 1,132,800 SP tablets and 1,098,409 amodiaquine tablets were procured for Senegal for seasonal malaria chemoprevention for approximately 625,000 children. (9) During FY 2014, USAID also procured 1,032,000 SP treatments for South Sudan. (10) In FY 2014, in addition to these SP tablets for IPTp, 900,000 SP tablets and 2,700,000 amodiaquine tablets were procured for Mali for seasonal malaria chemoprevention, protecting approximately 104,750 children. (11) In FY 2015, 3,623,375 SP/AQ co-blisters, 2,430,000 SP tablets, and 7,278,000 AQ tablets were procured for Senegal for seasonal malaria chemoprevention for approximately 625,000 children for the 2015 and 2016 campaigns. (12) During FY 2015, USAID also procured a total of 645,333 SP treatments for Burundi and South Sudan; 899,200 SP treatments were distributed. (13) In FY 2015, in addition to these SP tablets for IPTp, 1,600,000 SP/AQ co-blisters were procured for Mali for seasonal malaria chemoprevention, protecting approximately 296,163 children. (14) The cumulative column takes into account the 3-month overlap between Year 5 (covering the 2010 calendar year) and Year 6 (covering the 2011 fiscal year).

	Health Workers Trained in IPTp with PMI Support[1]										
	Country	**Year 1 (2006)**	**Year 2 (2007)**	**Year 3 (2008)**	**Year 4 (2009)**	**Year 5 (2010)**	**Year 6 (FY 2011)**	**Year 7[2] (FY 2012)**	**Year 8 (FY 2013)**	**Year 9[4] (FY 2014)**	**Year 10[5] (FY 2015)**
Round 1	Angola	1,450	290	1,481	2,554	2,695	1,488	1,308	686	729	646
	Tanzania	376	1,158	2,532	2,288	2,157	4,634	1,210	162	2,973	403
	Uganda	168	807	649	724	870	5,341	5,651	874	579	946
Round 2	Malawi	_	_	2,747	348	181	0	31	134	1,100	6,604
	Mozambique	_	_	_	_	_	_	776	569	158	0
	Rwanda[3]	_	250	436	0	964	225	0	0	0	0
	Senegal	_	43	2,422	865	1,025	1,563	672	512	3,842	309
Round 3	Benin	_	605	1,267	146	80	0	0	805	1,970	185
	Ghana	_	_	464	1,170	2,797	7,577	2,665	1,087	4,201	1,676
	Kenya	_	_	0	5,107	93	1,844	4,950	5,523	4,310	5,895
	Liberia	_	_	417	750	535	404	289	289	95	225
	Madagascar	_	_	0	0	1,576	3,370	3,808	0	0	0
	Mali	_	_	142	0	1,173	1,983	270	351	471	142
	Zambia	_	_	_	63	0	0	387	350	504	0
Round 4	DRC	_	_	_	_	0	443	1,347	3,265	2,210	2,485
	Nigeria	_	_	_	_	0	0	3,456	1,466	1,630	3,098
	Guinea	_	_	_	_	_	_	313	0	1,052	353
	Zimbabwe	_	_	_	_	_	_	215	86	1,382	8,803
	TOTAL	**1,994**	**3,153**	**12,557**	**14,015**	**14,146**	**28,872**	**27,348**	**16,159**	**27,206**	**31,770**

(1) A cumulative count of individual health workers trained is not provided because some health workers have been trained on more than one occasion. (2) During FY 2012, USAID also provided support for malaria in pregnancy activities in Burkina Faso and South Sudan; 2,077 health workers were trained in IPTp. (3) Health workers in Rwanda have been trained in focused antenatal care because IPTp is not national policy. (4) During FY 2014, USAID also provided support for malaria in pregnancy activities in Burkina Faso and South Sudan; 992 health workers were trained in IPTp. (5) During FY 2015, USAID also provided support for malaria in pregnancy activities in Burkina Faso, Burundi and South Sudan; 1,125 health workers were trained in IPTp.

4. CASE MANAGEMENT

Rapid Diagnostic Tests (RDTS) Procured and Distributed with PMI Support

RDTs Procured

RDTs Distributed

	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)	Year 7[1] (FY 2012)	Year 8[2] (FY 2013)	Year 9[3] (FY 2014)	Year 10[4] (FY 2015)	Cumulative[5]
Round 1	Angola	129,875	375,000	375,000	600,000	832,000	1,637,000	862,150	2,930,000	2,800,000	0	10,091,025
		0	101,000	380,875	975,000	282,000	1,637,500	1,762,150	900,000	2,030,000	0	8,068,525
	Tanzania	875,000	550,200	1,075,000	950,000	292,000	117,000	212,500	364,500	6,623,800	6,421,325	17,481,325
		250,000	1,025,200	425,000	989,500	661,900	194,574	212,500[6]	202,000	3,254,475	8,071,475	15,222,124
	Uganda	0	0	0	0	1,309,000	1,346,650	2,061,000	525,000	0	1,195,850	5,112,500
		0	0	0	0	34,000	296,985	0	500,000	0	0	795,055
Round 2	Malawi	_	0	0	0	0	0	2,966,675	9,227,000	4,000,000	11,700,000	27,893,675
		_	0	0	0	0	0	2,966,675	5,227,825	4,476,150	8,552,450	21,223,100
	Mozambique	_	0	0	0	0	5,000,000	1,000,000	9,956,375	14,450,000	6,000,000	36,406,375
		_	0	0	0	0	3,452,550	1,000,000	9,956,375	8,700,000	11,449,405	34,558,330
	Rwanda	_	0	0	0	200,010	200,010	500,010	500,010	1,162,020	0	2,362,050
		_	0	0	0	0	109,991	349,219[7]	240,000	500,010	489,810	1,689,030
	Senegal	_	0	0	0	0	0	700,000	300,000	0	2,555,750	3,555,750
		_	0	0	0	0	0	700,000[8]	300,000	0	1,890,500	2,890,500
Round 3	Benin	_	178,400	0	0	600,000	600,000	980,000	1,000,000	1,500,000	1,700,000	5,958,400
		_	73,815	104,585	0	0	600,000	490,000	1,190,000	961,825	826,875	4,247,100
	Ethiopia	_	_	0	1,680,000	1,560,000	0	0	0	0	0	3,240,000
		_	_	0	820,000	2,420,000	0	0	0	0	0	3,240,000
	Ghana	_	_	0	74,000	725,600	725,600	3,048,000	0	5,700,000	1,160,000	10,707,600
		_	_	0	0	0	725,600	1,000,000	0[9]	3,000,000	1,160,000	5,885,600
	Kenya	_	_	0	0	547,800	547,800	1,745,120	6,547,680	100,000	3,400,000	12,340,600
		_	_	0	0	0	292,040	667,960	3,298,320	4,500,000	500,000	9,258,320
	Liberia	_	_	0	850,000	1,200,000	0	1,900,000	2,500,000	0	1,750,000	8,200,000
		_	_	0	850,000	1,116,275	83,725	0	1,506,450	1,846,525	1,103,575	6,506,550
	Madagascar	_	_	0	0	270,000	1,500,000	778,000	1,000,000	2,780,000	2,000,000	8,328,000
		_	_	0	0	202,031	248,329	1,491,589	0	2,780,000	2,998,380	7,610,849
	Mali	_	_	0	30,000	500,000	500,000	1,000,000	3,000,000	2,000,000	2,000,000	9,030,000
		_	_	0	0	530,000	500,000	600,000	1,253,800	3,832,475	1,753,840	8,470,115
	Zambia	_	979,000	1,639,000	2,070,000	4,804,500	2,337,450	3,056,250	3,530,000	4,000,000	2,172,500	22,334,600[10]
		_	0	979,000	1,250,000	2,550,400	2,337,450	999,975	5,586,250	4,000,000	2,172,500	17,621,475
Round 4	DRC	_	_	_	_	500,000	0	3,500,000	4,000,000	8,000,000	2,875,000	18,875,000
		_	_	_	_	0	400,425	428,175	1,710,676	1,739,736	5,874,078	10,153,090
	Nigeria	_	_	_	_	_	0	2,700,000	4,000,000	2,500,000	6,718,000	15,918,000
		_	_	_	_	_	0	428,400	1,084,425	2,870,612	6,747,289	11,130,726
	Guinea	_	_	_	_	_	_	100,000	1,000,000	1,520,000	0	2,620,000
		_	_	_	_	_	_	100,000	1,000,000	1,520,000	0[12]	2,620,000
	Zimbabwe	_	_	_	_	_	_	1,599,700	1,135,375	2,266,000	2,338,000	7,339,075
		_	_	_	_	_	_	1,599,700	1,135,375	2,266,000	2,338,000	7,339,075
	Mekong	_	_	_	_	_	61,000	248,500	424,000	378,700	0	1,112,200
		_	_	_	_	_	61,000	5,250	120,126	152,075	160,200	498,651
	Burma	_	_	_	_	_	_	_	_	50,000	291,800	341,800
		_	_	_	_	_	_	_	_	232,100	264,775	496,875[11]
	Cambodia	_	_	_	_	_	_	_	_	0	285,500	285,500
		_	_	_	_	_	_	_	_	10,850	285,500	296,350[11]
	TOTAL	**1,004,875**	**2,082,600**	**3,089,000**	**6,254,000**	**13,340,910**	**14,572,510**	**28,957,905**	**51,939,940**	**59,830,520**	**54,563,725**	**229,533,475**
		250,000	**1,200,015**	**1,889,460**	**4,884,500**	**7,796,606**	**10,940,169**	**14,801,593**	**35,211,622**	**48,672,833**	**56,638,652**	**179,821,440**

(1) During FY 2012, USAID also provided support for case management activities in Burkina Faso, Burundi, and South Sudan; 1,600,000 RDTs were procured and 900,000 were distributed. (2) During FY 2013, USAID also provided support for case management activities in Burkina Faso, Burundi, and South Sudan; 7,741,300 RDTs were procured and 3,000,000 were distributed. (3) During FY 2014, USAID also provided support for case management activities in Burkina Faso, Burundi, and South Sudan; 9,941,300 RDTs were procured and 3,000,000 were distributed. (4) During FY 2015, USAID also provided support for case management activities in Burkina Faso, Burundi, and South Sudan; 7,835,000 RDTs were procured and 8,822,600 were distributed. (5) The cumulative column takes into account the 3-month overlap between Year 5 (covering the 2010 calendar year) and Year 6 (covering the 2011 fiscal year). (6) During FY 2012, an additional 259,200 RDTs were distributed in Tanzania. These RDTs were originally procured for Rwanda and transferred to Tanzania to avoid expiry. (7) Of the 500,010 RDTs Rwanda procured in FY 2012, 259,200 were relocated to Tanzania to avoid expiry. These RDTs are included in this total but were distributed in Tanzania. (8) In FY 2012, an additional 250,000 RDTs procured by other donors were distributed with U.S. Government support in Senegal. (9) In FY 2013, 2,800,000 RDTs procured by the Global Fund were distributed with U.S. Government support in Ghana. (10) In addition to these RDTs procured with U.S. Government funds, PMI procured RDTs for Zambia with a donation from DFID:1,350,000 RDTs were procured in FY 2011, 2,000,000 RDTs were procured in FY 2013, and 9,500,000 RDTs were procured in FY 2014. (11) The number of RDTs distributed exceeds RDTs procured because these distributed RDTs include some which were reported as procured under the Mekong row in previous years. (12) During FY 2015, 558,525 RDTs procured by Global Fund were distributed using U.S. Government funds to PMI zones in Guinea that had a need.

	Health Workers Trained in Malaria Diagnosis with PMI Support[1]										
	Country	**Year 1 (2006)**	**Year 2 (2007)**	**Year 3 (2008)**	**Year 4 (2009)**	**Year 5 (2010)**	**Year 6 (FY 2011)**	**Year 7[2] (FY 2012)**	**Year 8 (FY 2013)**	**Year 9[3] (FY 2014)**	**Year 10[4] (FY 2015)**
Round 1	Angola	_	374	1,356	691	1,022	1,028	225	487	1,092	1,235
	Tanzania	_	0	0	247	388	338	83	159	1,256	3,375
	Uganda	_	0	100	1,115	941	1,651	427	1,281	893	8,917
Round 2	Malawi	_	_	0	0	307	549	1,039	579	1,063	6,664
	Mozambique	_	391	0	136	0	0	0	8	0	44
	Rwanda	_	_	0	0	29	0	172	556	5,898	0
	Senegal	_	_	90	19	4,158	2,920	1,239	2,212	835	1,555
Round 3	Benin	_	605	0	24	583	232	884	967	2,546	1,034
	Ethiopia	_	_	0	0	0	7,666	9,068	563	738	789
	Ghana	_	_	0	46	4,511	8,680	2,540	1,292	19,864	4,655
	Kenya	_	_	77	0	485	210	408	3,257	346	110
	Liberia	_	_	0	22	906	39	0	0	0	0
	Madagascar	_	_	0	108	2,701	8,932	535	4,620	9,194	7,246
	Mali	_	_	40	412	1,276	1,957	1,292	375	765	138
	Zambia	_	_	0	36	0	37	2,017	719	524	82
Round 4	DRC	_	_	_	_	28	499	1,762	5,157	4,121	4,383
	Nigeria	_	_	_	_	0	2	3,555	1,919	1,629	2,262
	Guinea	_	_	_	_	_	_	835	20	1,821	459
	Zimbabwe	_	_	_	_	_	_	2,066	86	2,984	8,803
	Mekong	_	_	_	_	0	0	63	1,975	103	114
	Burma	_	_	_	_	_	_	_	_	1,887	1,297
	Cambodia	_	_	_	_	_	_	_	_	865	988
	TOTAL	**_**	**1,370**	**1,663**	**2,856**	**17,335**	**34,740**	**28,210**	**26,232**	**58,424**	**54,150**

(1) A cumulative count of individual health workers trained is not provided because some health workers have been trained on more than one occasion. (2) During FY 2012, USAID also provided support for case management activities in Burkina Faso and Burundi; 1,789 health workers were trained in malaria diagnostics. (3) During FY 2014, USAID also provided support for case management activities in Burkina Faso and South Sudan; 760 health workers were trained in malaria diagnostics. (4) During FY 2015, USAID also provided support for case management activities in Burkina Faso, Burundi and South Sudan; 1,114 health workers were trained in malaria diagnostics.

Artemisinin-based Combination Therapy (ACT) Treatments Procured and Distributed with PMI Support

ACTs Procured

ACTs Distributed

	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)	Year 7[1,2] (FY 2012)	Year 8[3] (FY 2013)	Year 9[4] (FY 2014)	Year 10[5] (FY 2015)	Cumulative[6]
Round 1	Angola	587,520	2,033,200	3,035,520	5,572,860	3,767,040	3,770,010	7,429,800	1,539,000	720,390	1,185,360	25,870,690
		0	1,689,321	3,109,089	1,947,188	3,567,360	3,770,010	3,600,000	3,829,800	1,539,000	1,185,360	24,237,128
	Tanzania	380,160	694,050	146,730	4,001,760	8,751,150	7,608,900	8,201,910	6,278,820	1,674,840	2,644,560	36,811,320
		380,160	494,050	346,730	544,017	4,873,207	8,819,640	8,663,280	1,593,300	7,668,300	3,134,280	34,209,574
	Uganda	261,870	0	1,140,480	0	2,085,120	2,085,120	1,169,820	799,800	762,150	1,326,840	7,546,080
		227,827	0	0	1,140,480	0	545,310	52,501	1,054,490	43,140	1,616,130	4,679,878
Round 2	Malawi	_	4,695,450	8,449,920	1,169,280	1,634,520	214,500	7,691,970	6,520,260	2,378,520	6,201,000	38,740,920
		_	4,694,013	3,579,278	3,693,510	2,198,460	215,100	6,536,307	3,908,910	7,026,480	6,380,730	38,017,688
	Mozambique	_	218,880	4,988,160	0	5,331,840	7,064,040	8,731,950	7,469,790	9,138,480	2,343,150	42,481,170
		_	218,880	1,440,000	2,210,320	1,553,430	4,920,990	5,947,290	8,227,470	8,354,970	7,893,410	39,788,340
	Rwanda	_	714,240	0	0	0	0	0	300,150	1,356,330	2,041,710	4,412,430
		_	0	714,240	0	0	0	0	300,150	269,430	1,876,001	3,159,821
	Senegal	_	0	0	443,520	670,080	659,790	355,000	346,110	789,600	220,800	3,426,820
		_	0	0	0	443,520	455,756	468,776	210,378	486,621	529,672	2,594,723
Round 3	Benin	_	_	1,073,490	215,040	1,002,240	509,100	1,841,190	132,000	2,032,170	750,660	7,555,890
		_	_	326,544	812,232	1,002,600	470,749	1,181,091	396,716	1,147,590	918,513	6,248,989
	Ethiopia	_	_	600,000	1,081,000	2,268,000	0	1,787,630	3,610,000	3,000,000	0	12,346,630
		_	_	0	1,681,000	648,000	1,596,630	0	1,821,000	3,600,000	1,800,000	11,146,630
	Ghana	_	_	1,142,759	0	0	0	2,090,130	849,460	3,698,170	7,438,930	15,219,449
		_	_	0	1,028,000	114,759	0	2,090,130	849,460	3,729,850	1,700,625	9,512,824
	Kenya	_	_	1,281,720	7,804,800	6,997,080	6,960,390	9,578,970	4,168,414	13,743,240	2,880,000	50,784,214
		_	_	1,281,720	6,015,360	7,667,310	3,268,260	2,410,810	10,422,328	6,084,137	10,350,990	47,033,435
	Liberia	_	496,000	0	1,303,175	1,631,625	4,444,875	2,375,525	2,703,000	1,451,100	2,484,625	16,318,325
		_	0	496,000	1,303,175	1,631,625	1,623,781	2,375,525	1,865,775	1,066,150	1,632,288	11,994,319
	Madagascar	_	_	0	0	0	100,025	400,000	0	881,000	1,609,900	2,990,925
		_	_	0	0	0	0	84,948	387,035	802,154	673,544	1,947,681
	Mali	_	_	0	241,720	739,200	1,289,190	2,400,030	2,289,720	1,506,300	2,200,410	9,927,370
		_	_	0	241,720	0	1,289,190	900,000	2,274,682	2,923,072	1,088,157	8,716,821
	Zambia	_	_	495,360	0	2,390,400	1,688,160	2,721,060	3,379,830	7,054,620	1,850,640	18,943,110[7]
		_	_	80,640	173,160	2,257,920	1,688,160	2,721,060	3,080,970	6,799,260	1,850,640	18,014,850
Round 4	DRC	_	_	_	_	3,780,000	0	7,000,000	2,378,400	9,537,400	0	22,695,800
		_	_	_	_	639,075	855,948	1,007,387	4,344,124	4,041,801	9,459,625	20,251,821
	Nigeria	_	_	_	_	0	0	7,201,535	3,584,060	17,955,180	19,304,880	48,045,655
		_	_	_	_	1,043,352[8]	0	1,241,363	3,184,730	7,357,739	17,153,639	29,980,823
	Guinea	_	_	_	_	_	1,450,000	754,750	1,401,300	1,201,580	2,976,375	7,784,005
		_	_	_	_	_	0	915,500	754,725	1,461,581	613,363	3,745,169
	Zimbabwe	_	_	_	_	_	744,120	969,150	581,460	2,251,940	0	4,546,670
		_	_	_	_	_	520,884	1,192,386	581,460	2,251,940	0	4,546,670
	Mekong	_	_	_	_	0	0	68,070	102,060	64,060	58,140	292,330
		_	_	_	_	0	0	0	17,415	0	27,463	44,878
	Burma	_	_	_	_	_	_	_	_	24,540	11,130	35,670
		_	_	_	_	_	_	_	_	25,040	15,660	40,700[9]
	Cambodia	_	_	_	_	_	_	_	_	0	140,190	140,190
			_	_	_	_	_	_	_	0	0	0
	TOTAL	**1,229,550**	**8,851,820**	**22,354,139**	**21,833,155**	**41,048,295**	**38,588,220**	**72,768,490**	**48,433,634**	**81,221,610**	**57,529,110**	**376,775,473**
		607,987	**7,096,264**	**11,374,241**	**20,790,162**	**27,640,618**	**30,040,408**	**41,388,354**	**49,104,918**	**66,678,255**	**69,900,090**	**319,912,762**

(1) During FY 2012, USAID also provided support for case management activities in Burkina Faso, Burundi, and South Sudan; 4,991,250 ACTs were procured and 2,367,675 were distributed. (2) During FY 2012, PMI also procured 786,305 ACT treatments for emergency stockpile purposes. These will be counted in next year's annual report once they have been allocated to specific countries. (3) During FY 2013, USAID also provided support for case management activities in Burkina Faso, Burundi, and South Sudan; 4,289,850 ACTs were procured and 1,830,475 were distributed. (4) During FY 2014, USAID also provided support for case management activities in Burkina Faso, Burundi, and South Sudan; 10,807,900 ACTs were procured and 5,648,425 were distributed. (5) During FY 2015, USAID also provided support for case management activities in Burkina Faso, Burundi, and South Sudan; 5,900,700 ACTs were procured and 9,571,725 were distributed. (6) The cumulative column takes into account the 3-month overlap between Year 5 (covering the 2010 calendar year) and Year 6 (covering the 2011 fiscal year). (7) In addition to these ACTs procured with U.S. Government funds, PMI procured ACTs for Zambia with a donation from DFID: 1,599,360 ACTs were procured in 2010, 3,805,560 ACTs were procured in FY 2011, 4,686,750 ACTs were procured in FY 2012, 4,432,140 ACTs were procured in FY 2013, and 1,000,200 ACTs were procured in FY 2014. (8) These ACTs were distributed in 2010 with U.S. Government funds but were procured before Nigeria became a PMI focus country. (9) The number of ACTs distributed exceeds ACTs procured because these distributed ACTs include some which were reported as procured under the Mekong row in previous years.

	ACT Treatments Procured by Other Donors and Distributed with PMI support											
	Country	**Year 1 (2006)**	**Year 2 (2007)**	**Year 3 (2008)**	**Year 4 (2009)**	**Year 5 (2010)**	**Year 6 (FY 2011)**	**Year 7 (FY 2012)**	**Year 8 (FY 2013)**	**Year 9 (FY 2014)**	**Year 10 (FY 2015)**	**Cumulative[1]**
Round 1	Uganda	_	8,709,140	112,330	4,459,918	0	0	0	0	0	0	13,281,388
Round 2	Malawi	_	_	0	2,056,170	0	5,015,490	0	0	0	0	6,779,580
	Mozambique	_	_	0	1,423,350	2,857,590	1,428,630	0	0	0	0	4,951,070
	Rwanda	_	_	_	396,625	282,494	114,471	966	0	0	0	794,556
	Senegal	_	_	_	0	0	0	275,000	0	0	0	275,000
Round 3	Madagascar	_	_	_	519,338	396,470	124,118	674,273	0	0	0	1,699,579
	Mali	_	_	_	_	_	_	_	184,319	0	0	184,319
Round 4	Nigeria	_	_	_	_	_	311,100	0	0	3,918,793	1,258,947	5,488,840
	Guinea	_	_	_	_	_	_	_	938,480	0	0	938,480
	Zimbabwe	_	_	_	_	_	_	_	344,160	0	0	344,160
	TOTAL	_	**8,709,140**	**112,330**	**8,855,401**	**3,536,554**	**6,993,809**	**950,239**	**1,466,959**	**3,918,793**	**1,258,947**	**34,736,972**

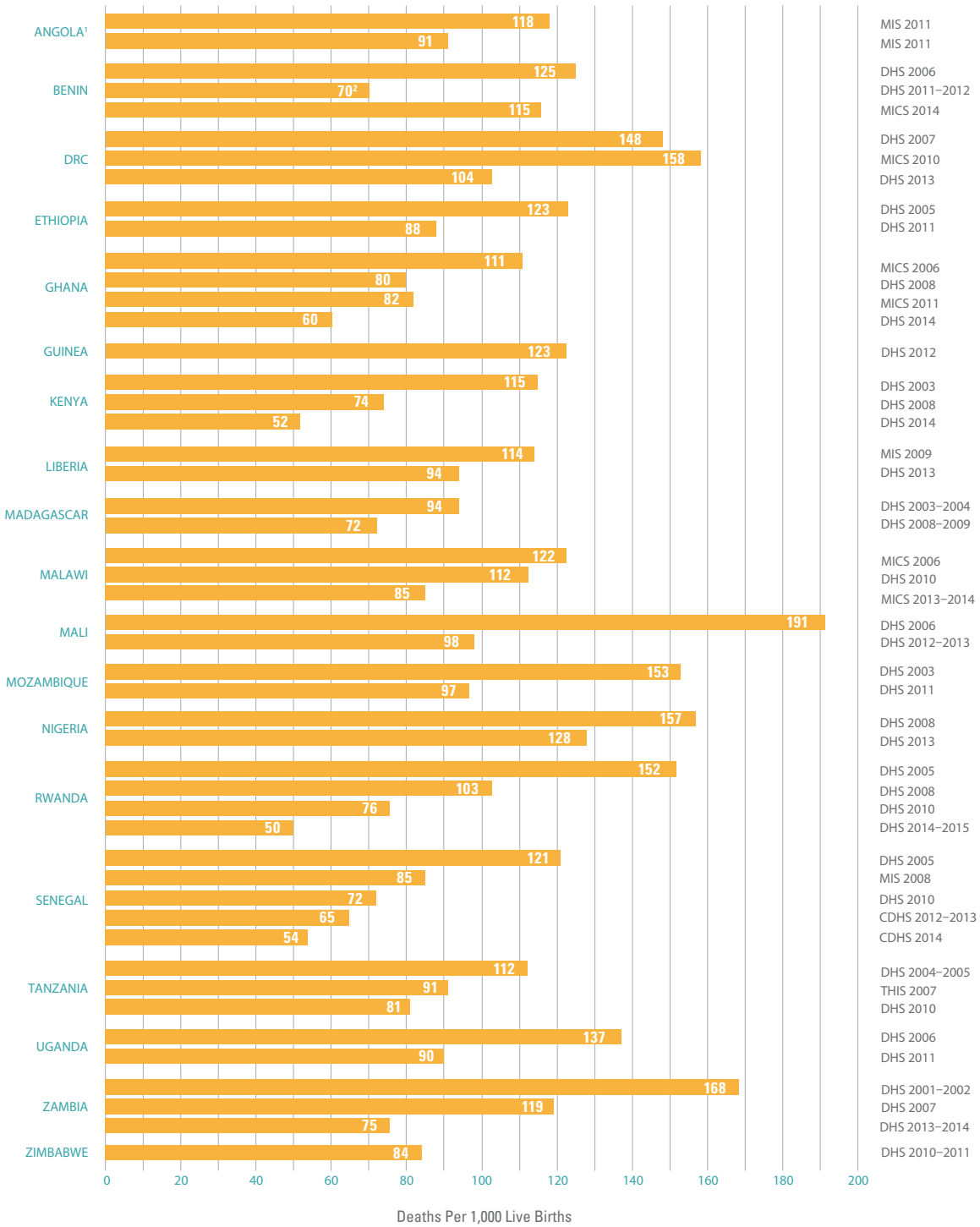
(1) The cumulative column takes into account the 3-month overlap between Year 5 (covering the 2010 calendar year) and Year 6 (covering the 2011 fiscal year).

	Health Workers Trained in Treatment with ACTS with PMI Support[1]										
	Country	**Year 1 (2006)**	**Year 2 (2007)**	**Year 3 (2008)**	**Year 4 (2009)**	**Year 5 (2010)**	**Year 6 (FY 2011)**	**Year 7[2] (FY 2012)**	**Year 8 (FY 2013)**	**Year 9[3] (FY 2014)**	**Year 10[4] (FY 2015)**
Round 1	Angola	1,283	290	1,357	2,784	2,868	238	1,489	2,492	3,164	3,299
	Tanzania	4,217	1,011	1,767	1,018	1,162	1,520	2,218	162	3,493	2,080
	Uganda	2,844	12,637	9,159	1,356	0	485	5,651	767	2,047	8,857
Round 2	Malawi	_	0	5,315	809	1,813	378	204	540	1,124	6,604
	Mozambique	_	174	422	16,768	219	0	2,383	1,190	0	32
	Rwanda	_	5,127	8,565	7,672	7,180	8,911	3,098	1,707	5,898	5,314
	Senegal	_	1,020	4,776	1,162	4,158	2,375	1,196	2,124	4,098	1,474
Round 3	Benin	_	605	_	762	1,178	1,207	678	907	2,610	1,641
	Ethiopia	_	_	2,786	0	1,740	7,666	8,694	4,560	6,570	3,179
	Ghana	_	_	368	1,144	2,952	7,954	1,318	10,278	19,619	13,151
	Kenya	_	_	_	4,747	390	0	0	0	0	0
	Liberia	_	_	595	746	1,008	498	289	60	97	220
	Madagascar	_	_	_	1,696	4,575	8,039	580	4,582	9,194	7,139
	Mali	_	_	101	412	1,283	1,957	1,260	328	765	138
	Zambia	_	_	186	197	0	493	542	655	503	80
Round 4	DRC	_	_	_	_	874	462	1,525	5,097	3,811	3,884
	Nigeria	_	_	_	_	5,058	0	5,608	24,195	14,923	6,866
	Guinea	_	_	_	_	_	_	707	20	1,675	2,064
	Zimbabwe	_	_	_	_	_	_	2,066	86	2,984	8,803
	Mekong	_	_	_	_	0	0	291	1,804	103	70
	Burma									1,790	1,254
	Cambodia									808	939
	TOTAL	**8,344**	**20,864**	**35,397**	**41,273**	**36,458**	**42,183**	**39,797**	**61,554**	**85,276**	**77,088**

(1) A cumulative count of individual health workers trained is not provided because some health workers have been trained on more than one occasion. (2) During FY 2012, USAID also provided support for case management activities in Burkina Faso and Burundi; 1,727 health workers were trained in ACT use. (3) During FY 2014, USAID also provided support for case management activities in Burkina Faso and South Sudan 831 health workers were trained in ACT use. (4) During FY 2015 USAID also provided support for case management activities in Burkina Faso and Burundi; 959 health workers were trained in ACT use.

Appendix 3: Mortality Rates and Intervention Coverage in PMI Focus Countries

Figure 1. All-cause mortality rates among children under five in PMI focus countries



(1) Both under-five mortality estimates for Angola are derived from the MIS 2011. The estimate 118/1,000 is for the period 2001-2006, while 91/1,000 is for the period 2006-2011.
(2) The final report of the DHS 2011-2012 notes that, while mortality among children under five in Benin has declined, there may have been significant under-reporting of neonatal and child deaths by respondents.

Figure 2. ITN ownership in PMI focus countries

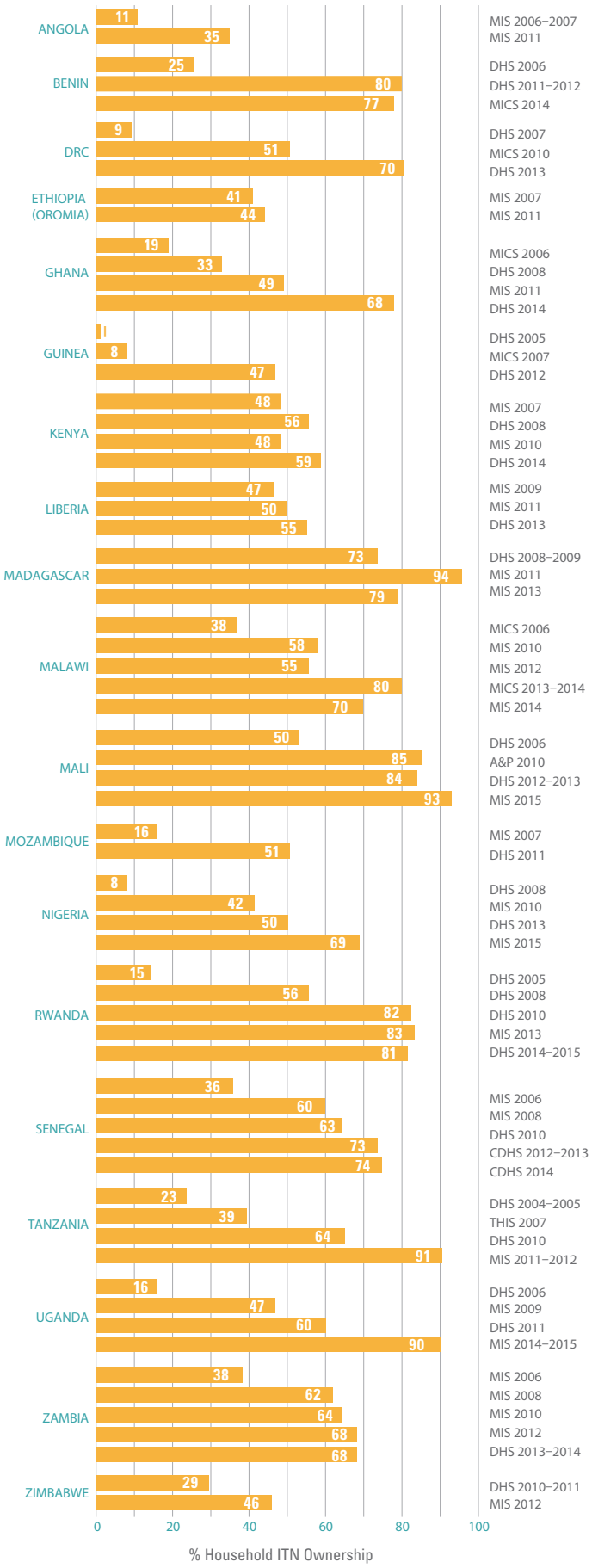


Figure 3. ITN use among children under five in PMI focus countries

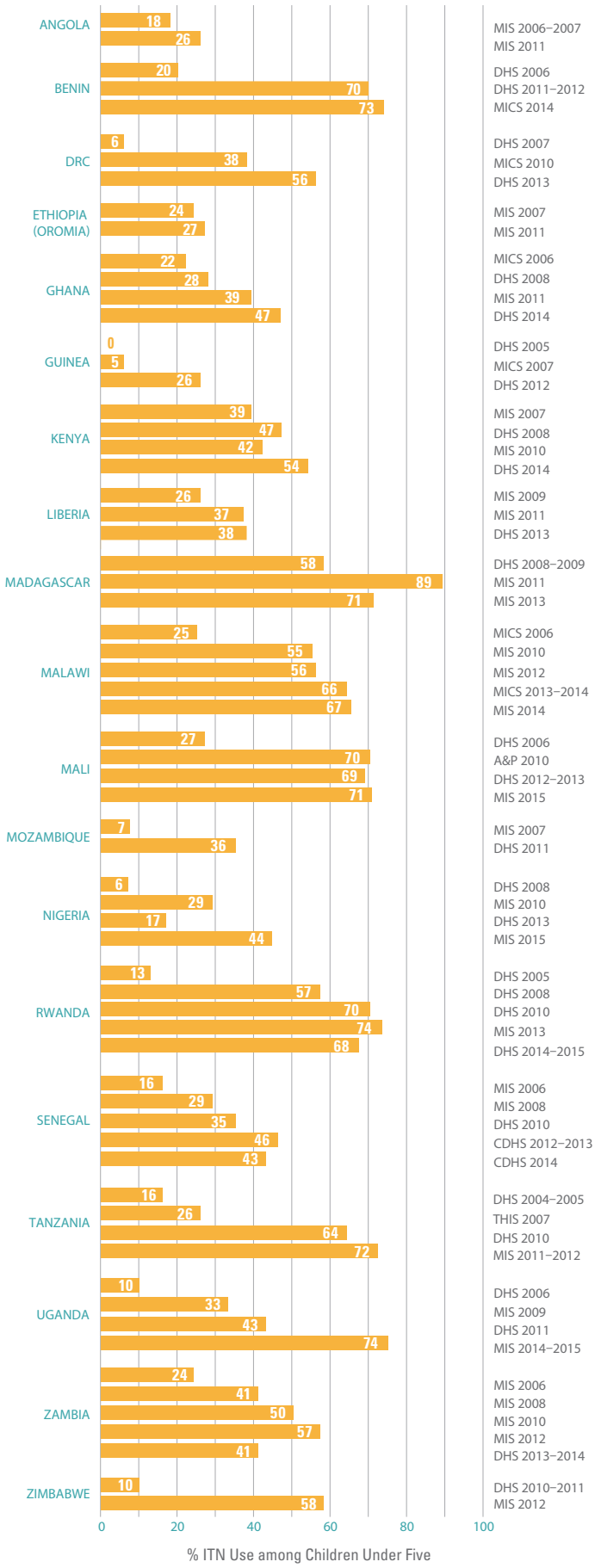


Figure 4. ITN use among pregnant women in PMI focus countries

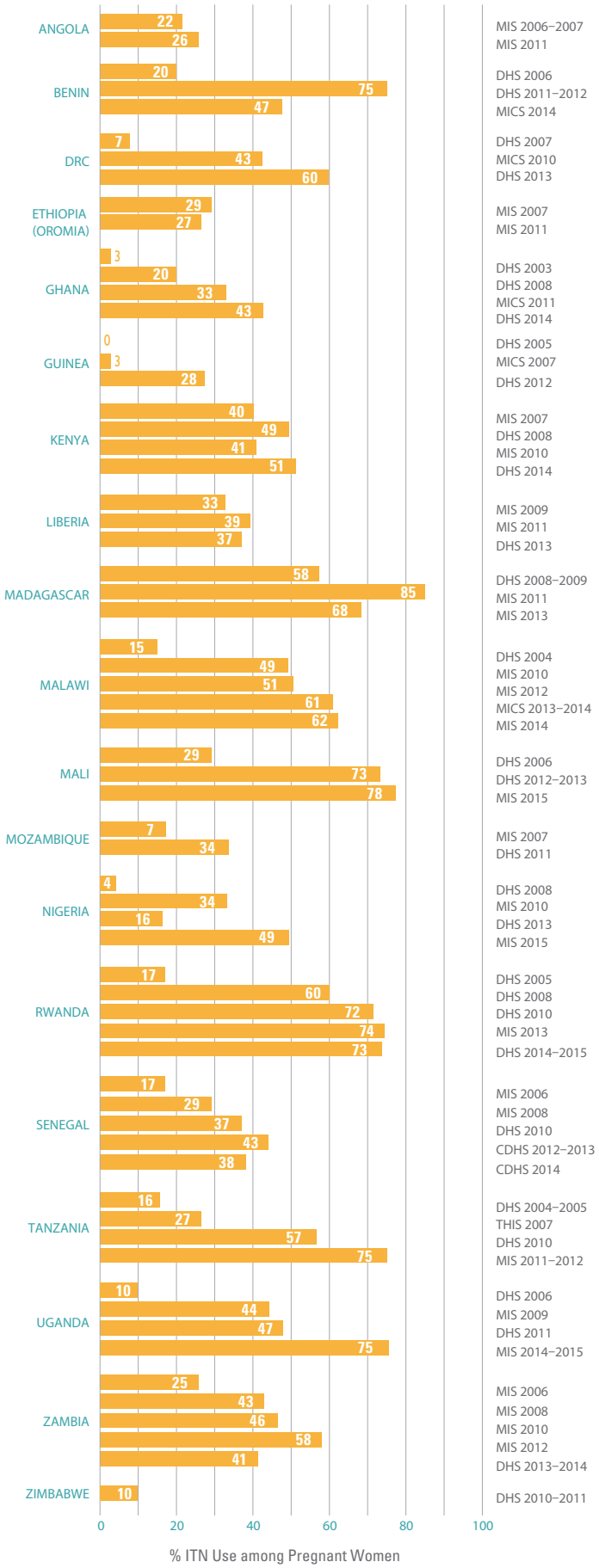
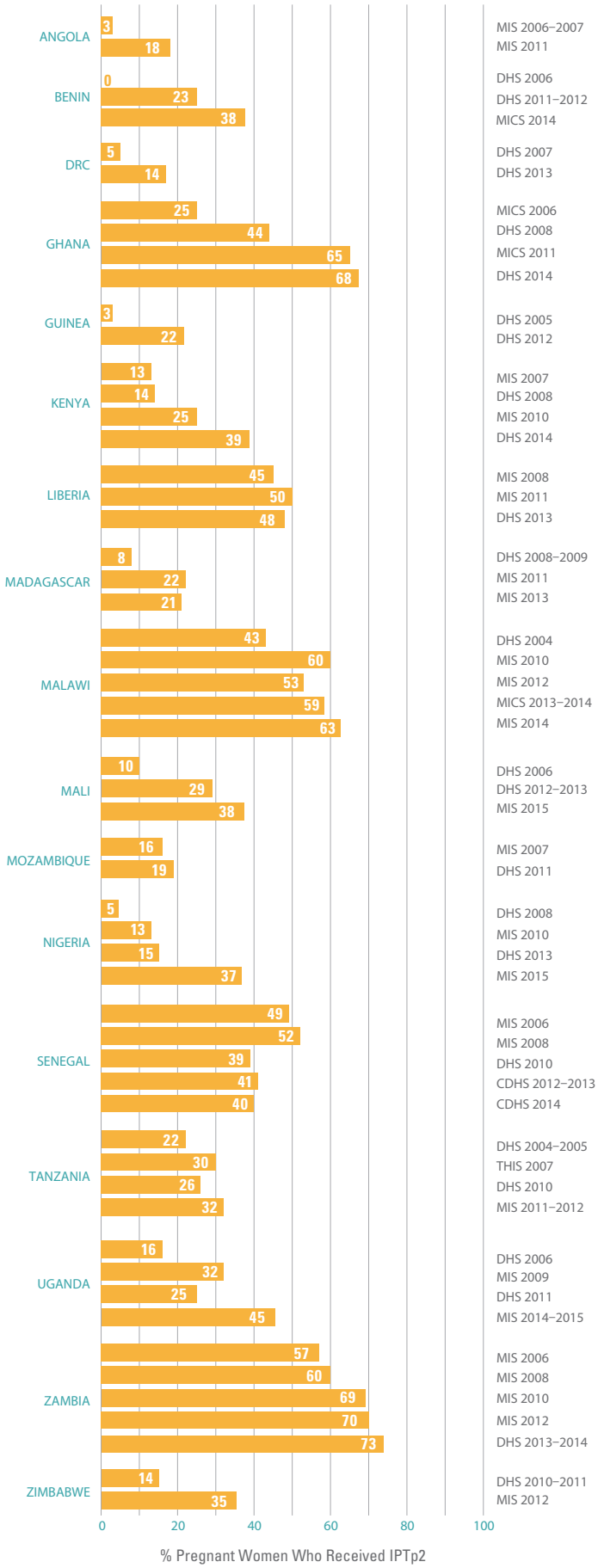


Figure 5. IPTp2 rates in PMI focus countries



APPENDIX 3 NOTES:

Figure 1. All-cause mortality rates among children under five in PMI focus countries
The PMI focus countries included in this figure have at least two data points from nationwide household surveys that measured ITN use among children under five, defined as the percentage of children under five who slept under an ITN the night before the survey.

Figure 2. ITN ownership in PMI focus countries
The PMI focus countries included in this figure have at least two data points from nationwide household surveys that measured ITN ownership, defined as the percentage of households that own at least one ITN.

Figure 3. ITN use among children under five in PMI focus countries
The PMI focus countries included in this figure have at least two data points from nationwide household surveys that measured ITN use among children under five, defined as the percentage of children under five who slept under an ITN the night before the survey.

Figure 4. ITN use among pregnant women in PMI focus countries
The PMI focus countries included in this figure have at least two data points from nationwide household surveys that measured ITN use among pregnant women, defined as the percentage of pregnant women who slept under an ITN the night before the survey.

Figure 5. IPTp2 rates in PMI focus countries
The PMI focus countries included in this figure have at least two data points from nationwide household surveys that measured IPTp2 coverage for pregnant women, defined as the percentage of women who received at least two doses of SP during their last pregnancy, with at least one dose given during an antenatal clinic visit. IPTp is not part of the national policy in Ethiopia and Rwanda.

COVER PHOTO CREDITS:

From left to right: Maggie Hallahan Photography, Karie Atkinson/USAID, Maggie Hallahan Photography, Jessica Scranton/Abt Associates, Maggie Hallahan Photography, Bonnie Gillespie/Voices for a Malaria-Free Future, Karie Atkinson/USAID, Lisa Kramer/PMI, and Brant Stewart/RTI

USAID
FROM THE AMERICAN PEOPLE

PRESIDENT'S MALARIA INITIATIVE

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

U.S. Agency for International Development
1300 Pennsylvania Avenue, NW
Washington, DC 20523
Tel: (202) 712-0000
Fax: (202) 216-3524
www.usaid.gov