



THE PRESIDENT'S MALARIA INITIATIVE

Sixth Annual Report to Congress | April 2012



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USAID **50** ANNIVERSARY

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Foreword

I am pleased to present the U.S. Congress with this report, which outlines the extraordinary steps the U.S. Government has taken on behalf of the American people to save lives and help control malaria in Africa. We have seen tremendous success against malaria, thanks to an infusion of resources, innovation, and political will. Ending malaria as a major killer of children is now considered possible.

In 2011, we commissioned a comprehensive external evaluation of the first five years of the President's Malaria Initiative (PMI), FY 2006–FY 2010. The final report concluded that “PMI is, by-and-large, a very successful, well-led component of the U.S. Government Global Health Initiative.” This is largely a result of the hard work and dedication of PMI staff at the country level and the strength of our partnerships with national malaria control programs, other donors, and nongovernmental organizations.

Malaria is one of today's best investments in global health, and it is vitally important that we sustain our momentum as we adapt to the changing malaria landscape. I thank the U.S. Congress for its continuous bipartisan support over two administrations. This support has improved the lives of millions of women and children in Africa.



R. Timothy Ziemer

Rear Admiral, United States Navy (Retired)
U.S. Global Malaria Coordinator

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Maggie Halahan Photography

Executive Summary

Over the past five years, many African countries have reported substantial progress in reducing their burden of malaria. Mortality in children under five years of age has fallen dramatically across sub-Saharan Africa in association with a massive scale-up of malaria control efforts with insecticide-treated mosquito nets (ITNs), indoor residual spraying (IRS), improved diagnostic tests, and highly effective antimalarial drugs. Evidence is growing that the cumulative efforts and funding by the President's Malaria Initiative (PMI), national governments, The Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund), the World Bank, and many other donors are having an effect and that the risk of malaria is declining. In fact, according to the World Health Organization's (WHO's) 2011 World Malaria Report, the estimated number of global malaria deaths fell from about 985,000 in 2000 to about 655,000 in 2010, with most of this reduction occur-

ring in sub-Saharan Africa. In spite of these remarkable achievements, progress is fragile, and malaria remains a public health problem. The goal over the next 5 to 10 years will be to sustain and build on these efforts in the face of such challenges as antimalarial drug resistance, insecticide resistance, and uncertainties around donor and national funding for malaria control.

IMPACT ON MALARIA

Since 2006, there has been substantial progress in malaria control in the PMI focus countries. Eleven of the original 15 PMI focus countries now have results from at least two nationwide household surveys that measured mortality in children under five years of age: a baseline survey and a follow-up survey three or more years after PMI support began. All 11 paired surveys demonstrate reductions in all-cause, under-five mortality rates, ranging from 16 percent (**Malawi**) to 50 percent (**Rwanda**) (see Fig-

ure 1). Follow-up surveys will be completed in the remaining four PMI focus countries by 2013.

Although multiple factors may be influencing the decline in under-five mortality rates, there is growing evidence that the scale-up of malaria prevention and treatment measures across sub-Saharan Africa are playing a major role in these unprecedented reductions in childhood mortality.

Tanzania is the first PMI focus country to carry out an in-depth evaluation of the impact of the scale-up of malaria prevention and treatment measures on childhood mortality. This evaluation was conducted in collaboration with the Government of Tanzania, the Roll Back Malaria (RBM) Partnership, WHO, and the Ifakara Health Institute. Between 1999 and 2010, under-five mortality in Tanzania fell by 45 percent from 148 to 81 deaths per 1,000 live births. This

PMI External Evaluation

In 2011, PMI commissioned an External Evaluation of the first five years (fiscal years [FYs] 2006–2010) of PMI’s activities and performance. The Evaluation Team reviewed extensive documentation and interviewed key personnel at USAID/ Washington and the U.S. Centers for Disease Control and Prevention (CDC)/Atlanta, together with staff from partner organizations, including WHO, the RBM Partnership, the United Nations Children’s Fund (UNICEF), the Global Fund, and major nongovernmental organizations (NGOs). The team conducted site visits to five PMI focus countries and e-mail and telephone interviews with national malaria control program personnel and PMI staff from the other 10 PMI focus countries. The External Evaluation Report affirmed that PMI’s planning, implementation, partnerships, and funding have been key to global efforts to combat malaria. The Evaluation Team made five policy and five technical overarching recommendations that will guide programmatic improvements in the coming years. Following are a selection of positive quotes from the Report:

PMI is by-and-large a very successful, well-led component of the U.S. Government’s Global Health Initiative.

[PMI] quickly re-oriented a problematic U.S. Government malaria program, took it to a large scale quickly, efficiently and effectively complemented the larger global malaria program, and contributed to the apparent reduction in child mortality.

PMI leadership successfully engaged key U.S. Government actors and sustained bipartisan political support for the Initiative amidst a change of Administrations and the emergence of the Global Health Initiative.

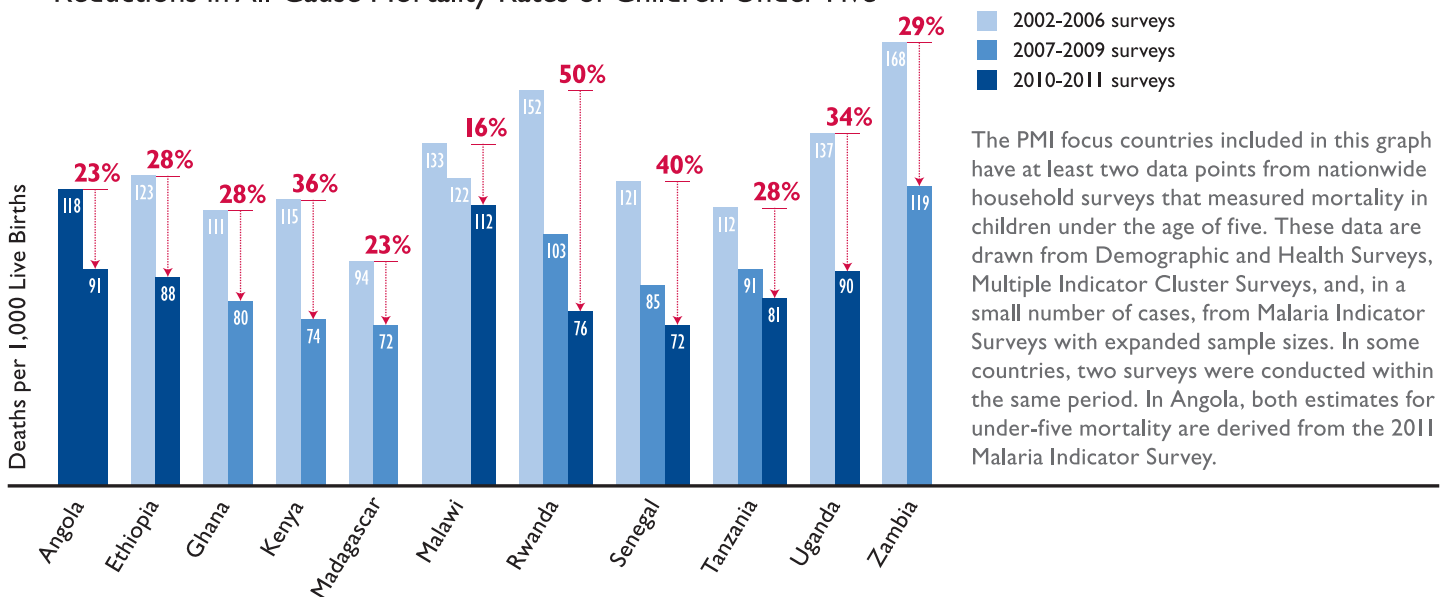
Through its major contributions to the global malaria response via its collaborations with multilateral and bilateral partners, its effective relationship with the Global Fund, and its contributions to reinvigorating national malaria control programs, PMI has made substantial progress towards meeting its goal of reducing under-five child mortality in most of the 15 focus countries.

PMI is generally considered as an exemplary partner by most partners because it is not using its large and broad presence and substantial financial support to gain undue influence within the partnership. [Partners] described PMI as “flexible,” “more transparent,” “inclusive in designing its approaches,” and “receptive to ideas and suggestions.”

The full report and PMI’s management response are available on the PMI website at http://www.pmi.gov/news/pressreleases/pmi_audit.html.

FIGURE 1

Reductions in All-Cause Mortality Rates of Children Under Five



PMI CONTRIBUTIONS AT A GLANCE

Indicator ¹	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)*	Cumulative
People protected by IRS (houses sprayed)	2,097,056 (414,456)	18,827,709 (4,353,747)	25,157,408 (6,101,271)	26,965,164 (6,656,524)	27,199,063 (6,693,218)	28,344,173 (7,004,903)	N/A ²
ITNs procured	1,047,393	5,210,432	6,481,827	15,160,302	18,592,039	23,254,496	59,706,489 (46,894,646 distributed) ³
ITNs procured by other donors and distributed with PMI support	–	369,900	1,287,624	2,966,011	10,856,994	19,307,756	31,035,352
SP treatments procured	–	583,333	1,784,999	1,657,998	6,264,752	4,701,162	13,794,245 (12,137,287 distributed) ⁴
Health workers trained in IPTp ⁵	1,994	3,153	12,557	14,015	14,146	28,872	N/A ⁶
RDTs procured	1,004,875	2,082,600	2,429,000	6,254,000	13,340,910	14,572,510	33,581,385 (24,377,490 distributed) ⁴
Health workers trained in malaria diagnosis (RDTs and/or microscopy)	–	1,370	1,663	2,856	17,335	34,740	N/A ⁶
ACT treatments procured	1,229,550	8,851,820	22,354,139	21,833,155	41,048,295	38,588,220	116,822,629 (92,864,575 distributed) ⁴
ACT treatments procured by other donors and distributed with PMI support	–	8,709,140	112,330	8,855,401	3,536,554	6,993,809	27,142,034
Health workers trained in treatment with ACTs	8,344	20,864	35,397	41,273	36,458	42,138	N/A ⁶

¹ The data reported in this table are up-to-date as of September 30, 2011, and include all PMI focus countries and the Greater Mekong Subregion. In addition, during FY 2011, the U.S. Government provided support for malaria prevention and control activities in other countries. For data by country, see Appendix 2.

² A cumulative count of people protected by IRS is not provided because most areas are sprayed on more than one occasion.

³ Distribution of ITNs varies and includes to health facilities, direct distribution to households through mass campaigns, and through the private sector via social marketing.

⁴ Distributed to health facilities.

⁵ These figures include health workers who were trained in focused antenatal care in Rwanda, where IPTp is not national policy.

⁶ A cumulative count of individual health workers trained is not provided because some health workers have been trained on more than one occasion.

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

decline occurred during a period when major improvements were taking place in malaria control policies in mainland Tanzania, including the adoption of highly effective artemisinin-based combination therapies (ACTs) for malaria treatment and a massive scale-up of ITN distribution and use.

Although no national-level data on the prevalence of malaria parasitemia are available from Tanzania, information from several sources shows declines in parasitemia rates in children under five years of age from a level of 18 to 25 percent in the early part of the decade to less than 5 percent in recent years. The prevalence of severe anemia in young children (which is closely associated with malaria) also fell by 50 percent from 11 percent in 2004 to just 6 percent in 2010. These findings of a reduction in malaria morbidity are further supported by a modeling exercise that indicates that malaria mortality in children under five in Tanzania has fallen and that nearly 63,000 lives have been saved over the 10-year period between 2000 and 2010 due to malaria interventions.

THE PRESIDENT'S MALARIA INITIATIVE

Malaria prevention and control is a major focus of U.S. Government foreign assistance objectives. The U.S. Government is the single largest funder of the Global Fund. PMI, which was launched in June 2005 by President George W. Bush, represented a major five-year (FYs 2006–2010), \$1.265 billion expansion of U.S. Government resources for malaria control. Its goal is to reduce the burden of malaria and thereby help promote development on the African continent. The initial objective was to reduce malaria-related deaths by 50 percent in 15 African countries with a high burden of malaria by expanding coverage of four highly effective malaria prevention and treatment measures, with a focus on pregnant women and children under five years of age, the groups most vulnerable to the severe consequences of malaria.

Based on the 2008 Lantos-Hyde United States Leadership against HIV/AIDS, Tuberculosis, and Malaria Act, which autho-

rized a further increase of up to \$5 billion in PMI funding for five more years, PMI's goal was broadened to achieve Africa-wide impact by halving the burden of malaria in 70 percent of at-risk populations in sub-Saharan Africa, i.e., approximately 450 million residents.

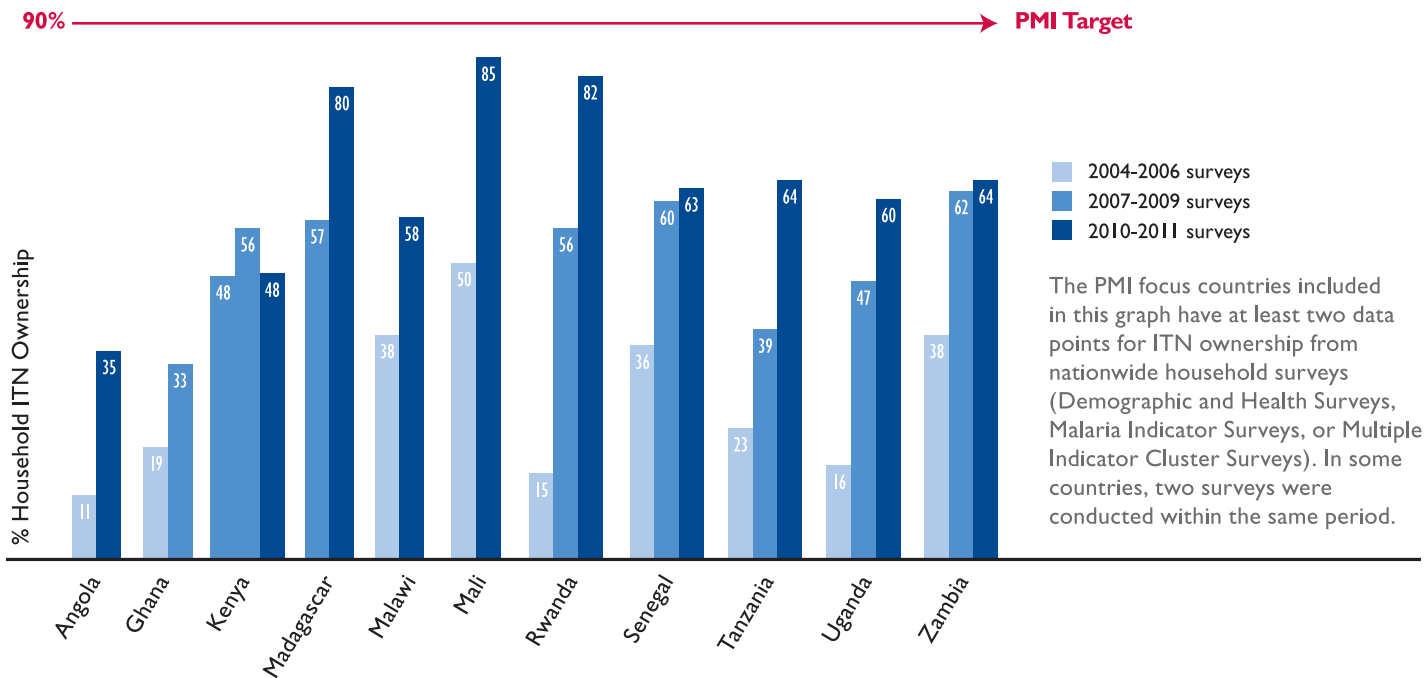
During the past year, PMI has expanded its efforts in Africa by:

- Designing PMI programs and beginning implementation of malaria control activities in two new PMI focus countries: **Guinea** and **Zimbabwe**.
- Expanding PMI programs in **Nigeria** to 8 of 36 states (total population of 27 million) and the **Democratic Republic of the Congo** to 4 of 11 provinces (total population of 19 million).

PMI now includes 19 focus countries in Africa and one regional program in the Greater Mekong Subregion of Southeast Asia (see map on page 8). In addition, the

FIGURE 2

Increasing ITN Ownership



U.S. Agency for International Development (USAID) supports malaria control activities in three other countries in Africa (Burkina Faso, Burundi, and South Sudan), as well as a regional program in Latin America (the Amazon Malaria Initiative). Furthermore, USAID has made significant investments to support development of new antimalarial drugs and vaccines.

Malaria control is also a key component of the U.S. Government’s Global Health Initiative (GHI), which was announced by President Barack Obama in May 2009. This initiative builds on the U.S. Government’s commitment to address major global health concerns, such as malaria, HIV/AIDS, tuberculosis, maternal and child health, nutrition, and neglected tropical diseases. Under GHI, PMI has expanded its integration with maternal and child health and HIV/AIDS programs, worked to strengthen partnerships, and continued to build capacity in health systems.

SCALING UP MALARIA CONTROL INTERVENTIONS

Since PMI was launched in 2005, the efforts of national governments, together with PMI, the Global Fund, the World Bank, and many other donors, have resulted in a massive

scale-up of malaria prevention and treatment measures across PMI focus countries.

In FY 2011 alone, PMI procured more than 23 million long-lasting ITNs and 38 million ACT treatments, and protected more than 28 million residents by spraying their houses with residual insecticides (see PMI Contributions at a Glance on page 5). Additionally, PMI assisted with the distribution of more than 19 million long-lasting ITNs and nearly 7 million ACT treatments procured by other partners, highlighting the well established and productive collaboration between PMI and other donors. PMI also trained tens of thousands of health workers in malaria control – often as part of integrated health worker training and capacity building efforts – including diagnosis and treatment of malaria with ACTs. In all PMI focus countries in Africa and the Greater Mekong Subregion, PMI supported health systems strengthening and capacity building, with a particular focus on pharmaceutical management, laboratory diagnosis, vector control, and monitoring and evaluation.

These contributions have led to dramatic improvements in the coverage of malaria control interventions in the 15 original PMI focus countries. Eleven PMI focus countries

(Angola, Ghana, Kenya, Madagascar, Malawi, Mali, Rwanda, Senegal, Tanzania, Uganda, and Zambia) have now reported results of recent nationwide household surveys that allow a comparison with similar surveys used as the PMI baseline. In those 11 countries:

- Household ownership of one or more ITNs increased from an average of 32 to 61 percent (see Figure 2).
- Usage of an ITN the night before the survey more than doubled from an average of 23 to 51 percent for children under five years and about the same amount for pregnant women.
- The proportion of pregnant women who received two or more doses of intermittent preventive treatment for pregnant women (IPTp) for the prevention of malaria increased from an average of 20 to 37 percent.

Thanks to these improvements in coverage, together with the many millions of residents protected by PMI-supported IRS, a large proportion of at-risk populations in the PMI focus countries are now benefiting from highly effective malaria prevention

measures. Follow-up national household surveys to assess improvements in coverage of malaria control measures in the remaining four PMI focus countries will be completed by 2013. In addition, although most African countries did not adopt ACTs as their first-line treatment for malaria until 2003–2004, these highly efficacious drugs are now widely available in health facilities throughout Africa.

STRENGTHENING PARTNERSHIPS FOR MALARIA CONTROL

In keeping with the principles of GHI, PMI coordinates its activities with a wide range of partner organizations, including national malaria control programs (NMCPs); multilateral and bilateral institutions, such as WHO, the United Nations Children’s Fund, the World Bank, the Global Fund, and the U.K. Department for International Development (DFID); private foundations, such as the Bill & Melinda Gates Foundation, the William J. Clinton Foundation, and the UN Foundation; and numerous NGOs and faith-based organizations, many of which have strong bases of operation in underserved rural areas, where the burden of malaria is greatest. To date, PMI has supported malaria control interventions by 230 nonprofit organizations, more than one-third of which are faith based.

- In 2011, DFID channeled \$23 million in funding (in addition to \$11 million in 2010) through USAID in **Zambia** for the procurement of antimalarial drugs and essential medicines for other conditions for the period 2011–2015. This flexible funding will make it possible to fill the commodity gaps brought about by delays in donor funding and improve access to commodities.
- Because delays in procurements may lead to stockouts of critical commodities, such as antimalarial drugs and ITNs, PMI has established a Central Emergency Procurement Fund to help alleviate shortages at the national level. During FY 2011, PMI worked with other partners to assist 12 countries in filling emergency gaps in essential malaria commodities – gaps caused by changes in country needs, fluctuations in funding and timing of procurements from external partners, and other unforeseen circumstances. Through its Central Emergency Procurement Fund, PMI

purchased nearly \$9 million of malaria commodities, including long-lasting ITNs and ACT treatments. PMI’s responsiveness and flexibility in its commodity procurement and management systems minimized or prevented dangerous stockouts, saving many lives.

PROMOTING PROGRAM INTEGRATION

- *Integration with Maternal and Child Health Programs:* Malaria prevention and control is a fundamental part of comprehensive maternal and child health services in Africa and contribute to the capacity of ministries of health to deliver high-quality services. ITNs procured by PMI are distributed primarily through antenatal and child health clinics or integrated health campaigns that include other interventions, such as vitamin A supplementation and vaccinations. PMI also funds antenatal care programs that provide a comprehensive package of services for pregnant women, including IPTp, during their regular antenatal clinic visits.
- *Integrated Community Health Programs:* One of the greatest barriers to prompt and effective treatment of malaria in Africa is the lack of access to health facilities for people living in rural areas. In response to this problem, many countries have begun to introduce and scale up integrated community case management (iCCM), which provides health care to children in hard-to-reach communities using trained, supervised community workers. PMI has worked with other maternal and child health programs in expanding iCCM of the major causes of fever – pneumonia, malaria, and diarrhea – in children under five in Africa. In FY 2011,

PMI provided support to iCCM programs in 14 focus countries, of which **Ethiopia, Madagascar, Malawi, Rwanda, and Senegal** have moved quickly to scale up their iCCM programs nationwide. Most of the remaining PMI focus countries are piloting iCCM in more circumscribed areas but have plans to expand in the coming years.

STRENGTHENING HEALTH SYSTEMS AND BUILDING NATIONAL CAPACITY

PMI resources and activities help strengthen the overall capacity of health systems, both indirectly and directly. Reducing the burden of malaria in highly endemic countries, where malaria typically accounts for 30 to 40 percent of outpatient visits and hospital admissions, enables overstretched health workers to concentrate on managing other childhood illnesses, such as diarrhea and pneumonia. Ministries of health and NMCPs must be able to provide both leadership and the technical and managerial skills to plan, implement, evaluate, and adjust, as necessary, their malaria control efforts. Thus, PMI builds national capacity by helping NMCP staff gain expertise in a variety of areas, including entomology, epidemiology, monitoring and evaluation, laboratory diagnosis, supply chain management, behavior change communication, and financial management. In FY 2011, PMI efforts to strengthen health systems included:

- Building a cadre of ministry of health staff with technical skills in the collection, analysis, and interpretation of data for decision-making and epidemiologic investigations, including through support to the CDC’s Field Epidemiology and Laboratory Training Program in **Angola**,



A woman serving on an indoor residual spraying team travels to a village in Rwanda to begin her day’s work.

Credit: Brant Stewart/RTI International

Ethiopia, Ghana, Kenya, Mozambique, Nigeria, Tanzania, and Zimbabwe.

PMI-Supported Malaria Programs

- Collaborating with NMCPs and other partners, such as the U.S. President’s Emergency Plan for AIDS Relief (PEPFAR) and WHO, to strengthen laboratory diagnosis of malaria and improve the overall quality of health care.
- Providing funds for strengthening supply chain management systems across all PMI focus countries. In almost all of these countries, PMI has been able to complement investments by PEPFAR and other U.S. Government programs.
- Working with national institutions in PMI focus countries to conduct operational research on issues affecting the implementation of major malaria prevention and treatment measures.

PMI also intentionally promotes and fosters country ownership by carrying 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.



CHALLENGES

In spite of the progress that has been documented in malaria control in Africa over the past 5 to 10 years, technical challenges remain, such as achieving IPTp coverage targets. The gains are fragile, and the global malaria partnership must remain vigilant to potential threats, as described below:

- **Antimalarial Drug and Insecticide Resistance:** Resistance to artemisinin drugs has not yet been documented in sub-Saharan Africa, but if this were to occur, as it has with the importation of chloroquine-resistant parasites from Southeast Asia, it would represent a major setback for malaria control efforts on the continent. Resistance of the mosquito vector of malaria to the pyrethroid class of insecticides, which are widely used for IRS and are the only recommended insecticides for ITNs, is already being reported from multiple sites in Africa. PMI supports national malaria control programs to conduct regular monitoring of both antimalarial drug and insecticide resistance. In addition, PMI is looking at other

In addition, USAID provides malaria funding to Burkina Faso, Burundi, and South Sudan in Africa and the regional Amazon Malaria Initiative in Latin America (which includes Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, and Suriname).

approaches, such as rotation of insecticides used for IRS, as a way of delaying the development of further resistance to pyrethroid insecticides and prolonging their effectiveness on ITNs.

- **Funding for Malaria Control:** Due to the worldwide economic recession, global support for malaria control has peaked and now seems to be leveling off. The \$30 million increase in PMI funding from the U.S. Congress in FY 2012 and the announcement of a substantial increase in malaria support from the British Government through DFID will help meet some of the needs, but malaria control is a long-term challenge, and sustained external donor support will be critical to national malaria control programs’ continued progress.
- **Limited Global Supply of ACTs:** Since 2000, ACTs have become the treatment

of choice for malaria in most countries, resulting in a substantial increase in demand. The active ingredient in all artemisinin products is plant based, and although progress has been reported on chemical alternatives, no synthetic substitute is available. The long lead time for producing artemisinin products, combined with the upsurge in demand for ACTs, have resulted in a dynamic global ACT market. In response to this increased demand and uncertain supply, PMI is working with other major donors and host-country malaria programs, as well as a WHO ACT Taskforce, to identify and prioritize country needs.

PMI is working together with other partners to overcome these and other challenges in program implementation. With sustained funding for malaria control, we expect to see further advances in the fight against malaria in the coming years.



Arturo Sanabria/ST

Chapter I

Outcomes and Impact

Evidence is growing that the dramatic scale-up of malaria prevention and treatment interventions that has taken place over the past 5 to 10 years in sub-Saharan Africa is having a major impact on malaria illnesses and malaria-specific deaths. According to the World Health Organization (WHO) 2011 World Malaria Report, the estimated number of global malaria deaths fell from about 985,000 in 2000 to about 655,000 in 2010.

IMPACT IN PMI FOCUS COUNTRIES

Since last year's President's Malaria Initiative (PMI) Annual Report, nationwide household surveys providing information on mortality rates in children under five years of age were completed in four additional PMI focus countries. To date, a total of 11 of the original 15 PMI focus countries have data from paired nationwide household surveys, the first conducted about the time

PMI began activities in those countries and a follow-up survey conducted between 2008 and 2011. All 11 of these countries have seen a reduction in mortality rates in children under five years of age. The decline in under-five mortality rates ranged from 16 percent (**Malawi**) to 50 percent (**Rwanda**) (see Figure 1.1). PMI is in the process of evaluating the contribution of malaria control efforts to these declines in mortality, but there are strong indications that a substantial portion of the decline is due to malaria control. Follow-up surveys will be completed in the remaining four PMI focus countries within the next 12 months.

MEASURING PROGRESS: THE PMI TANZANIA EVALUATION OF IMPACT

Mainland **Tanzania** is the first PMI country to undergo an in-depth evaluation of the impact of malaria interventions on mortality in children. The evaluation was carried out

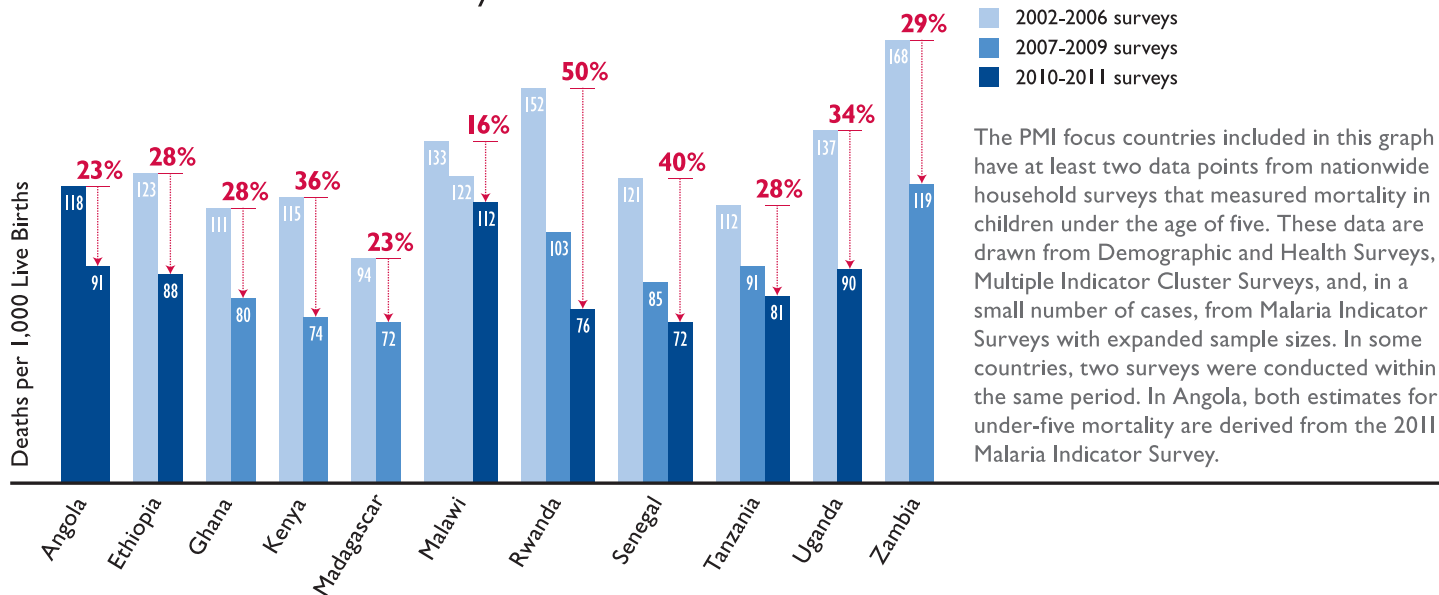
during 2011 in coordination with the Government of Tanzania, the Roll Back Malaria (RBM) Partnership, WHO, the Ifakara Health Institute, and several other national institutions and scientists.

Between 2000 and 2010, significant improvements in the survival of children under five years of age were recorded in Tanzania (see Figure 1.2). Under-five mortality fell from 148 per 1,000 live births in 1999 to 81 per 1,000 live births in 2010 – a remarkable decline of 45 percent. These reductions were also more pronounced in children living in rural areas, where the risk of malaria is much higher.

Early in the decade 2000–2010, major changes took place in malaria control policies in mainland Tanzania that should have resulted in significant reductions in malaria morbidity and mortality (see Figure 1.3). In

FIGURE 1.1

Reductions in All-Cause Mortality Rates of Children Under Five



The PMI focus countries included in this graph 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, in a small number of cases, from Malaria Indicator Surveys with expanded sample sizes. In some countries, two surveys were conducted within the same period. In Angola, both estimates for under-five mortality are derived from the 2011 Malaria Indicator Survey.

How PMI Evaluates the Health Impact of Malaria Control Efforts

PMI is required to report annually on the estimated impact of U.S. Government assistance on childhood mortality and morbidity from malaria in PMI's focus countries. PMI defines impact in the following two ways:

- Reductions in all-cause and malaria-specific mortality in children under five years of age.
- Reductions in malaria parasitemia and anemia (which has been shown to be closely associated with malaria infections) in children under five.

Accurate measurements of malaria-specific mortality in young children have proven to be impossible in sub-Saharan Africa for several reasons:

- National registration systems for births and deaths have low coverage.
- Many childhood deaths occur in the home without contact with the formal health system.
- The validity of reported causes of death is unknown.

Because of the lack of malaria-specific mortality data, another approach to evaluating the impact of malaria control interventions on under-five mortality must be used. The RBM Monitoring and Evaluation Reference Group, a working group of internationally recognized scientists and public health workers, recommends the following approach:

- Determine if all-cause under-five mortality has declined.
- Assess whether malaria control interventions have increased to a level at which impact can be expected.
- Determine if malaria morbidity (i.e., anemia or parasitemia) has fallen.
- Examine if alternate explanations for the mortality reductions exist.

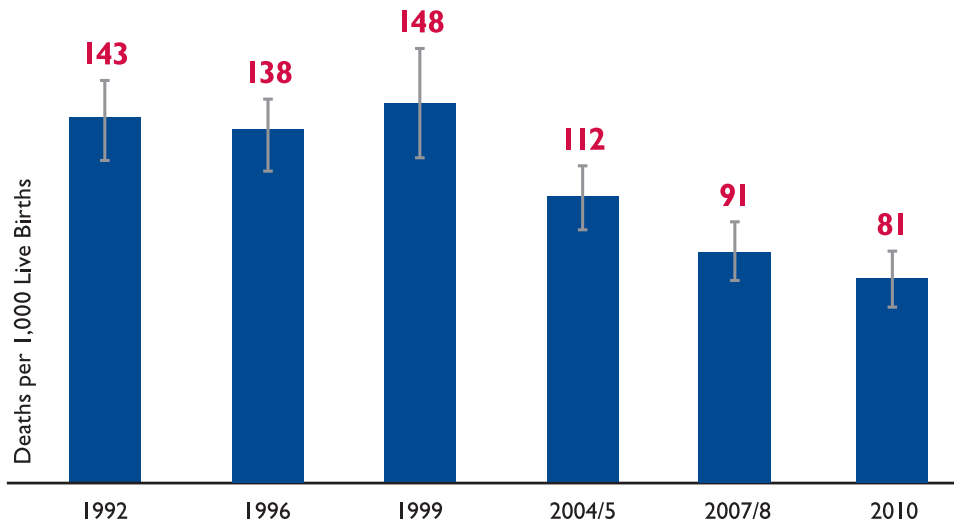
If the first three conditions are met and no other explanation for the reduction in all-cause, under-five mortality can be identified, or the fall in mortality can only be partially explained by other factors, then it is reasonable to conclude that malaria control interventions resulted in the reduction in all-cause child mortality.

PMI is working with national malaria control programs and other members of the RBM Partnership, including WHO; the United Nations Children's Fund; The Global Fund to Fight AIDS, Tuberculosis and Malaria; and nongovernmental organizations, to implement impact evaluations using this approach in all the 15 original PMI focus countries. Local research institutions and scientists are engaged wherever possible. PMI impact evaluations do not attempt to attribute results to any specific intervention or organization. Rather, the emphasis is on the overall impact that has been achieved by the national malaria control program and its partners.

2001, the first-line antimalarial drug changed from sulfadoxine-pyrimethamine, which was no longer effective, to highly effective artemisinin-based combination therapies. Intermittent preventive treatment for pregnant women was introduced in 2002, and large-scale distribution of insecticide-treated mosquito nets (ITNs) began in 2003–2004. Between 2007 and 2010, almost 19 million ITNs were distributed in mainland Tanzania. As a result, ownership of ITNs by households rose from 23 percent in 2004 to 63 percent in 2010, and use of ITNs by children under five years of age increased from 16 to 64 percent (see Figure 1.4). Although indoor residual spraying was implemented in certain areas where it undoubtedly had an effect on malaria morbidity and mortality, the geographic scope of the spraying was probably too limited to expect a significant impact at national level.

In addition to malaria cases, two of the main indicators for assessing malaria morbidity are the prevalence of malaria parasitemia and severe anemia in children under five. Although no national-level parasitemia rates are available, data from demographic surveillance sites and subnational surveys in Tanzania show declines in parasitemia rates in children under five years of age from a level of 18 to 25 percent in the early part of the decade to less than 5 percent in recent years. The prevalence of severe anemia (defined as hemoglobin less than 8g/dl), which is closely

FIGURE 1.2
All-Cause Under-Five Mortality in Tanzania (1992–2010)



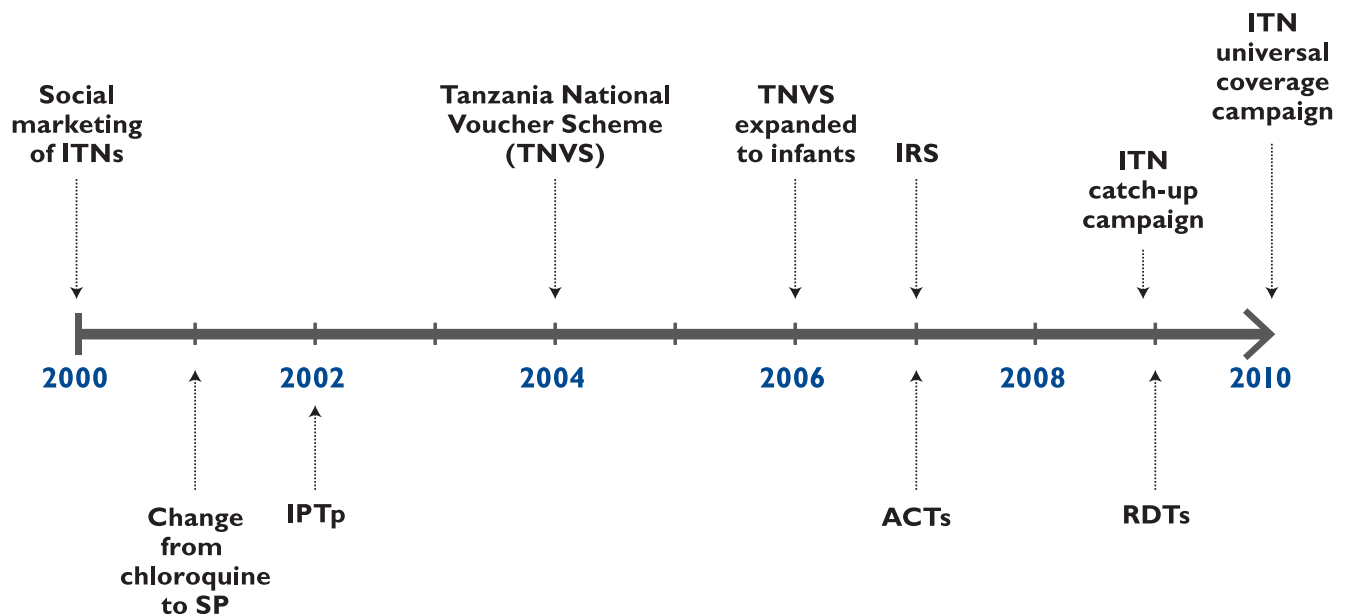
Source: Demographic and Health Surveys

associated with malaria, fell by 50 percent in children 6–59 months of age from 11 percent in 2004 to 6 percent in 2010 (see Figure 1.5). The conclusion that these reductions were associated with malaria control measures is supported by the observation that the greatest declines in both parasite and anemia prevalence were registered in rural areas and among children 6–23 months of age, where the risk of malaria morbidity is highest.

To rule out other potential explanations for the decline in under-five mortality between 2000 and 2010, health-associated contextual factors, such as vitamin A supplementation, immunizations, acute respiratory infections, diarrheal disease, breastfeeding, and nutrition, were assessed. Factors such as rainfall, changes in socioeconomic status, changes in gross domestic product, and others were also evaluated for their potential impact

on malaria morbidity and all-cause mortality. Rainfall did not appear to have had an effect on malaria morbidity. The rate of childhood immunizations did not change appreciably, and it does not appear that it played a significant role in further reducing mortality in children under five. In fact, of all the contextual factors examined, only vitamin A supplementation, increases in maternal education, and increases in per

FIGURE 1.3
Malaria Control Policy Milestones in Tanzania (2000–2010)



From the PMI External Evaluation Report:

The PMI team, including the Global Coordinator and Deputy, the technical leadership within the U.S. Government line agencies responsible (U.S. Agency for International Development [USAID] and U.S. Centers for Disease Control and Prevention [CDC]), the technical and administrative personnel in Washington, Atlanta, and the Missions, and the country implementation partners (national malaria control program [NMCP] personnel, partners, and PMI contractors) have done a remarkable job using the initial PEPFAR and subsequent Lantos-Hyde Authorization to make substantive and substantial contributions to the global malaria response over the past five years.

The use of the effective integrated package of malaria control interventions clearly contributed to the observed reduction of under-five mortality.

The full report and PMI's management response are available on the PMI website at http://www.pmi.gov/news/pressreleases/pmi_audit.html.

capita income showed improvements of sufficient magnitude to expect a reduction in mortality in children under five. Although these three factors could partially account for a reduction, they do not fully explain the decreases in mortality. Thus, after accounting for the potential impact of these contextual factors, evidence remains strong that a major proportion of the 45 percent reduction in mortality in children under five years of age can be attributed to the scale-up of malaria control interventions between 2000 and 2010.

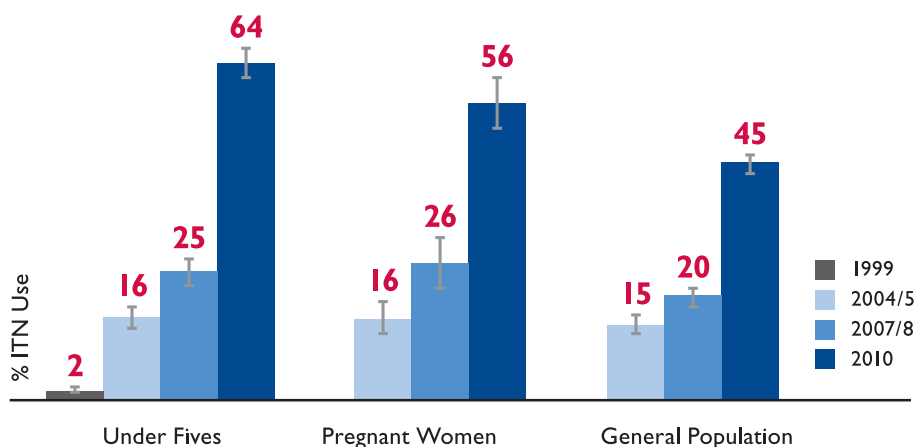
Confirmatory evidence that malaria control efforts played a major role in the reduction of all-cause under-five mortality comes from a modeling tool called the Lives Saved Tool. This model, used by WHO to assess the potential impact of different child health interventions on childhood mortality, calculates that the lives of at least 63,000 children under five years of age were saved between 2000 and 2010 as a result of the scale-up of malaria control interventions.

ECONOMIC IMPACT OF MALARIA

Malaria continues to place a heavy burden

on both families and national health systems in sub-Saharan Africa, and PMI is supporting several efforts to help quantify the economic impact of malaria. For example, a PMI-commissioned literature review of the economic impact of malaria in Africa found that the total household cost of an adult case of malaria is estimated to be about \$13. On average, a malaria infection costs a family more than three days of lost productivity. If this figure is extrapolated to the entire population of sub-Saharan Africa, it would amount to nearly 300 million days of lost productivity annually¹.

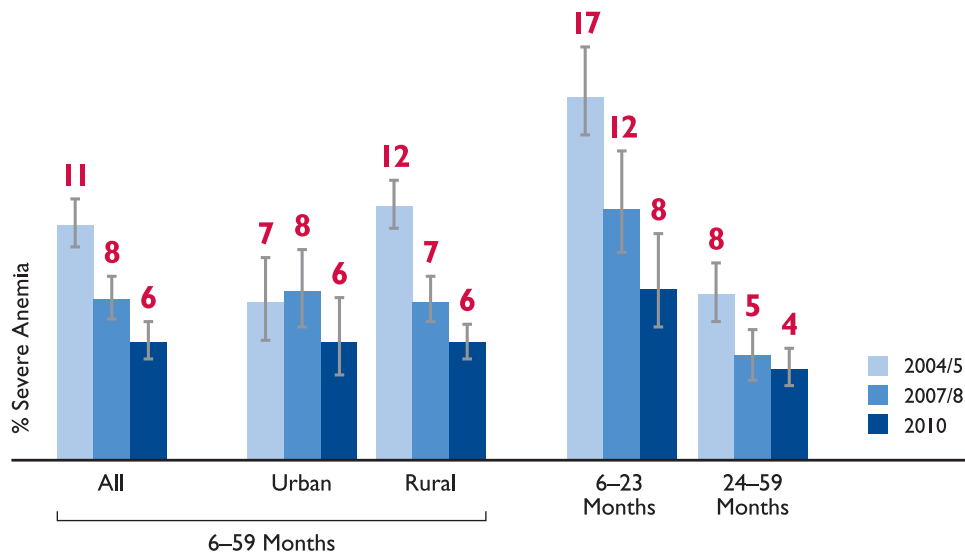
FIGURE I.4
ITN Use among Children Under Five Years of Age,
Pregnant Women, and the General Population in Tanzania (1999–2010)



Source: Demographic and Health Surveys

FIGURE 1.5

Prevalence of Severe Anemia in Children 6–59 Months of Age, by Residence and Age in Tanzania (2004–2010)



Source: Demographic and Health Surveys

SUMMARY

The Tanzania evaluation of impact provides strong evidence that malaria interventions in Tanzania have had a positive effect on reducing mortality among children under five years of age between 2000 and 2010. There are also indications that the scale-up of malaria interventions in other PMI focus

countries is contributing to a reduction in the mortality of children under five years of age. This is supported by WHO’s 2011 World Malaria Report and other reports and analyses. Evaluations of impact of malaria control in the 14 remaining PMI focus countries will be completed by 2014.

To access the complete Tanzania evaluation of impact report, please visit www.pmi.gov.

1 Based on McFarland DA, Njau JD and Staats C. 2012. Systematic review: Household economic burden of malaria. Bethesda, MD: Abt Associates Inc.



Most PMI countries use a variety of mass media and interpersonal communication interventions to promote malaria control and treatment. In Senegal, a group of women refer to a behavior change communication tool during their discussion about appropriate ITN use.

Credit: Maggie Hallahan Photography



Felicia Thompson/NetWorks

Chapter 2

Malaria Prevention

Malaria can be prevented with proven and cost-effective measures that include insecticide-treated mosquito nets (ITNs), indoor residual spraying (IRS) with insecticides, and intermittent preventive treatment for pregnant women (IPTp).

Prevention – Insecticide-Treated Mosquito Nets

ITNs, when used correctly and consistently, are a highly effective method of providing individual protection from malaria infection. ITNs not only provide a barrier between

the mosquito and the individual, but also the insecticide on the nets can repel, and in some cases kill, the mosquito. ITNs are now the primary means for malaria prevention worldwide. Research shows that high ownership and use of ITNs reduce all-cause mortality in children under five by about

PMI ITN SUMMARY

Indicator ¹	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)*	Cumulative
ITNs procured	1,047,393	5,210,432	6,481,827	15,160,302	18,592,039	23,254,496	59,706,489 procured ² (46,894,646 distributed)
ITNs procured by other donors and distributed with PMI support	–	369,900	1,287,624	2,966,011	10,856,994	19,307,756	31,035,352 ²

¹ The data reported in this table are up-to-date as of September 30, 2011, and include 17 PMI focus countries. In addition to these activities, more than 3.4 million ITNs have been distributed through PMI-supported voucher programs, and more than 5.4 million ITNs have been sold with PMI marketing support. For data by country, see Appendix 2.

² The cumulative count of ITNs procured and distributed takes into account the three-month overlap between Year 5 (covering the 2010 calendar year) and Year 6 (covering the 2011 fiscal year).

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

20 percent and malarial infections among children under five and pregnant women by up to 50 percent. In addition, high rates of ITN coverage (i.e., at least 65 percent) greatly reduce populations of mosquitoes that transmit malaria, providing a protective community effect that reduces the risk of malaria even among those not using an ITN.

PMI'S ITN STRATEGY

In a 2007 position statement, the World Health Organization (WHO) changed its recommended strategy from targeted coverage of long-lasting ITNs (i.e., children under five years of age and pregnant women) to universal coverage of the entire population at risk of malaria. Universal coverage is defined as one ITN per every two persons. The President's Malaria Initiative (PMI) strives to achieve universal coverage with long-lasting ITNs when this approach is in line with the country's strategy and adequate resources exist to achieve universal coverage across all populations at risk. In line with WHO recommendations, PMI only procures long-lasting ITNs. PMI's ITN strategy is based on the following three principles:

- Achieving universal coverage
- Sustaining universal coverage
- Ensuring that all distributed ITNs are used appropriately

ACHIEVING UNIVERSAL COVERAGE THROUGH MASS DISTRIBUTION CAMPAIGNS

Interventions to achieve universal coverage target whole communities, not just vulnerable subgroups. The aim is to provide equitable protection and to achieve a "community effect," whereby a high level of ITN coverage reduces malaria transmission in the nearby population. Mass distribution of free ITNs to all those at risk of malaria is an effective method for rapidly scaling up the use of long-lasting ITNs and for achieving high and equitable ITN coverage across economic strata. For example:

- In **Ghana**, PMI is a major partner in supporting long-lasting ITN mass distribution campaigns to achieve universal coverage. In fiscal year (FY) 2011, PMI procured more than 2.2 million long-lasting ITNs and covered most of the costs for their distribution in 2 of Ghana's 10 regions, protecting more than 4.6 million

residents. Ghana uses a door-to-door distribution approach that includes campaign volunteers who assist in hanging the nets in each recipient's home. An evaluation of the first campaign conducted in 2010 demonstrated that household ownership of at least one ITN increased from 27 to 82 percent and the proportion of children under five years of age who slept under an ITN the previous night rose from 11 percent to 52 percent in communities benefiting from the campaigns. PMI is also spearheading the redesign of Ghana's continuous ITN distribution system.

SUSTAINING UNIVERSAL COVERAGE

Mass campaigns alone are not enough to sustain universal coverage. Sustaining high net ownership requires a continuous input of ITNs into the community, both to keep pace with new members of the population and to replace worn out, damaged, or lost nets. Consequently, sustaining ITN coverage at levels that provide a community effect requires introduction of nets into the community on a continuous basis to all segments of the population. This is best accomplished through multiple distribution channels, including free delivery through health facilities and community-based approaches, as well as subsidized and commercially available nets. For example:

- In **Tanzania**, a total of 18.2 million nets were distributed nationally through universal coverage campaigns in 2010 and 2011. In addition, PMI procured another 530,000 long-lasting ITNs for infants to be distributed through the Tanzania National Voucher Scheme. This combination of approaches appears to be successful; a household survey conducted in FY 2011 in two districts showed household ownership of at least one ITN to be 96 percent, with 86 percent of reported sleeping spaces covered by long-lasting ITNs. ITN use was 82 percent for women of child-bearing age (15–49 years) and 84 percent for children under five years of age.

PROMOTING REGULAR USE

During the past six years, 11 PMI focus countries, where sufficient data are available, have reported an increase in household ownership of at least one ITN (see Figure 2.1) from an average of 32 percent to 61 percent. During the same time period, use of ITNs among children under the age of five has more than doubled from an average



USAID | DELIVER PROJECT

In Madagascar, PMI has partnered with other donors to distribute ITNs through a mass distribution campaign.

ITNs Protect Seasonal Workers in Madagascar

Mr. Ranaivo is a father of five children and migrant farmer working in Ambo-lomoty, in the western region of Boeny, Madagascar. This area attracts many seasonal workers from Madagascar's central highlands, where there is low malaria transmission. With their lack of immunity to malaria, the migrant workers are at higher risk of serious life-threatening infection. Mr. Ranaivo and his family moved here to farm rice paddies, and the small shelter where they sleep at night is open, exposing the family to the threat of malaria. Mr. Ranaivo knew of malaria and the risks to his family's health, but, until recently, he did not have the resources to protect his family.

Then, in November 2010, a free mass ITN distribution campaign, supported by PMI and launched in collaboration with other malaria technical and financial partners, provided the commune of Am-bolomoty with more than 6,000 mosquito nets. Distribution activities were combined with mass media campaigns and interpersonal communications to help people hang the nets and use them correctly. After receiving free nets through the campaign, Mr. Ranaivo says, "We now sleep peacefully at night and are in good health in the morning, so we can go to work and earn a little money."

FIGURE 2.1
Increasing ITN Ownership

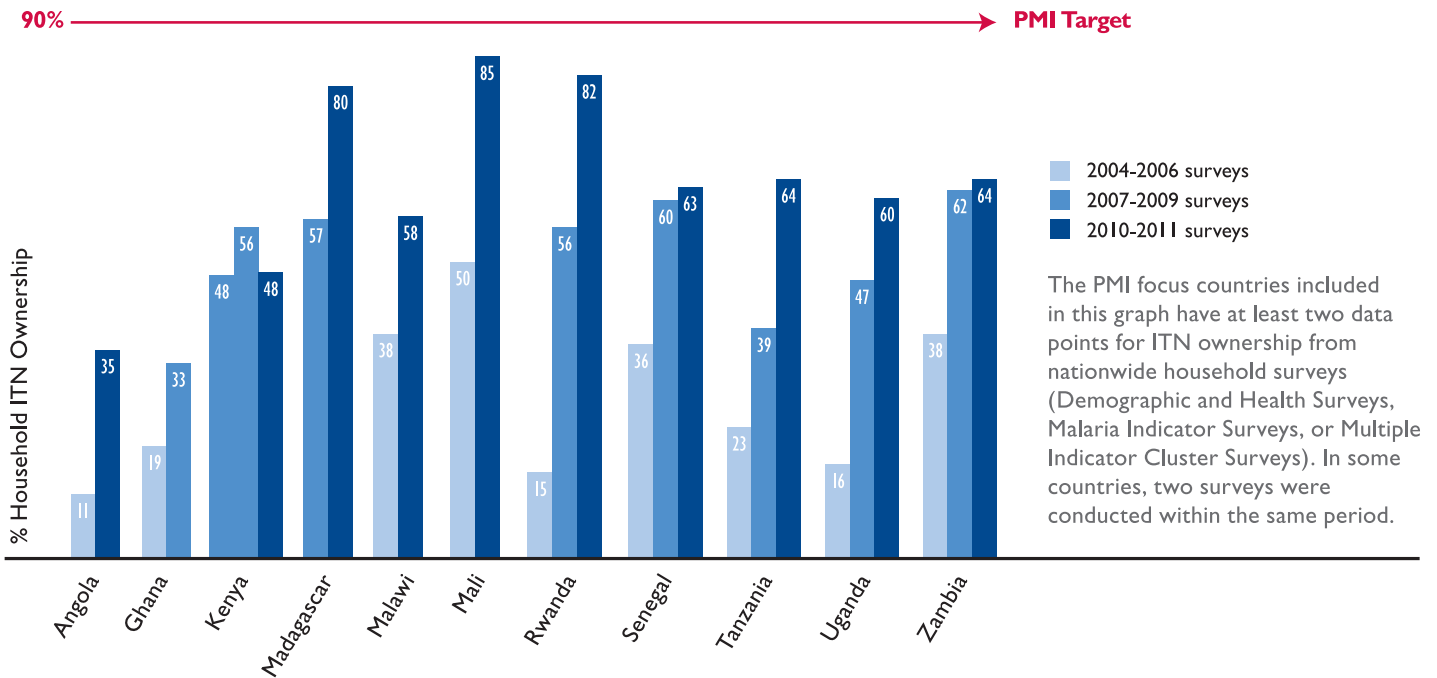
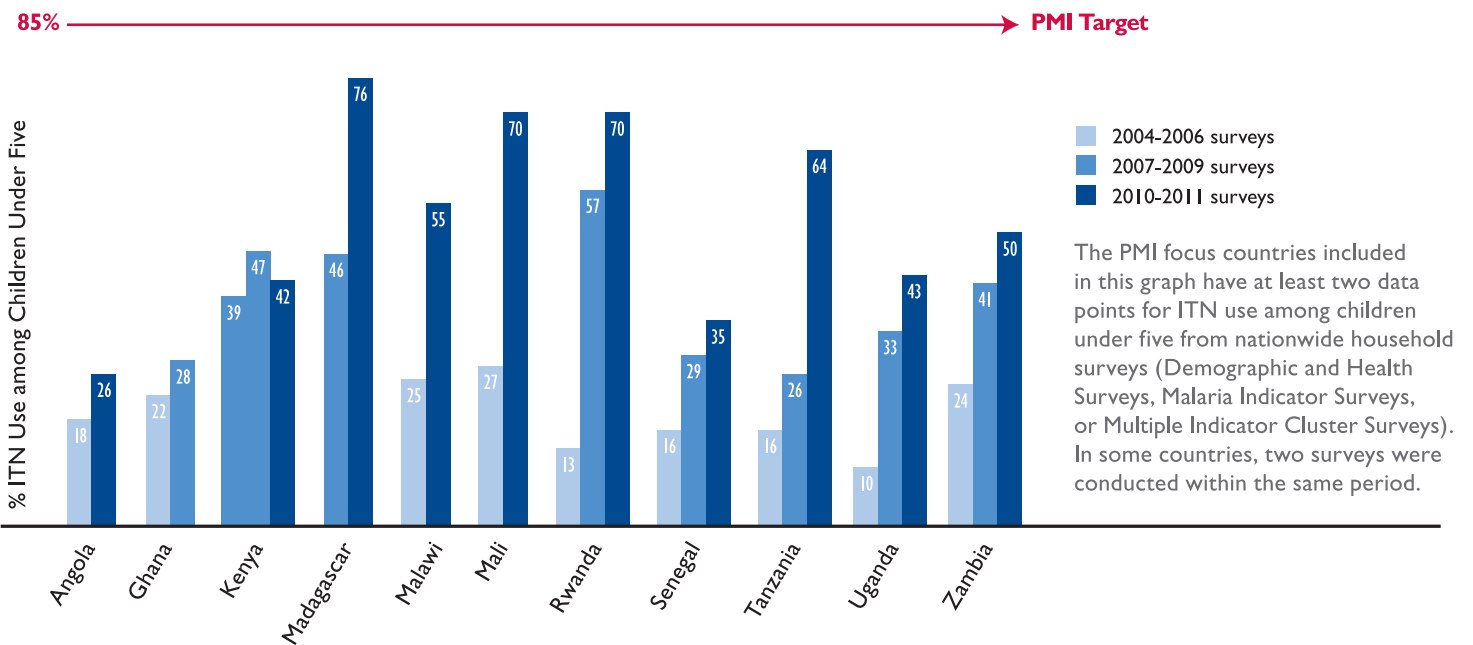


FIGURE 2.2
Increasing ITN Use among Children Under Five



of 23 percent to 51 percent (see Figure 2.2). Closing this gap between net ownership and use has been a priority in many PMI focus countries over the past several years, and the dramatic improvement in use among children under five years of age is an indication that these efforts are showing results. Most PMI focus countries use a range of mass

media and interpersonal communication interventions to promote net use. For example:

- With substantial numbers of long-lasting ITNs distributed to households and health centers in **Mali**, PMI promoted behavior change communication

(BCC) messages focused on improving awareness of malaria transmission and year-round net use. PMI supported these messages through delivery channels that included interpersonal activities conducted by community health workers at the household level, and mass media through regional and community radio



In Zambia, community radio stations play a crucial role in informing communities about ITN distribution and proper use.

Community Radio Creates Demand for ITNs in Zambia

“Almost 95 percent of information comes from us,” says Radio Mano Senior Programs Officer and host Paul Chileshe. Community radio stations, like Radio Mano in Kasama, Northern Province, have played an important role in disseminating information about the Zambian Government’s national ITN mass distribution campaign and creating demand for ITNs.

A PMI-funded communications project has supported the government to produce a radio public service announcement (PSA), as well as malaria and ITN fact sheets and posters. Radio Mano aired the PSA for one month following the launch of the campaign, and the broadcast helped create massive demand for ITNs among communities. Upon hearing the PSA, people who had not initially received ITNs clamored to find out when additional nets would be distributed. For those who already had nets, the PSA served as a reminder to sleep under them every night. Furthermore, a campaign fact sheet enhanced the radio hosts’ knowledge of malaria and ITNs. “[The fact sheet] was good because we had the information at our fingertips. Any questions that [the listeners] were asking us, we were able to give the feedback.”

spots and TV broadcasts at the national level. According to a 2010 survey, ITN use among children under five the previous night was 70 percent – up from 27 percent in 2006.

Prevention – Indoor Residual Spraying

IRS, one of the major tools used for malaria control, involves the spraying of interior walls of houses with insecticides. IRS works because female *Anopheles* mosquitoes tend to rest on indoor walls after a blood meal. IRS targets these mosquitoes, killing them before they have a chance to transmit malaria to others in the community. By shortening the lifespan and killing mosquitoes, IRS interrupts the malaria transmission cycle, thus providing community-level protection when at least 80 percent of houses in a targeted area are sprayed.

Over the past six years, PMI’s IRS program has focused on ensuring the timeliness and quality of IRS, combined with management of insecticide resistance, which poses a potential threat to successful IRS programs. PMI relies on entomologic data, often collected in partnership with national malaria control programs (NMCPs), local universities, and national research institutions, to assess program impact by monitoring vector densities and biting rates and to inform the process of selecting an insecticide. This evidence-based approach enables the selection of the correct class or classes of insecticide for each country, ensuring susceptibility of the local mosquitoes to the insecticide being used and efficacy of the selected insecticide throughout the peak malaria transmission season.

PMI’S IRS STRATEGY

IRS campaigns are logistically complex and challenging. To succeed, program managers must oversee a series of individual activities according to a precise timeline, including identifying appropriate spray locations; conducting environmental assessments; managing entomologic and environmental monitoring to select pesticides and confirm their impact on the vector; planning commodity procurement; organizing logistics, including transportation of supplies, equipment, and workers; training; coordinating mobilization and communication campaigns; and conducting the spraying and clean-up just as the rains and the malaria transmission season begin.

PMI’s IRS strategy is based on the following best practices:

- Personal and environmental protection
- Management of insecticide resistance
- Local capacity building for IRS
- Strategic communication and mobilization campaigns

SAFELY MANAGING INSECTICIDES

PMI-supported IRS activities comply with U.S. Government and international regulations regarding the safe transport, use, and disposal of insecticides. PMI builds capacity within ministries of health, agriculture and the environment to carry out environmental assessments and develop plans for the appropriate handling and safe use of insecticides throughout the supply chain. For example:

- The **Benin** IRS program partnered with the St. Jean de Dieu Hospital in Tangueta – located near the spray areas – for the safe incineration of insecticide exposed waste. The hospital management allowed the IRS program to use the hospital incinerator for waste incineration of 26,806 empty sachets of insecticide, 18,025 used respiratory masks, and 1,411 used pairs of gloves.
- In **Mozambique**, local residents are aware that the same pyrethroids being used for IRS also can be used to control pests in agriculture. However, intensive monitoring and supervision of the PMI-supported IRS program has deterred pilferage of insecticides and its misuse for other purposes. Supervisors from the district health offices routinely carry out random checks of spray operators to monitor progress of work and quality of spraying. At the end of each day of spraying, an audit of insecticides is also carried out to account for used insecticide. To date, all empty insecticide sachets have been fully accounted for, and IRS insecticides have not been observed for sale on the local market.

RESPONDING TO MALARIA INSECTICIDE RESISTANCE

Both IRS and ITN strategies focus on transmission inside the house and rely heavily on pyrethroid insecticides. The emergence and expansion of mosquito resistance to insecticide classes such as pyrethroids, as

Since its launch in Uganda in 2006, PMI has supported implementation of a high-quality IRS program in Northern Uganda's 10 districts, an area of intense malaria transmission. Two rounds of spraying are implemented each year, just prior to the peak malaria transmission seasons. In May 2011, the program successfully reached more than 95 percent of the 922,000 targeted houses, protecting more than 2.8 million residents.

During the first rounds of spraying, in 2007–2009, the IRS program primarily used pyrethroids, except in Apac District, where DDT was used for the first spray round. Apac District is known to have one of the highest number of infectious mosquito bites per person per year.¹ Despite multiple rounds of spraying, only modest decreases in the slide positivity rate were seen. After insecticide resistance surveillance demonstrated resistance to both DDT and pyrethroids, the program switched insecticide classes to carbamates (bendiocarb) for the 2010–2011 spray seasons. An analysis of health facility data at Aduku Health Center IV in Apac District showed a sharp decrease in malaria cases. After three rounds of spraying, slide positivity rates for malaria fell from 74 percent in August 2010 to 34 percent in August 2011 among children under five years of age and from 42 percent to 33 percent among those over five years of age. Similarly, reported malaria cases decreased significantly in St. Joseph's Hospital in Kitgum and Lacor Hospital in Gulu, where slide positivity rates for malaria dropped from 60 percent to 20 percent and from 38 percent to 5 percent after three consecutive spraying rounds, respectively. These results show not only the high effectiveness of IRS as a malaria control measure, but also the crucial need for IRS programs to monitor insecticide resistance so that changes in insecticides can be made in a timely manner.

¹ Okello PE, Van Bortel W, Byaruhanga AM, et al. 2006. Variation in malaria transmission intensity in seven sites throughout Uganda. *American Journal of Tropical Medicine and Hygiene*, 75:219-25

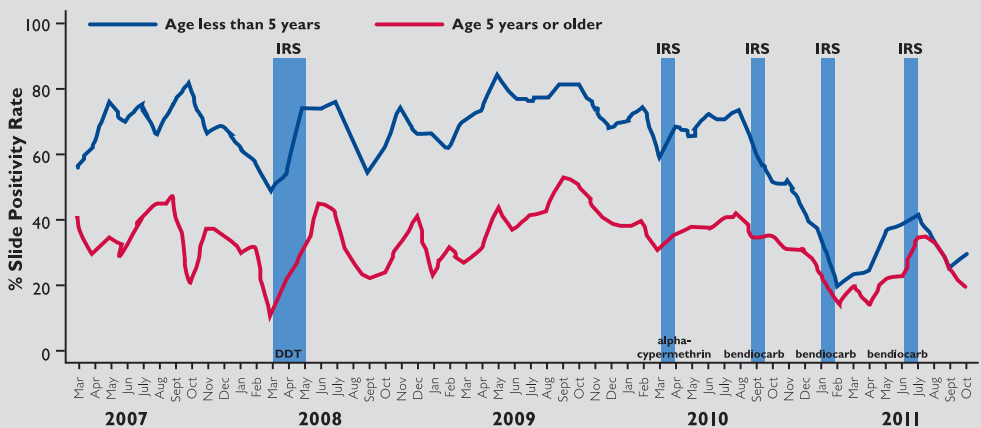
- In **Zambia**, PMI first reported vector resistance to DDT and pyrethroids in May 2010 in the Copperbelt Province, where these pesticides have been used for IRS since 2000. Based on insecticide susceptibility data from 25 locations in 17 districts, the program switched insecticide classes to carbamates and organophosphates for the 2011 spray season. In areas with high ITN coverage and some pyrethroid resistance, IRS was implemented using carbamates instead of pyrethroids. PMI is supporting the NMCP's resistance management program by funding an entomologist and helping draft an insecticide management plan. PMI engaged the Zambia Bureau of Standards to conduct DDT analysis of soil and crop samples and supported a senior chemist to train local laboratory staff in the procedures needed to monitor DDT levels in the environment. These data will serve as a baseline for any future use of DDT in Zambia.

BUILDING LOCAL CAPACITY

PMI builds local capacity for IRS through recruitment and training of local village and government health staff and private companies to implement and supervise IRS in their own communities. Furthermore, PMI introduces tools to assist with data collection and trains teams in use of these tools. For example:

- In FY 2011, PMI trained entomologists from **Nigeria, Senegal, and Tanzania** on the use and interpretation of the U.S. Centers for Disease Control and Prevention (CDC) bottle bioassay for insecticide resistance monitoring. In addition, entomologists from **Kenya and Zambia** were trained to use biochemical and molecular methods to detect insecticide resistance.
- In **Ethiopia**, PMI strengthened capacity in districts where IRS had been supported by PMI in previous years so financial and management responsibility for spraying could be turned over to local authorities. Through this “IRS district graduation” approach, PMI was able to expand support for IRS to 20 new districts. In FY 2011, the process of graduation began in 24 of 50 districts where PMI has been supporting IRS.

Malaria Cases - Aduku Health Center IV, Apac District (2007-2011)



well as the higher expense of alternative insecticides, pose a threat to both IRS and ITN programs across Africa. In response to this challenge, PMI builds capacity within national programs to rigorously monitor

insecticide resistance and conduct entomologic assessments and works with other agencies and partners to manage insecticide resistance. For example:

PMI IRS SUMMARY

Indicator ^{1,2}	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)*
People protected by IRS	2,097,056	18,827,709	25,157,408	26,965,164	27,199,063	28,344,173
Spray personnel trained ³	1,336	13,795	19,077	21,664	30,545	26,038
Houses sprayed	414,456	4,353,747	6,101,271	6,656,524	6,693,218	7,004,903

1 The data reported in this table are up-to-date as of September 30, 2011, and include 15 PMI focus countries (no IRS was carried out in DRC, Guinea, Nigeria, and Zimbabwe). For data by country, see Appendix 2.

2 A cumulative count of the number of people protected, personnel trained, and houses sprayed is not provided because many areas have been sprayed on more than one occasion.

3 Spray personnel are defined as spray operators, supervisors, and ancillary personnel. These calculations do not include many people trained to educate residents about IRS and carry out community mobilization around IRS campaigns.

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

USING COMMUNICATIONS TO MOBILIZE COMMUNITIES

PMI works with NMCPs and local authorities to use BCC strategies to educate residents about IRS and foster cooperation with the spray teams. For example:

- In five districts of **Rwanda**, PMI supported an IRS campaign that protected more than 1.5 million people in FY 2011. While the campaign was successful, some households initially refused IRS, citing misconceptions and misunderstandings, such as the belief that IRS spraying brought fleas. To address these concerns, BCC teams engaged local authorities to educate communities so the vast majority of targeted households accepted IRS. The chief of Sharita Village in Rweru sector led by example by publicly allowing his own house to be sprayed and walking door-to-door to encourage others to do the same.

Prevention – Malaria in Pregnancy

Malaria presents a serious threat to pregnant women, fetuses, and newborns in Africa. The risks of malaria in pregnancy include maternal anemia, miscarriage, stillbirth, and low birth weight in newborns, which increases the risk of infant death. The fetus is endangered when malaria parasites infect the placenta. In newborns, malaria may account for up to 30 percent of preventable low birth weight in sub-Saharan Africa and may account for as many as 200,000 infant deaths a year.

PMI'S MALARIA IN PREGNANCY STRATEGY

PMI's strategy reflects WHO's recommended multipronged approach for managing malaria in pregnancy. This entails distribution of ITNs, IPTp, prompt diagnosis and effective treatment of confirmed malaria cases, and prevention and treatment of maternal anemia.

IPTp reduces the serious consequences of malaria during pregnancy, especially in a woman's first and second pregnancies when the risk of malaria-related complications is much higher. It involves the administration of two or more doses of sulfadoxine-pyrimethamine (SP), an antimalarial drug, provided at antenatal visits after quickening (i.e., first fetal movement), at least one month apart. Since focused antenatal care (FANC) guidance recommends three antenatal care visits after quickening, pregnant women without associated health problems who follow these recommendations ideally should receive three doses of IPTp during their routine antenatal visits under direct observation by a health care worker.

FANC, an important component of PMI's strategy for malaria in pregnancy, is a comprehensive package of antenatal care services. FANC strives to ensure healthy pregnancies by identifying pre-existing health conditions; detecting complications early; promoting health and disease prevention, including IPTp and ITNs; and preparing for birth and planning for possible complications.

Across all focus countries, PMI works to prevent malaria in pregnancy by:

- Training health workers in IPTp and focused antenatal care
- Integrating malaria activities with maternal and child health and HIV/AIDS programs
- Supporting BCC
- Strengthening supply chain management systems to procure and distribute essential commodities for both IPTp and treatment
- Conducting operations research to improve programming



Spray team members in Ghana carefully clean their equipment. PMI-supported IRS activities comply with regulations regarding the safe use and disposal of insecticides.

Credit: Scott Torres/RTI International

PMI MALARIA IN PREGNANCY SUMMARY

Indicator ¹	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)*	Cumulative
SP treatments procured ²	—	583,333	1,784,999	1,657,998	6,264,752	4,701,162	13,794,245 procured ³ (12,137,287 distributed)
Health workers trained in IPTp ⁴	1,994	3,153	12,557	14,015	14,146	28,872	N/A ⁵

¹ The data reported in this table are up-to-date as of September 30, 2011, and include only those PMI focus countries that have data to report for this indicator.

² In most countries, national governments and other donors meet SP needs for IPTp.

³ The cumulative count of treatments procured and distributed takes into account the three-month overlap between Year 5 (covering the 2010 calendar year) and Year 6 (covering the 2011 fiscal year).

⁴ IPTp is usually given as part of the FANC package of services.

⁵ A cumulative count of health workers trained is not provided because some health workers have been trained on more than one occasion.

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

TRAINING HEALTH CARE WORKERS

PMI collaborates with NMCPs, reproductive and maternal and child health divisions of ministries of health, and other partners to train health care workers to provide FANC and to prevent, diagnose, and treat malaria in pregnant women. For example:

- In **Ghana**, in FY 2011, PMI supported the Ghana Health Services to train 6,584 health workers in prevention of malaria in pregnancy with a focused malaria training curriculum. An additional 929 health facility workers were trained through an integrated maternal and child health, reproductive health, and malaria prevention program. These in-service trainings have now covered all 10 regions of the country. PMI also supported a project that integrates maternal and child health, reproductive health, HIV/AIDS, and malaria resources to educate tutors and preceptors at 13 midwifery and community health nursing schools to increase their competencies in diverse health service skills, including newborn resuscitation, IPTp, and use of malaria rapid diagnostic tests (RDTs).
- To improve health care provider practices in **Kenya**, in FY 2011, PMI supported the Ministry of Health in rolling out malaria in pregnancy guidelines to health workers in the malaria-endemic regions of the country. These guidelines are consistent with current WHO recommendations. In preparation for the roll-out of the guidelines, 381 malaria focal persons and

102 clinical mentors were trained to carry out cascade training on the messages in order to increase IPTp uptake. To date, 1,386 health workers have been sensitized on the messages. It is anticipated that these guidelines will lead to an increase of IPTp2 rates from the 25 percent reported in the 2010 Malaria Indicator Survey (see Figure 2.4 for a definition of IPTp2).

INTEGRATING MALARIA ACTIVITIES WITH MATERNAL HEALTH AND HIV/AIDS PROGRAMS

In line with Global Health Initiative principles, PMI has collaborated with partners and supported activities to prevent and treat malaria in pregnancy within the context of maternal and child health services and HIV/AIDS programs. In 2011, for example:

- In **Rwanda**, the Ministry of Health, with the support of PMI and other partners, continues to improve the quality of FANC services at health facilities. PMI supported integrated FANC training in 9 of the country's 30 districts, with the training of 225 providers in district hospitals and health centers. In collaboration with U.S. President's Emergency Plan for AIDS Relief, PMI assisted the Ministry of Health to develop and revise training materials for strengthening integrated antenatal care services, including FANC, prevention of mother-to-child transmission of HIV, nutrition education, and promotion of breastfeeding and family planning. PMI also supported trainings and commodity procurements to scale

up and strengthen the role of community health workers in malaria in pregnancy.

MALARIA IN PREGNANCY COVERAGE

While ITN use among pregnant women has steadily increased in most of the PMI focus countries from an average of 21 percent to 47 percent (see Figure 2.3), there has been less progress achieved with IPTp coverage



A nurse in Malawi gives a pregnant woman a cup of clean drinking water and directly observes as she swallows a dose of SP during her antenatal care visit.

Credit: Aleisha Monique Rosario/Jhpiego

FIGURE 2.3
Increasing ITN Use among Pregnant Women

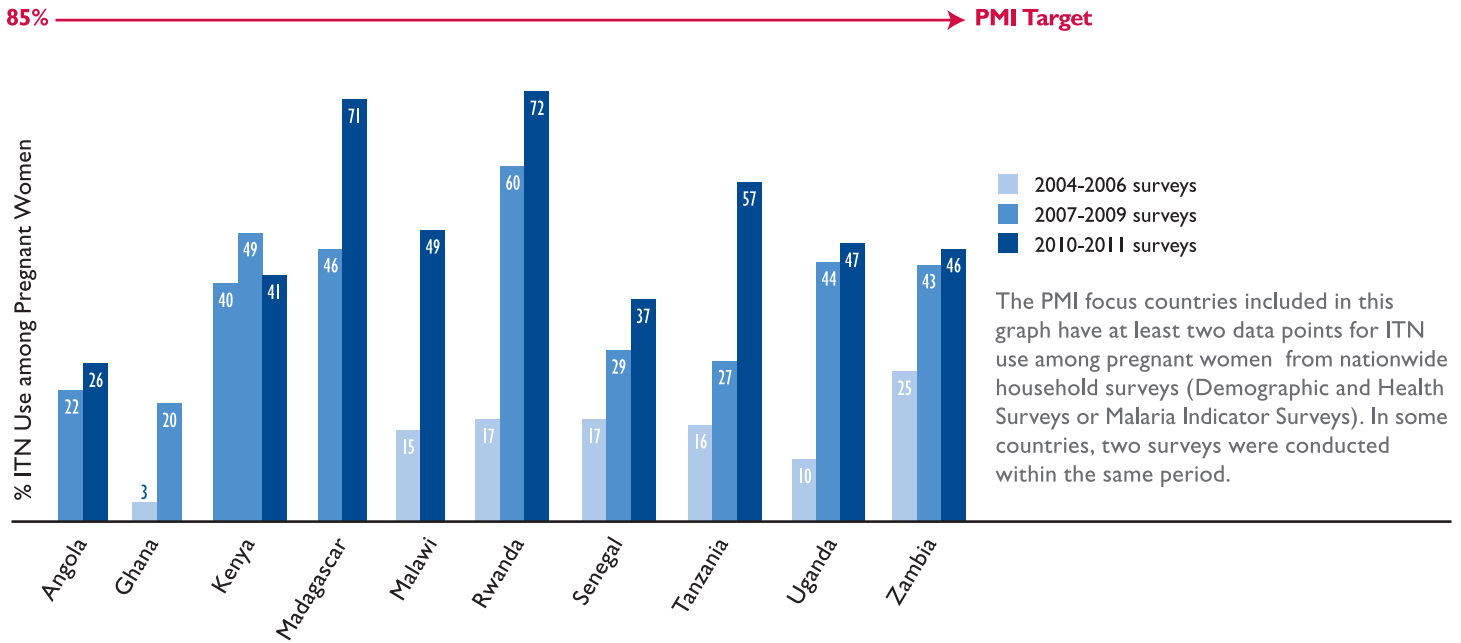
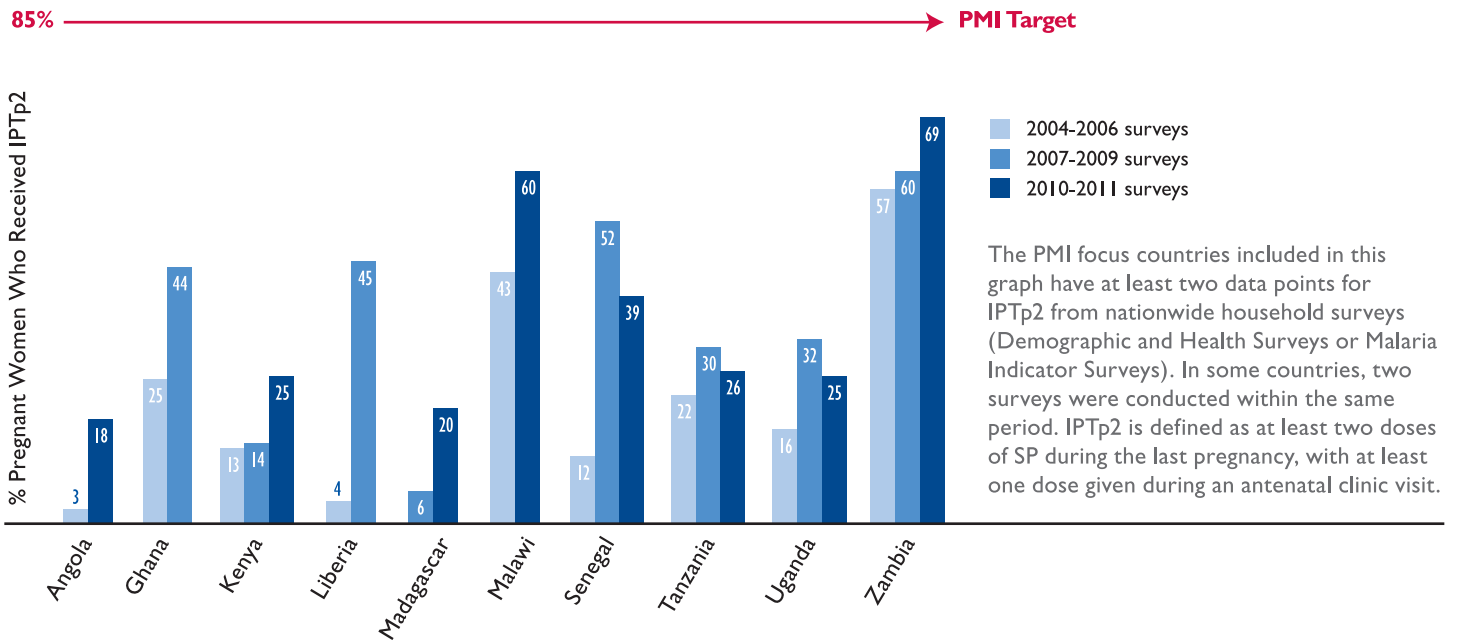


FIGURE 2.4
Increasing IPTp2 Rates



rates (see Figure 2.4). PMI agrees with the External Evaluation’s observation that coverage rates achieved for IPTp have been disappointingly low and recognizes the need for greater country-level collaboration between malaria and reproductive health programs

to improve antenatal care. In response, PMI has established an interagency working group to address operational and behavioral constraints to improving IPTp rates, particularly targeting countries where IPTp rates appear to have recently decreased.

SUPPORTING BEHAVIOR CHANGE COMMUNICATION

PMI supports BCC at the community level to promote early attendance at antenatal clinics, acceptance of IPTp, regular use of ITNs, and to overcome community and

ITN use is part of a multipronged approach for managing malaria in pregnancy. This Tanzanian mother, cradling her newborn, received a free ITN through the Under 5 Catch-Up Campaign, which was jointly funded by PMI, the Global Fund, and the World Bank.

Credit: Dan Albrecht/CDC



cultural barriers that could prevent pregnant women from accessing malaria prevention and treatment services. For example:

- To promote the uptake of at least two doses of SP to prevent malaria during pregnancy in **Mali**, PMI supported intensive BCC activities in FY 2011. These activities focused on promoting early attendance at antenatal care clinics through community health workers, religious and community leaders, and local radio stations. These activities appear to be having a positive effect, as health facility data indicate Mali is on track to significantly increase the coverage of IPTp.

STRENGTHENING SUPPLY CHAIN MANAGEMENT SYSTEMS

PMI supports supply chain strengthening in order to ensure availability of all commodities needed to prevent and treat malaria in pregnant women (see Health Systems Strengthening and Integration chapter, page 27). For example:

- To increase the proportion of pregnant women receiving the recommended two doses of SP in **Uganda**, PMI complemented the Ministry of Health's ongoing public sector efforts by increasing access to appropriate IPTp through the private sector. PMI trained more than 5,300 private sector health workers on IPTp administration and procured and distributed 80,000 SP treatments through private sector partners, with the private companies matching PMI contributions. In addition, more than 1 million artemisinin-based combination therapy treatments and more than 1 million RDTs were procured and distributed through private-not-for-profit supply chains and facilities that provide more than 40 percent of health services in Uganda. This support strengthens alternative private sector supply chain systems and provides quality care to more than 50 percent of the fever cases that access care through the private sector in Uganda.



Maggie Halatun Photography

Chapter 3

Malaria Diagnosis and Treatment

Although the World Health Organization (WHO) reports that the estimated number of malaria deaths has fallen by almost one-third since 2000, the burden of malaria in most countries in sub-Saharan Africa, and particularly among children under five years of age, remains unacceptably high. Compared to the success in scaling up insecticide-treated mosquito nets (ITNs) and indoor residual spraying (IRS), progress in expanding effective case management for malaria has been slower. This is probably due, in large part, to the fact that programs to diagnose and treat persons with malaria have to depend on the weak health systems that exist in the region. In addition, it has taken time for countries to adopt new guidance issued by WHO in 2010, which calls for universal diagnostic testing for malaria and reserving antimalarial treatment for those with a positive diagnostic test.

Since its launch in 2005, the President's Malaria Initiative (PMI) has worked closely with ministries of health and nongovernmental partners to scale up malaria case management. PMI supports all essential elements of a comprehensive program to diagnose and treat patients appropriately for malaria, including:

- Development of updated diagnosis and treatment policies, guidelines, and training and supervision curricula
- Procurement and distribution of essential commodities and equipment, including artemisinin-based combination therapies (ACTs), microscopes, and rapid diagnostic tests (RDTs)
- Training and supervision of health workers at all levels, including in the community

- Strengthening and building the capacity of health systems to improve patients' access to high-quality care and ensure an uninterrupted supply of drugs and diagnostic tests

PMI'S CASE MANAGEMENT STRATEGY

Effective case management of malaria entails early, accurate diagnosis and rapid treatment with an efficacious antimalarial drug. Thus, PMI's strategy focuses on universal diagnostic testing and appropriate treatment with ACTs, as well as community case management of malaria. PMI also supports routine monitoring of the efficacy of antimalarial drugs.

UNIVERSAL DIAGNOSTIC TESTING

Even before WHO updated its guidance in 2010 to recommend universal diagnostic testing for malaria, PMI was supporting the scale-up of high-quality diagnostic test-

PMI DIAGNOSIS AND TREATMENT SUMMARY

Indicator ¹	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)*	Cumulative
RDTs procured	1,004,875	2,082,600	2,429,000	6,254,000	13,340,910	14,572,510	33,581,385 procured ² (24,377,490 distributed)
Health workers trained in malaria diagnosis (RDTs and/or microscopy)	–	1,370	1,663	2,856	17,335	34,740	N/A ³
ACT treatments procured	1,229,550	8,851,820	22,354,139	21,833,155	41,048,295	38,588,220	116,822,629 procured ² (92,864,575 distributed)
ACT treatments procured by other donors and distributed with PMI support	–	8,709,140	112,330	8,855,401	3,536,554	6,993,809	27,142,034 ²
Health workers trained in treatment with ACTs	8,344	20,864	35,397	41,273	36,458	42,183	N/A ³

¹ The data reported in this table are up-to-date as of September 30, 2011, and include 17 PMI focus countries. For data by country, see Appendix 2.

² The cumulative count of RDTs and treatments procured and distributed takes into account the three-month overlap between Year 5 (covering the 2010 calendar year) and Year 6 (covering the 2011 fiscal year).

³ A cumulative count of health workers trained is not provided because some health workers have been trained on more than one occasion.

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

ing for malaria with both microscopy and RDTs. This support has included procurement of RDTs, microscopes, and laboratory supplies; revision and dissemination of national malaria diagnostic policies and tools; strengthening of quality assurance

programs; and training and supervision of laboratory technicians and clinicians. Examples of PMI's work related to malaria diagnosis in 2011 include the following:

- In **Ghana**, quality assurance activities for malaria microscopy have been scaled up, with 917 outreach training and supportive supervision visits conducted at 302 laboratories. During these visits, 2,512 laboratory staff and 264 clinical staff received training. On average, participating facilities performed 85 percent of malaria microscopy steps according to protocol.
- In **Malawi**, PMI is supporting the establishment of quality assurance/quality control procedures for diagnosis of malaria. To date, 54 percent of health facilities with laboratories have been enrolled in the quality assurance program. In preparation for a roll-out of malaria RDTs, an implementation plan was developed with partners and 4,000 copies of a standardized laboratory register for malaria for both microscopy and RDT results were disseminated nationally. In addition, in all 29 health districts in the

country, laboratory supervisors received refresher training in malaria diagnostics, based on microscopy competency assessment, and clinical supervisors received refresher training in clinical diagnosis.

CORRECT TREATMENT WITH ACTS

PMI has worked with national malaria control programs (NMCPs) to update their malaria diagnostic and/or treatment policies, guidelines, and training materials; procured drugs for treatment of both uncomplicated and severe malaria; provided technical and financial assistance to improve the capacity of the logistics systems to deliver an uninterrupted supply of drugs to front-line health providers; supported the training and supervision of health workers in correct treatment practices; and monitored the therapeutic efficacy of current first-line treatments for malaria.

- In **Mali**, for example, PMI supported training and supervision on malaria case management in health facilities nationwide. Supervisory visits that focused on health provider compliance to standards were conducted in the regions of Bama-



A patient with suspected malaria is seen by a private provider and referred to a health facility in Pailin, Cambodia.

Credit: URC

ko, Koulikoro, and Sikasso, reaching 286 health centers and 1,596 health providers. Additionally, 225 health workers, including nurses, physicians and midwives, have been trained on malaria case management in the northern regions of Gao, Kidal, and Tombouctou.

- In Oromia Regional State in **Ethiopia**, with the implementation of RDTs for diagnosis of malaria, the annual consumption of ACTs has dropped from more than 5 million treatments in 2009 to approximately 800,000 in 2011.

INTEGRATED COMMUNITY CASE MANAGEMENT

In efforts to reach those communities with limited access to care, most PMI focus countries have adopted strategies to provide treatment for malaria, pneumonia, and diarrhea (the three leading killers of African children) at the community level. This approach, called integrated community case management (iCCM), extends the reach of public health services to communities, particularly in remote rural areas, using a cadre of trained community health workers, equipped with standardized treatment algorithms. In collaboration with the U.S. Agency for International Development (USAID) maternal and child health program, PMI supports iCCM introduction and scale-up in nearly all focus countries, supporting train-

ing and supervision of community health workers, development and maintenance of supply chains down to the community level, and design and implementation of systems for monitoring, reporting, and evaluation. Examples of progress in this area during 2011 include:

- In **Rwanda**, the Ministry of Health has made significant progress in scaling up iCCM throughout the country. All 11 PMI-supported districts where only home-based management of malaria had been implemented have completed the conversion to iCCM. PMI procured and distributed 46,000 malaria RDTs for use at the community level in these 11 districts. To date, 9,100 community health workers have been trained and received medical supplies with PMI support. In 2011, more than 235,000 children – or 54 percent of all malaria cases, according to Ministry of Health statistics – were treated for fever by these community health workers.
- In **Malawi**, PMI, in collaboration with USAID's Child Health program, expanded its support for iCCM in four additional districts to reach a total of 11 of the country's 28 districts. Support for scale-up of iCCM includes procurement and distribution of ACTs, training and supervisory support to community health workers,



Joana Rosário, The MENTOR Initiative

Expanding Access to Malaria Treatment through Private Pharmacies in Angola

In Angola, PMI has funded a pilot of the sale of a subsidized ACT, artemether-lumefantrine, under the brand name *Coartem® é fixe* (Coartem is cool) through private pharmacies. The three-year program, run in cooperation with the Ministry of Health, the NMCP, and the local association of private pharmacists, involved 95 percent of private pharmacies in two municipalities of Huambo Province. The aim of the project was to increase availability and use of quality-assured ACTs and reduce the price of ACTs while increasing the share of the market that ACTs occupy. At the start of the project, ACTs in private pharmacies in the project area were prohibitively expensive (\$20–\$40 per treatment) due to a lack of competition and low demand. The price of the branded Coartem® in those pharmacies taking part in the pilot was only \$0.75 per treatment.

During the past year, more than 1 million ACT treatments procured by PMI were distributed through Huambo's private pharmacies for the treatment of malaria in children under five years of age. The provision of ACTs was accompanied with training for pharmacy staff dispensing the antimalarials, monthly monitoring and supervision visits to every participating pharmacy, and marketing and education activities in surrounding communities. Sales data show an impressive increase in the market share of ACTs for the treatment of uncomplicated malaria from 4 percent in July 2009 to 86 percent in July 2011. Over the same period, sales of oral artemisinin monotherapies, which are not recommended for use in malaria treatment, declined from 38 to 7 percent as did sales of non-artemisinin therapies (from 58 to 6 percent).

Responding to a Dynamic Global ACT Market

Since 2000, ACTs have become the treatment of choice for malaria in most countries. At present, five different ACT products are recommended for uncomplicated falciparum malaria by WHO, as well as intravenous artesunate for severe malaria. This has resulted in a substantial, but predictable, increase in demand. In addition, demand in the private sector has significantly increased in recent years, creating a challenge for donors to meet ACT public sector needs in a timely manner.

The active ingredient in all artemisinin products is plant-based, and although progress has been reported on chemical alternatives, no synthetic substitute is available. The lead time for producing artemisinin products – from planting the crop to manufacturing a finished pharmaceutical product – is about 14 months. The many variables surrounding a successful harvest and manufacturers' capacity, combined with the upsurge in demand for ACTs, have resulted in a highly dynamic and complex global ACT market.

In response to this increased demand and uncertain supply, PMI is working with other major donors and host-country malaria programs, as well as a WHO ACT Taskforce, to identify and prioritize country needs. This effort, in concert with ongoing communication with ACT manufacturers, has resulted in 12-month rolling forecasts for all ACT needs in PMI focus countries. PMI is also promoting rational use of ACTs through improved diagnostic capacity, helping to ensure that, where RDT or microscopic diagnosis is available, ACTs are used only for test-positive cases.



A health extension worker shows a job aid about correct ITN hang-up and use to the district health officer at a health post in Oromia Regional State, Ethiopia.

Ensuring that Malaria Services Are Available at Community Level: Ethiopia's Health Extension Program

In 2004, Ethiopia's Federal Ministry of Health launched the Health Extension Program, which extends primary health care beyond the district level, making it more accessible to the population in each municipality (*kebele*) of the country. At the core of the program are health extension workers (HEWs), who are primarily women. The U.S. President's Emergency Plan for AIDS Relief, USAID's Maternal and Child Health and Reproductive Health programs, and The Global Fund to Fight AIDS, Tuberculosis and Malaria supported the training and equipping of two HEWs for each rural village with a population of 5,000 or more. HEWs are implementing a package of 17 health services, including immunization, family planning, reproductive health, and malaria. HEWs are equipped with RDTs and antimalarial drugs to diagnose and treat malaria and also participate in ITN distribution campaigns and IRS operations at the community level.

PMI has supported the Health Extension Program since 2007 through the procurement of RDTs, antimalarial drugs, and long-lasting ITNs, and through support for IRS operations, HEW training, and iCCM. The establishment of the Health Extension Program has had a dramatic effect on improving malaria case management in Ethiopia by improving prompt access to malaria interventions and services among rural populations. According to the 2011 Demographic and Health Survey, all-cause under-five mortality has been reduced by 28 percent since 2005. The scale-up of the Health Extension Program and the construction and equipping of rural health care facilities have been among the most significant new public health interventions implemented in Ethiopia between 2005 and 2010.

and support for case reporting. As a result of this scale-up, village health clinics in these 11 districts provided care to 163,800 children under five years of age.

- Under the leadership of the Ministry of Health, the **Democratic Republic of the Congo** has successfully implemented iCCM since December 2005. As of September 2010, iCCM-trained community health workers were providing services at 716 community sites, covering approximately 1.7 million people, of which USAID has supported 345 sites. With five years of experience, PMI is now leveraging existing maternal and child health and reproductive health/family planning resources to further scale up iCCM beyond the currently supported community care sites, to 450 sites in 80 health zones.

THERAPEUTIC EFFICACY STUDIES

Because artemisinin resistance has been reported in Southeast Asia – and would represent a severe setback to malaria control efforts in sub-Saharan Africa, should it appear there as well – routine monitoring of the efficacy of antimalarial drugs is a high priority. PMI is supporting therapeutic efficacy studies for current first-line malaria treatments in nearly all PMI focus countries in Africa and all six countries in the Greater Mekong Subregion. All countries are conducting therapeutic efficacy studies in line with WHO guidelines, and data are being reviewed regularly in each country and added to WHO's Global Malaria Programme database. In the Greater Mekong Subregion, PMI supports a regional network of therapeutic efficacy studies at 35 sites across the six countries. Along with testing the current first-line antimalarial drug, the network tests potential alternatives every two years to inform national treatment guidelines.



Hamisu Hassan/ USAID IDELIVER PROJECT

Chapter 4

Health Systems Strengthening and Integration

Across all President’s Malaria Initiative (PMI) focus countries, weak health systems and limited capacity at the central, district, and peripheral levels are major constraints to the planning, implementation, and sustainability of malaria control efforts. PMI considers capacity building for the broad range of activities that national malaria control programs (NMCPs) are responsible for to be an integral part of strengthening national health systems. Wherever practical, PMI implements its malaria control activities together with other major health programs, particularly those for maternal and child health, routine immunization, HIV/AIDS, tuberculosis, and other vector-borne diseases. PMI focuses on the following areas:

- Strengthening health information systems
- Building leadership and technical capacity in NMCPs

- Linking and integrating malaria and maternal and child health services
- Supporting pharmaceutical and supply chain management
- Improving laboratory diagnostic services

INFORMATION SYSTEMS AND USE OF DATA FOR DECISION MAKING

All NMCPs need to collect and use information on the progress of their programs and make informed decisions about how to adjust their activities. PMI supports NMCPs by providing technical assistance, training, computers, and software, and, in some cases, seconding staff with monitoring and evaluation (M&E) expertise to work in NMCP offices. For example, during fiscal year (FY) 2011, PMI supported information systems in the following ways:

- From 2009 to 2011, PMI supported a

monitoring and evaluation advisor, who was seconded to the **Uganda** NMCP to provide on-the-job training and supportive supervision for district-level personnel.

- In **Zanzibar**, PMI supported the scale-up of the cellphone-based Malaria Early Epidemic Detection System (MEEDS) and by late 2011, MEEDS expanded to cover all 140 government health facilities. The overall malaria diagnostic testing rate for all patient visits was 32 percent at these facilities. The average reporting timeliness (i.e., weekly reports received within one week) increased from 45 percent in 2010 to 63 percent in 2011, and reporting completeness (i.e., all required data points received for each surveillance week) was 98 percent in January 2012.
- In **Ethiopia**, PMI supported weekly cellphone-based reporting of laboratory-confirmed malaria cases at 35 health

From the PMI External Evaluation Report:

PMI's responsiveness and flexibility in its commodity procurement and management systems minimized or prevented serious stock-outs, probably saving many lives. PMI support is valued as predictable, reliable, flexible, and responsible.

PMI has made significant investments into Health Systems Strengthening activities. NMCP managers recognize the value of these investments. They commented that "Our capacity has been strengthened," and "we now have the capacity for procurement and distribution."

PMI successfully developed and implemented a participatory, country-driven planning process based on the Malaria Operational Plans to guide PMI-supported malaria control program activities.

The full report and PMI's management response are available on the PMI website at http://www.pmi.gov/news/pressreleases/pmi_audit.html.

facilities in 10 districts within Oromia Regional State. Based upon the success of timely malaria surveillance and improved epidemic detection at these sites, in 2012, the Federal Ministry of Health plans to scale up this epidemic detection system to more than 250 health facilities within 50 districts across nearly all regions of Ethiopia.

- In **Rwanda**, in order to help achieve the NMCP's new goal of pre-elimination of malaria by 2017, the NMCP is implementing an epidemic surveillance and response system in 19 epidemic-prone districts in the western region out of the country's 30 districts.

BUILDING COUNTRY LEADERSHIP AND TECHNICAL CAPACITY

NMCPs must have the leadership, management, and technical skills to plan, execute, and assess their malaria control efforts. NMCP teams must possess a variety of skills and expertise in fields such as entomology, epidemiology, laboratory diagnosis,

case management, supply chain management, M&E, and financial management. To help develop and strengthen this capacity, PMI provides technical assistance and training. For example:

- In the **Democratic Republic of the Congo**, PMI facilitated the development of the NMCP's 2011–2015 Social and Behavioral Change Communication Strategic Plan, which was designed through a consultative process that included all major partners. A technical review panel has approved the document, and it is currently undergoing field testing while awaiting formal administrative endorsement by the Ministry of Health.
- In **Kenya**, PMI has strengthened the capacity of technical staff in the Division of Malaria Control by helping to build robust M&E systems for malaria control. Two staff – the head of the M&E Unit and her deputy – have been trained in program management, with a focus on leadership and malaria M&E. Fifty gov-

ernment officers drawn from the national, provincial, and district levels were also trained on malaria M&E.

- In **Angola, Ethiopia, Ghana, Kenya, Mozambique, Nigeria, Tanzania, and Zimbabwe**, PMI provides funding to support the U.S. Centers for Disease Control and Prevention's Field Epidemiology and Laboratory Training Program (FELTP). Approximately a dozen students are currently enrolled in the program with PMI support. In Tanzania, the program has supported a total of 26 students since 2008, of which 18 have graduated thus far.

INTEGRATING MALARIA AND MATERNAL AND CHILD HEALTH

Even though NMCPs and maternal and child health departments are both part of ministries of health in most countries, communication and coordination between the two programs are not always ideal. PMI's malaria in pregnancy activities are integrated with the U.S. Agency for International Development's (USAID's) maternal and child health and reproductive health programs. In many countries, PMI further promotes integration by supporting intermittent preventive treatment for pregnant women and malaria case management strengthening through programs that are scaling up focused antenatal care and integrated management of childhood illnesses in both health facilities and communities. For example, during FY 2011:

- PMI supported integrated community case management training and support-

Careful monitoring and tracking of commodities is an essential component of PMI's systems strengthening activities. In Nigeria, a worker fills out a stock sheet for malaria commodities.

Credit: Hamisu Hassan/
USAID | DELIVER PROJECT



Combating Commodity Thefts

In several PMI countries, artemisinin-based combination therapies (ACTs) that were purchased by the U.S. Government and intended for public sector use have been stolen and were subsequently found for sale in street markets in West Africa. This diversion of ACTs appears to be well organized and involves drugs financed by the U.S. Government as well as by other donors. Various factors contribute to the theft of medicines, including widescale corruption; the globalization of trade; weak regulatory and enforcement capacity; and the lack of financial, technical, human, and other resources in developing countries necessary to protect drug supply chains.

The U.S. Government is taking aggressive steps to combat thefts and diversion of antimalarials. As a routine practice, PMI works through ministries of health to build local capacity in supply chain management. When problems occur, PMI will first work with host governments to strengthen national-level oversight by establishing tighter controls, heightened vigilance, and a robust review of standard operating procedures. PMI also demands accountability within host country supply chains through diplomatic channels when necessary. If evidence of theft, corruption, or fraud is found, the U.S. Government has taken strong action to safeguard PMI-funded commodities and their intended recipients, including temporarily shifting storage and transportation of PMI-funded commodities to a parallel, nongovernmental system until national systems are strong enough to independently manage commodities.

In several countries, PMI is piloting an assessment of national supply chain management systems, including internal controls and financial aspects and their capacity to safeguard PMI-funded commodities. These assessments identify specific vulnerabilities in the system with recommendations for corrective actions and guide PMI (and other donors) in future supply chain strengthening activities. In other countries, PMI is working with partners to strengthen stock monitoring and improve internal controls to minimize diversions. Measures include central-level stock tracking, periodic physical inventories, and rapid facility-based surveys to monitor the presence of U.S. Government-financed malaria commodities. These steps have improved transparency in these systems and detected loss and diversion of commodities.

ive supervision of rural health extension workers in **Ethiopia** to ensure quality provision of malaria diagnosis, treatment, and prevention services at community-level health posts in 283 districts in six of the country's nine regional states (see story on page 26).

- In **Uganda**, PMI has leveraged inter-agency Global Health Initiative efforts, including improved integration with maternal and child health and HIV/AIDS programs through antenatal care; coordinated laboratory and health management information system strengthening; and strengthening health systems through a more robust public and private sector response to malaria. Through this effort, more than 20,000 pregnant women received an integrated package of services in private sector health facilities offering maternal, reproductive health, and malaria services.

PHARMACEUTICAL AND SUPPLY CHAIN MANAGEMENT

All malaria prevention and treatment interventions depend on the availability of key

commodities. Without predictable supplies of essential drugs and diagnostic tests, insecticide-treated mosquito nets, insecticides, and other supplies for indoor residual spraying, malaria control measures cannot be implemented. In most PMI focus countries, supply chain management systems are weak, leading to inaccurate quantification of commodity needs and frequent stock-outs. PMI helps to strengthen supply chain management systems to ensure products are available when and where they are needed and to protect their quality and integrity. Examples of assistance provided by PMI related to supply chain management in FY 2011 include:

- In **Rwanda**, PMI, with the support of other partners, assisted in the development of new standard operating procedures for the supply chain management of all health products through a harmonized logistics management and information system. This paper-based data collection system, launched in March 2011, collects consumption data on selected commodities at health facilities and district pharmacies and reports them

to the Logistics Management Office of the Ministry of Health for data entry and aggregation at the central level. This information assists the NMCP in quantifying needs and procuring the appropriate amounts of commodities, leading to a leaner supply chain and overall cost savings. PMI is also supporting a logistics advisor in the NMCP who uses these data to plan and forecast malaria commodities.

- Across all PMI focus countries, PMI is using an end-use verification tool to strengthen supply chain management by improving transparency, accountability, and demand forecasting. The tool surveys the quantities and quality (e.g., expiry dates, storage condition) of supplies available in a sample of health facilities – the “last mile” of the supply chain – and provides timely and accurate data to the NMCP and regional district managers to better inform their decision making and refine quantifications.
- PMI supported postmarketing antimalarial drug quality control programs and assessments in many PMI focus countries, including **Benin, Ghana, Madagascar, Senegal, and Uganda**.

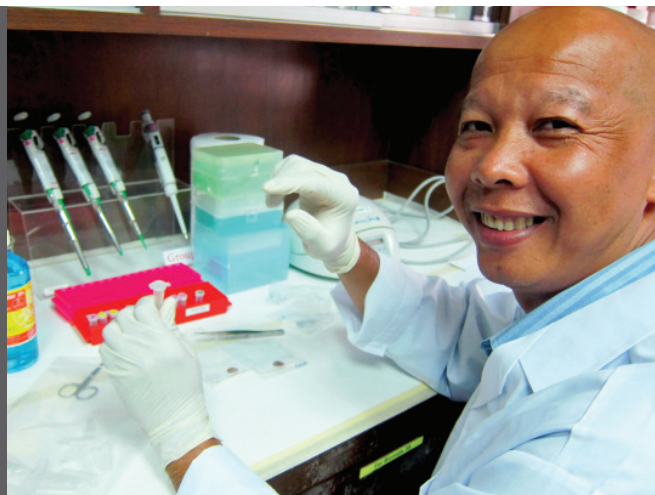


A pharmacy manager in Malanville Health Zone in Benin checks the batch number on a box of ACTs in a health facility storeroom. Malaria products are stocked according to the principle of “First Expiry, First Out,” in keeping with good supply chain management guidelines.

Credit: Simplice Takoubo/PMI

In Thailand, a workshop participant learns to genotype malaria parasites. Measuring antimalarial drug efficacy is especially important in the Greater Mekong Subregion, where there is drug-resistant malaria.

Credit: Jureeporn Duanguppamal/
Mahidol University



IMPROVING LABORATORY DIAGNOSTIC SERVICES

With the 2010 change in World Health Organization recommendations that patients of all ages with suspected malaria receive diagnostic testing and that antimalarial treatment be administered only to those with positive tests, the need for high-quality diagnostic services has become even more critical. PMI helps strengthen diagnostic systems by renovating and upgrading laboratory facilities, ensuring steady supplies of laboratory commodities, including microscopes and rapid diagnostic tests, and training and supervising laboratory staff. As part of this effort, PMI works with NMCPs to update their malaria laboratory policies and guidelines, develop training and supervision materials, and implement quality assurance programs. PMI also works to change the behaviors of clinicians who frequently do not trust or comply with laboratory test results

when prescribing treatment. Examples of PMI support in FY 2011 include:

- In Kwanza Sul, Huambo and Zaire Provinces in **Angola**, PMI supported the establishment of a simple quality assurance process for the microscopic diagnosis of malaria. Laboratory technicians' performance has improved in 23 out of the 29 municipalities with mentoring and coaching techniques through classroom and on-the-job training and supportive supervision.
- In partnership with a USAID tuberculosis program in **Mozambique**, PMI renovated and equipped the National Malaria Reference Laboratory; developed, printed, and disseminated 4,000 copies of the newly approved malaria case management guidelines; developed, printed, and disseminated 1,000 updated malaria

diagnostic manuals, 700 malaria diagnosis bench aids, and 3,000 charts; developed and piloted malaria supervision guidelines; and trained 67 master trainers in malaria microscopy. These master trainers conducted cascade microscopy trainings in every province of Mozambique. By the end of November 2011, every laboratory technician in the country – a total of 1,182 – had been trained on the laboratory component of the newly approved case management guidelines.

- With PMI support, the **Rwandan** National Reference Laboratory (NRL) has implemented a system of quality assurance for microscopy. The laboratory conducts integrated supervisory visits to clinical laboratories to review and strengthen HIV, tuberculosis, and malaria diagnostic services. In addition, district hospitals have assumed increased responsibility for providing supervision and quality assurance/quality control for health center laboratories. Supervisors use a standardized checklist to review supplies and monitor performance, and routine feedback is provided to health centers. The NRL also conducts supervisory visits to district hospitals to provide a tertiary level of quality control for blood smears. If supervisors see a high proportion of discordant results, they provide refresher training immediately. Rwanda adopted mandatory laboratory confirmation of malaria cases in December 2009 and achieved 96 percent laboratory confirmation of malaria cases in 2010, as reported by the health management information system.



Petty Officer 2nd Class Nathan Laird/U.S. Navy

Chapter 5

Global and U.S. Government Partnerships

The President's Malaria Initiative (PMI) has contributed to building and strengthening partnerships at national and international levels that are key to the success of malaria control efforts. PMI's investments are strategically targeted to support each focus country's malaria control strategy and plan while coordinating with and leveraging the support of other partners, including:

- Multilateral and bilateral organizations
- Other U.S. Government agencies and initiatives
- Private sector partners
- Nongovernmental organizations (NGOs)

This collaborative approach to scaling up sustainable malaria control programs embodies the core principles of President

Obama's Global Health Initiative and was recognized by the recently completed PMI External Evaluation as one of PMI's strengths (see box on page 32).

MULTILATERAL AND BILATERAL COLLABORATION

Global Fund: PMI and The Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund) are committed to coordinating their investments for malaria control in order to maximize their impact on malaria disease burden in each country. All PMI focus countries have received substantial malaria financing from the Global Fund. The U.S. Government is the Global Fund's largest single contributor and has a seat on the Global Fund Board. The U.S. Global Malaria Coordinator and Deputy Coordinator are members of the U.S. delegation to Global Fund Board meetings. Through this involvement, PMI helps shape policy issues at the highest level of the Global Fund's

governance mechanisms. Because the Global Fund has no in-country technical staff, PMI in-country advisors play an important role in coordinating and planning malaria activities in each country and sharing information with Global Fund Secretariat staff on grant implementation issues. PMI staff also participate on the Technical Review Panel for Global Fund proposals and on the Global Fund Country Coordinating Mechanisms. The Deputy Coordinator is a member of the Global Fund Technical Evaluation Reference Group, representing the malaria community.

Roll Back Malaria (RBM): PMI is an active member of the RBM Partnership, a global alliance of governments, multilateral organizations, private sector companies, foundations, academic institutions, and other nongovernmental organizations, working to coordinate the international response to malaria. PMI provides financial support

From the PMI External Evaluation Report:

PMI is recognized as one of the key partners at country level and its contribution is well appreciated by most of the multilateral and bilateral partners.

PMI is generally considered as an exemplary partner by most partners because it is not using its large and broad presence and substantial financial support to gain undue influence within the partnership.

[Partners] describe PMI as “flexible,” “more transparent,” “inclusive in designing its approaches,” and “receptive to ideas and suggestions.”

The full report and PMI’s management response are available on the PMI website at http://www.pmi.gov/news/pressreleases/pmi_audit.html.

for numerous RBM activities, serves on the Partnership’s Board of Directors, and participates in many of its working groups, including the Harmonization Working Group, the Case Management Working Group, the Vector Control Working Group, the Procurement and Supply Management Working Group, and the Monitoring and Evaluation Reference Group. During 2011, PMI continued to provide technical support to African countries to prepare their Global Fund Malaria Grant applications through the Harmonization Working Group. Overall, the Working Group supported 15 malaria proposals from Africa in Round 10, of which 89 percent were successful.

To maximize the potential of the U.S. Government’s investment in the Global Fund, PMI works with the U.S. Department of State to manage a grant to RBM for the provision of technical assistance to countries

experiencing problems with their Global Fund grants. This assistance is specifically intended to improve the implementation of Global Fund-financed malaria programs. Through this grant, RBM supported:

- Malaria program reviews in seven African countries to assess progress and recommend improvements in national malaria strategies and plans
- Training for 26 national malaria control program (NMCP) representatives in logistics, implementation and monitoring and evaluation (M&E) of long-lasting insecticide-treated mosquito net (ITN) mass distribution campaigns
- Identifying and resolving implementation bottlenecks related to Global Fund grants by conducting multipartner diagnostic missions in 11 countries

World Health Organization (WHO): PMI provides financing to the WHO Global Malaria Program to support activities related to anti-malarial drug resistance surveillance, vector control, and M&E. PMI funds the salaries of 12 WHO national and international program officers in PMI focus countries. PMI also enhances the capabilities of the WHO Africa Regional Office by funding the salaries of four staff persons (including an epidemiologist and a data manager). In the **Greater Mekong Subregion**, PMI provides funding to the WHO-Mekong Malaria Programme, which coordinates and enhances collaboration between the Southeast Asia and Western Pacific Regional Offices. U.S. Agency for International Development (USAID) malaria funds also support activities in seven countries in the Amazon Region of South America (**Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, and Suriname**) through the Pan American Health Organization.

United Nations Children’s Fund (UNICEF): In addition to partnering closely with UNICEF in each PMI focus country on malaria-related activities (such as mass ITN distribution campaigns), PMI provides partial support for two UNICEF staff and also procures some malaria commodities (such as rapid diagnostic tests [RDTs], artemisinin-based combination therapies [ACTs], and ITNs) through UNICEF.

Multipartner Coordination: PMI, the Global Fund, and the World Bank Malaria Booster Program continue to coordinate closely to prevent or overcome problems that their re-

In addition to distributing ITNs procured with PMI funds, in Nigeria and other focus countries, PMI helps to distribute ITNs procured by other partners.

Credit: Maggie Hallahan
Photography



spective programs are facing, such as harmonizing procurement specifications for malaria commodities, collaborating on jointly funded long-lasting ITN campaigns, and addressing bottlenecks to grant disbursements. Examples of PMI's collaboration with partners during fiscal year (FY) 2011 include:

- Assistance in the preparation of successful Global Fund Round 10 proposals, including:
 - In **Liberia**, PMI staff participated in all phases of the preparation and development of the Global Fund Round 10 proposal, including providing technical assistance and recommendations throughout the process. As 49 percent of Liberia's population seeks treatment from the private sector, PMI and the Global Fund will supply subsidized ACTs to the private sector, thus expanding access to affordable first-line treatment for malaria.
 - In the **Democratic Republic of the Congo (DRC)**, PMI provided support to the Government of DRC for the development of its successful Global Fund Round 10 malaria proposal. PMI and Global Fund support, together with other donor funding, will help cover all of the country's health zones with a minimum package of interventions in 2012–2014.
- Support for mass ITN campaigns to achieve universal coverage, including:
 - In **Benin**, PMI contributed to a national malaria prevention campaign launched by the Ministry of Health and its partners in July 2011. The campaign was planned with the participation of numerous donors, including PMI, the World Bank Malaria Booster Program, the African Development Bank, the Global Fund, and the Government of Benin under the leadership of the NMCP and with technical assistance from WHO. In total, 4.5 million long-lasting ITNs were distributed. PMI procured 905,000 long-lasting ITNs, of which about 200,000 were distributed during the 2011 mass campaign; the remainder were distributed through rou-

tine services for women and children at health facilities and through social marketing outlets. To ensure retention and use of ITNs, a broad communications strategy was put in place, including mass media, community mobilization, and job aids for the community mobilizers.

- **DRC's** malaria strategic plan calls for mass distribution of mosquito nets to achieve universal ITN coverage. Close partner collaboration, including the World Bank, the Global Fund, the U.K. Department for International Development (DFID), Population Services International, UNICEF, and PMI is helping the NMCP launch this effort. In 2012, many provinces will complete the first round of net distribution. For example, in Katanga Province, ITN needs are being met through a joint effort between the World Bank (3.5 million long-lasting ITNs) and PMI (2 million long-lasting ITNs). Two additional provinces (Maniema and Orientale) will be targeted in late 2012, bringing the total population covered to about 65 million (i.e., 95 percent of the country's population). Under the revised 2011–2015 Malaria Strategic Plan, DRC plans to extend its universal coverage efforts together with the same group of partners and donors.
- In **Nigeria**, PMI contributed to the distribution of more than 15 million ITNs procured by other donors, such as DFID, the Global Fund (covering most states in Nigeria), UNICEF, and the World Bank (covering most operational costs). PMI support covered logistics, mobilization around the campaign, and donor coordination.
- Support for emergency malaria commodity shipments to prevent or relieve stock-outs of critical commodities. For example:
 - In **Zambia**, DFID channeled \$11 million in emergency funding through USAID for the procurement of ITNs, ACTs, and RDTs in 2010. In 2011, DFID provided an additional \$23 million in funding for the procurement of antimalarial drugs and essential medicines for other conditions for the pe-

riod 2011–2015 through USAID. This flexible funding will make it possible to fill commodity gaps and improve access to commodities.

OTHER U.S. GOVERNMENT-SUPPORTED HEALTH PROGRAMS

PMI integrates its activities with other U.S. Government-funded global health activities to maximize health sector investments and reduce duplication.

- **U.S. President's Emergency Plan for AIDS Relief (PEPFAR):** Headquarter-level discussions began in 2011 to strengthen and expand PMI-PEPFAR collaboration where further opportunities for program integration and leveraging exist in order to reach populations at risk for both diseases with essential interventions and to ensure there is efficient use of resources, commodities, and personnel. This expanded partnership under development recognizes that PMI and PEPFAR form central pillars for implementing integrated health programs. While there are many examples of integration and collaboration between the two programs, this new effort will enhance their engagement in selected countries at the field level to accelerate PMI's goal of reducing the number of deaths related to malaria as well as reduce



U.S. Army Civil Affairs team members work with local volunteers in Mena District, Bale Zone, Ethiopia, to track distribution of ITNs, which were procured by PMI and distributed by a Combined Joint Task Force – Horn of Africa Civil Affairs team in partnership with the Ethiopian Government.

Credit: Staff Sergeant Robert Barnett/U.S. Air Force

the number of deaths from HIV-malaria co-infection. The six technical areas where integration efforts will be concentrated are antenatal care strengthening, laboratory strengthening, community-based programming, health facility-level health worker training, supervision and service delivery improvements, supply chain management, and health management information systems. Examples of collaboration during FY 2011 include:

- In **Rwanda**, PMI and PEPFAR have integrated maternal and child health, reproductive health, family planning, HIV, tuberculosis, malaria, and other health activities both at the community and health facility levels. PMI-supported activities include distributing PMI-procured long-lasting ITNs through antenatal clinic visits; harmonizing routine tools such as immunization cards and antenatal clinic registers to ensure comprehensive delivery of services; developing training materials; and launching a computerized Logistics Management Information System that provides data on drug consumption and stock-outs to support distribution of medicines and supplies to district pharmacies.
- PMI is currently working in Iringa Region in central **Tanzania** with a PEPFAR partner to roll out RDTs for malaria as part of a PEPFAR-funded home-based care program for persons living with HIV/AIDS. Home-based care volunteers are trained to recognize malaria symptoms in clients during home visits, test them with an RDT, and treat them if malaria is detected.

Results indicate that only 5 percent of the HIV/AIDS patients with febrile illness had a positive RDT. Testing has therefore reduced unnecessary treatment with ACTs.

- In **Ethiopia**, PMI is leveraging support through PEPFAR to strengthen laboratory diagnosis of malaria in conjunction with strengthening laboratory capacity to diagnose tuberculosis and HIV infections.
- **Peace Corps:** PMI and Peace Corps launched a partnership to recruit experienced Peace Corps volunteers to support national malaria control programs in PMI focus countries. Peace Corps volunteers in 13 PMI focus countries (**Benin, Ethiopia, Ghana, Guinea, Kenya, Madagascar, Malawi, Mali, Rwanda, Senegal, Tanzania, Uganda, and Zambia**) have begun implementing joint activities with PMI in-country teams. Examples of collaboration during FY 2011 include:
 - In **Malawi**, a Peace Corps volunteer evaluated the distribution of 10,000 PMI-procured long-lasting ITNs that were distributed in villages where Peace Corps volunteers reside. She provided technical and logistical support on a long-lasting ITN campaign, which distributed approximately 400,000 nets in two districts. She also involved other district-based Peace Corps volunteers in training, planning, and distribution of long-lasting ITNs procured by PMI and the Global Fund in preparation for a national universal coverage campaign.

- In **Ghana**, two malaria volunteers served as field supervisors for a household anemia and parasitemia survey in Bunkpurugu-Yunyoo District, Northern Region. The survey was part of a three-year operations research project, assessing whether indoor residual spraying (IRS) once or twice per year is preferable for malaria control in the northern savannah region. The volunteers supported 10 field teams and focused on data quality control.
- In **Rwanda**, a malaria volunteer worked with behavior change communication (BCC) community mobilization teams and local authorities to increase acceptance of IRS to 99 percent by educating and correcting misconceptions about spraying. The malaria volunteer also engaged other Peace Corps volunteers in malaria control activities by conducting trainings, coordinating with ongoing long-lasting ITN campaigns, working with education volunteers on including malaria information in their curriculum, and designing a webpage where Rwanda Peace Corps volunteers could ask questions and be apprised of any ongoing malaria activities in their areas.
- **U.S. Department of Defense (DOD):** In many countries, PMI collaborates with DOD. For example, in FY 2011:
 - In **Ethiopia**, PMI partnered with the Combined Joint Task Force – Horn of Africa and an implementing partner to conduct ITN hang-up/keep-up campaigns in Giji Zone (33,000 nets) and West Herarge Zone (9,000 nets), both in Oromia Regional State.
 - In **Tanzania**, PMI continues to partner with the Walter Reed Army Institute of Research to help strengthen malaria diagnostics throughout the country. In cooperation with the NMCP and the Ministry's Diagnostics Services Section, malaria diagnostic leads from 53 out of 121 districts have received a comprehensive two-week course on quality malaria diagnostics, including microscopy and RDTs. These district-level leads subsequently coordinate and supervise diagnostic strengthening efforts in their respective districts.



Through a partnership between PMI and Peace Corps, Peace Corps malaria volunteers are supporting national malaria control programs in 13 PMI focus countries.

Credit: Bethany Allen/Peace Corps Madagascar

Since December 2009, 80 trainees from 60 district hospitals and health centers across Tanzania have benefited from this training.

- PMI leverages the technical expertise of U.S. Navy entomologists who are providing technical assistance in vector control and insecticide-resistance management, both at the country level and at PMI headquarters.

PRIVATE SECTOR PARTNERSHIPS

PMI works with private sector partners to help leverage their capabilities and resources and ensure their efforts are well coordinated with government strategies and plans. Examples of PMI collaboration with the private sector in FY 2011 include:

- For many years, several **Zambian** industries have invested heavily in malaria control in the areas where they operate. PMI supports the **Zambian National Malaria Control Program's** partnership with the copper mining and the sugar industries by conducting IRS needs assessments and compliance inspections. The **Zambia Sugar Company** provides insecticides, equipment, and spray operators for IRS of its employees' homes in Mazabuka District of Southern Province, where the plant is located. In Copperbelt Province, **Konkola Copper Mine** and **Mopani Copper Mine** provide the same support for IRS in the communities in which they operate. The companies have documented a 94 percent reduction in malaria cases among their employees and dependents at company-run clinics over the period 2000–2009. They have also documented a net savings on their investment in malaria control.¹
- From 2006 to 2011, **ExxonMobil Foundation** contributed a total of \$4 million to support PMI objectives in **Angola**, specifically for the scale-up of ACTs and intermittent preventive treatment for pregnant women (IPTp) through subgrants to NGOs and faith-based organizations (FBOs) in eight provinces (Benguela, Huambo, Huila, Kwanza Norte, Kwanza Sul, Malange, Uige, and Zaire) where government health infrastructure is weak. During FY 2011, more than 2,400 health workers were trained in pharmaceutical management, laboratory



In Mozambique, PMI has supported an interfaith network to implement behavior change communication programs for malaria control.

Credit: PIRCOM

diagnosis, rational use of ACTs, malaria in pregnancy, and IPTp with this funding.

COMMUNITY-BASED ORGANIZATIONS

NGOs and FBOs often have strong bases of operation in underserved, rural areas where malaria is a major public health problem and formal health services are limited. Through support to these groups and efforts to ensure their work is well coordinated with national malaria control program strategies and plans, PMI helps build local capacity and program sustainability and improves access at the community level to critical malaria prevention and treatment services. To date, PMI has supported malaria activities through 230 nonprofit organizations, more than one-third of which are faith based. Many of these are new U.S. Government partners and are funded through the Malaria Communities Program. For example, during FY 2011:

- In **Madagascar**, where U.S. Government restrictions against working with the Government of Madagascar exist, PMI is supporting the introduction and expansion of malaria case management in health facilities operated by local NGOs and FBOs in all 22 of the country's regions. Health staff from four NGOs and FBOs were trained in supply chain management for malaria commodities and correct malaria diagnosis and treatment. In August and September 2011, PMI supported nine training workshops for 150 health workers at 130 health facilities. A formal agreement was established

in which these organizations agreed to provide RDTs free of charge to patients and report cases in exchange for a supply of RDTs procured by PMI. An evaluation of malaria case management in these NGO-supported facilities is planned for early 2012.

- Since 2007, **PMI/Mozambique** has supported the organizational and management capacity of the *Programa Inter-religioso Contra a Malaria* (PIRCOM), an interfaith network, to implement donor-funded health programs in malaria and waterborne disease prevention and control. This included capacity assessments at national and provincial levels, trainings and ongoing mentoring of PIRCOM staff, and development of policies, procedures, work plans, budgets, and other tools to guide the organization and its work. During the past year, a PMI-supported implementing partner provided technical assistance to PIRCOM to strengthen its capacity in social and BCC and monitoring and evaluation.

¹ World Health Organization on behalf of the Roll Back Malaria Partnership. 2011. Progress and Impact Series, no. 6: Business Investing in Malaria Control: Economic Returns and a Healthy Workforce for Africa.



Brant Stewart/RTI International/Ethiopia

Chapter 6

Malaria Research and Innovation

Research to support malaria control efforts and reduce the burden of malaria has been a high priority of the U.S. Government for many years. The U.S. Government malaria research effort involves the U.S. Centers for Disease Control and Prevention (CDC) and the National Institutes of Health (NIH) of the Department of Health and Human Services, the Naval Medical Research Center (NMRC), and the Walter Reed Army Institute of Research (WRAIR) of the U.S. Department of Defense (DOD), and the U.S. Agency for International Development (USAID).

These U.S. Government agencies collaborate with a wide variety of partners both internationally and within malaria-endemic countries, including national malaria control programs, universities, research institutes, private companies, and nongovernmental organizations. Such partnerships help strengthen local capacity and contribute to the sustain-

ability of national malaria control efforts. U.S. Government-supported malaria research has made contributions in the following areas:

- Defining basic malaria biology and pathogenesis to design new malaria prevention and treatment interventions
- Developing candidate vaccines and carrying out field trials
- Developing new drugs to address antimalarial drug resistance
- Evaluating and setting standards for malaria diagnostic tests
- Improving treatment strategies for severe malaria
- Conducting operations research to improve malaria control program implementation and impact

Research activities supported by the U.S. Government provide direction and support for reducing the global burden of malaria by ensuring that basic research and product development are effectively translated into field-applicable interventions.

DEPARTMENT OF HEALTH AND HUMAN SERVICES

- **CDC:** In addition to operations research as part of the President's Malaria Initiative (PMI), CDC investigators are engaged in a wide range of research activities:
 - **Diagnostics:** Evaluating and developing new tools for field-based malaria diagnosis, including methods that employ simple, portable equipment to perform molecular tests in the field.
 - **Treatment:** Evaluating the potential efficacy of new antimalarial drug compounds in nonhuman primates;

developing tests to determine malaria drug quality and identifying counterfeit drugs; evaluating effectiveness of new strategies to increase prompt, appropriate treatment for malaria in sub-Saharan Africa; identifying strategies to improve health care worker performance in case management of malaria.

- **Prevention:** Evaluating vaccine candidate antigens in nonhuman primates; testing new combinations of strategies to reduce malaria transmission, including vaccine candidates; evaluating new tools to reduce vectorial capacity for malaria transmission; establishing new ways to measure malaria transmission; identifying the optimal mix of malaria control interventions in different malaria transmission settings; determining the effect of specific interventions on malaria transmission in settings of different transmission; and testing new drugs for intermittent preventive treatment for pregnant women (IPTp).
- **Clinical:** Evaluating the effect on children without malaria of the new World Health Organization (WHO) recommendation to provide antimalarial treatment only to children with a parasitologic confirmation of malaria.
- **Entomologic:** Developing assays to detect insecticide resistance and surveillance systems to monitor and manage insecticide resistance; understanding resistance mechanisms in anopheline mosquitoes.

For more information, see www.cdc.gov/MALARIA/.

- **NIH:** NIH-supported investigators carry out research in a broad range of areas, including:
 - **Basic research:** Studying the biology of malaria parasites and mosquito vectors, as well as disease pathogenesis and immunology, and characterizing the mechanisms by which malaria parasites infect and survive in humans and by which infections result in disease. Understanding these mechanisms should yield new approaches to malaria prevention and treatment.

- **Genomics:** Supplying scientists with the complete genetic sequences of the mosquito vector *Anopheles gambiae* and the parasites *Plasmodium falciparum* and *P. vivax* to help identify new targets for effective disease interventions, such as vaccines or drugs.
- **Vaccine development:** Identifying novel vaccine candidates by characterizing protective immunological responses to malaria parasites from various life cycle stages, which could confer protection from infection or disease. Alternative strategies seek to identify transmission-blocking vaccines that will prevent transmission of malaria parasites to the mosquito vector.
- **Drug development:** Developing new methods and improving existing ones for the treatment of malaria, including the identification and characterization of unique parasite biochemical pathways that may serve as targets for drugs; determining the mode of action of existing and potential drugs; and analyzing the mechanisms of drug resistance.
- **Diagnostics:** Developing easy-to-use tests for the diagnosis of malaria infections and identifying parasite drug-resistance profiles.
- **Clinical and field research:** Strengthening field site capacity for research and clinical trials on drugs, vaccines, and diagnostics and supporting multiple vaccine

clinical trials in the United States and in malaria-endemic countries.

NIH invests heavily in developing and strengthening sustainable local research capacity in disease-endemic countries with the Fogarty International Center (see www.fic.nih.gov). Through the National Institute of Allergy and Infectious Diseases, NIH supports 10 International Centers of Excellence for Malaria Research in Africa, Asia, and Latin America, which generate evidence-based strategies to support malaria prevention and treatment. For more information, see www.niaid.nih.gov.

U.S. DEPARTMENT OF DEFENSE

The Military Infectious Disease Research Program's research efforts are focused on antimalarial drugs and vaccines. The DOD antimalarial drug development program is an Army-led effort at WRAIR, which has been instrumental in developing antimalarial drugs for global use since World War II. The U.S. Military Malaria Vaccine Program is a combined Army-Navy research and development initiative that represents more than 20 years of research with a focus on creating vaccines to prevent malaria in military personnel. Both the drug and vaccine programs take advantage of DOD's laboratories outside the contiguous 48 states of the United States.

- **Navy Malaria Program:** The Navy Malaria Program, based at NMRC, focuses on vaccine development and other preventive measures to protect military personnel deploying to malaria-endemic areas. The



Vietnam is part of PMI's program in the Greater Mekong Subregion, where training for drug quality testing is a component of PMI's support.

Credit: Souly Phanouvong/USP



In Thailand, Burmese migrants participate in a focus group discussion to learn more about their access and utilization of malaria prevention and treatment resources.

Assessing Access to Malaria Prevention and Treatment Resources in Thailand

In Tak Province, western Thailand, PMI is supporting an assessment of malaria care-seeking behaviors among mobile workers and migrant populations to determine the factors that affect their access to malaria prevention and treatment resources. Although malaria case management and vector control interventions in western Thailand have been targeted to Burmese refugees and migrant workers, as well as Thai nationals, very little is known about how Burmese migrants access and use malaria resources. Findings from this assessment will guide the planning and implementation of malaria control and elimination interventions for border communities in western Thailand.

program includes malaria research efforts based out of Naval Medical Research Units in Cambodia, Egypt, Ghana, and Peru, where studies of malaria epidemiology, drugs, and vaccines are conducted, many of these in collaboration with U.S. Army components.

- **Army Malaria Program:** The Army malaria research program focuses on supporting military personnel through the development of malaria vaccines, drugs for prevention and treatment of malaria (including severe malaria), and malaria diagnostics. For more information see <http://wrair-www.army.mil>. The Army

Malaria Research Program encompasses the Armed Forces Research Institute for Medical Sciences, Bangkok, and the U.S. Army Research Unit Kenya, Nairobi, where studies on malaria epidemiology, drugs, and vaccines are conducted.

U.S.AGENCY FOR INTERNATIONAL DEVELOPMENT

While USAID does not directly conduct malaria research, it invested approximately \$10 million in fiscal year (FY) 2011 to develop new drugs and vaccines.

- **Medicines for Malaria Venture (MMV):** MMV is a public-private partnership established 12 years ago to catalyze anti-malarial drug development by supporting development of effective and affordable medicines for the treatment and prevention of malaria. Currently, MMV is partnering with 21 biotech companies and 38 pharmaceutical companies, enabling it to gain access to novel and proprietary compound libraries to boost the diversity of candidate drugs in discovery research. USAID has provided funding for MMV activities since 2004, contributing to MMV's achievements, which include:

- More than 50 unique compounds in various stages of the research and development pipeline.
- Three new treatments being submitted for strict regulatory authority approval. Two of these, dispersible artemether-lumefantrine (AL) and dihydroartemisinin-piperazine, have been registered, and a third, pyronaridine-artesunate, is expected to receive approval in 2012.

- Injectable artesunate, an alternative to quinine, has received WHO prequalification and is now being recommended by WHO as preferred treatment for severe malaria. It has been adopted by a growing number of countries as their first-line treatment for severe malaria.

- A new class of antimalarial drugs, known as synthetic peroxides, has completed Phase II trials and will enter Phase III trials in 2012 for the treatment of uncomplicated malaria. For more information, see www.mmv.org.

- **Vaccine research:** USAID, as well as NIH, CDC, and the Military Malaria Vaccine Program, all contribute to the development of safe and effective malaria vaccines.

- USAID's Malaria Vaccine Development Program (MVDP) strives to accelerate the development of a vaccine that can be used as part of malaria control efforts. Over the years, the program has shifted its emphasis from research into promising vaccine candidates to producing and testing investigational vaccines. The MVDP works with academia, the commercial sector, and other government agencies. To date, MVDP's key accomplishments include:

- Discovery of systems for cultivating different stages of the parasite in the laboratory
- Initial discovery of a parasite molecule potentially useful as a vaccine constituent and subsequent discoveries of other molecules that are candidates for vaccine development
- Numerous tests of investigational vaccines in humans

THE PRESIDENT'S MALARIA INITIATIVE

PMI supports operations research projects designed to inform and improve program implementation and contribute to global malaria control efforts. The following are examples of operations research undertaken in PMI focus countries:

- In **Zambia**, a study of the physical and insecticidal longevity of insecticide-treated mosquito nets showed that nets deteriorated after fewer than 27 months of use. The study also found that less than 10 percent of nets had been repaired. Thus, nets may need to be replaced more frequently than anticipated in order to maintain high coverage with intact nets. These findings will be used to design behavior change communication messages on ways to care for nets and repair holes.
- In **Kenya**, a study is assessing the effect of nine different insecticides or insecticide formulations on entomologic indica-

tors as well as the acceptability of insecticides to residents. Findings from these studies will help lead to more effective indoor residual spraying (IRS) campaigns while at the same time helping to mitigate the development of resistance.

- In collaboration with the Malaria in Pregnancy Consortium, PMI contributed to a multicenter study to assess the effectiveness of sulfadoxine-pyrimethamine (SP) for IPTp. Results from **Zambia** suggest SP effectiveness for IPTp has declined, which is in line with preliminary study results from **Malawi** and **Uganda** indicating that increasing parasite resistance to SP may be compromising its efficacy and effectiveness for IPTp. Zambia's policy of giving SP for IPTp will be discussed in light of these findings. Furthermore, this study highlights the need for additional pharmacological options for IPTp. This collaborative work will also contribute to future PMI strategies to prevent adverse outcomes of malaria in pregnancy.



PMI conducts operations research to help improve the effectiveness of IRS campaigns and mitigate the development of insecticide resistance.

*Credit: Brant Stewart/
RTI International*

- In **Ethiopia**, a study was conducted to assess adherence and factors affecting adherence to AL, for routine treatment of uncomplicated malaria. Findings showed that factors negatively affecting adherence were younger age (under five years), lower education level, lack of recognition of the drug name, and not receiving instructions on the number of

days to take pills, which can be addressed in health worker training and behavior change communication efforts.

Appendix I: PMI Funding FY 2006–FY 2011 (in USD)

	Country ¹	FY 2005 Jump-Start Funding	FY 2006	FY 2007 ²	FY 2008 ³	FY 2009	FY 2010 ⁴	FY 2011 ⁵	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	131,400,000
	Tanzania	2,000,000	11,500,000	31,000,000	33,725,000	35,000,000	52,000,000	46,906,000	212,131,000
	Uganda	510,775	9,500,000	21,500,000	21,822,000	21,600,000	35,000,000	34,930,000	144,862,775
Round 2	Malawi		2,045,000	18,500,000	17,854,000	17,700,000	27,000,000	26,447,000	109,546,000
	Mozambique		6,259,000	18,000,000	19,838,000	19,700,000	38,000,000	29,241,000	131,038,000
	Rwanda		1,479,000	20,000,000	16,862,000	16,300,000	18,000,000	18,962,000	91,603,000
	Senegal		2,168,000	16,700,000	15,870,000	15,700,000	27,000,000	24,451,000	101,889,000
Round 3	Benin		1,774,000	3,600,000	13,887,000	13,800,000	21,000,000	18,313,000	72,374,000
	Ethiopia		2,563,000	6,700,000	19,838,000	19,700,000	31,000,000	40,918,000	120,719,000
	Ghana		1,478,000	5,000,000	16,862,000	17,300,000	34,000,000	29,840,000	104,480,000
	Kenya		5,470,000	6,050,000	19,838,000	19,700,000	40,000,000	36,427,000	127,485,000
	Liberia			2,500,000	12,399,000	11,800,000	18,000,000	13,273,000	57,972,000
	Madagascar		2,169,000	5,000,000	16,862,000	16,700,000	33,900,000	28,742,000	103,373,000
	Mali		2,490,000	4,500,000	14,879,000	15,400,000	28,000,000	26,946,000	92,215,000
	Zambia		7,659,000	9,470,000	14,879,000	14,700,000	25,600,000	23,952,000	96,260,000
Round 4	DRC						18,000,000	34,930,000	52,930,000
	Nigeria						18,000,000	43,588,000	61,588,000
	Guinea							9,980,000	9,980,000
	Zimbabwe							11,977,000	11,977,000
	Mekong							11,976,000	11,976,000
Headquarters		1,500,000	10,000,000	21,596,500	26,100,000	36,000,000	36,000,000	131,196,500	
PMI Total		30,000,000	154,200,000	295,857,500	299,900,000	500,000,000	578,413,000	1,858,370,500	
Jump-Start Total	4,250,775	35,554,000	42,820,000	0	0	36,000,000	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	1,976,995,275	

1 This table does not include other U. S. Government funding for malaria activities from USAID, CDC, the National Institutes of Health, or the U.S. 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).

Appendix 2: PMI Contribution Summary

The reporting timeframe for this PMI Annual Report covers the 2011 fiscal year (FY) (October 1, 2010 to September 30, 2011). Previous PMI Annual Reports reported on the calendar year. Therefore, in certain tables in this Appendix, the cumulative column subtracts the three-month overlap to avoid double counting the quantities of commodities procured and distributed, as these were reported on last year (see table footnotes for more detail).

I. INDOOR RESIDUAL SPRAYING

PEOPLE PROTECTED BY PMI-SUPPORTED INDOOR RESIDUAL SPRAYING (IRS) ^{1,2,3}							
Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)*	
Round 1	Angola	590,398	612,776	992,856	485,974	650,782	650,782
	Tanzania	1,018,156	1,279,960	1,569,071	2,087,062	4,861,179	4,502,814
	Uganda	488,502	1,865,956	2,211,388	2,262,578	2,794,839	2,839,173
Round 2	Malawi	–	126,126	106,450	299,744	364,349	364,349
	Mozambique	–	2,593,949	1,457,142	2,263,409	2,945,721	2,945,721
	Rwanda	–	720,764	885,957	1,329,340	1,365,949	1,571,625
	Senegal	–	678,971	645,346	661,814	959,727	887,315
Round 3	Benin	–	–	521,738	512,491	636,448	426,232
	Ethiopia	–	3,890,000	5,921,906	6,484,297	2,064,389	2,920,469
	Ghana	–	–	601,973	708,103	849,620	926,699
	Kenya	–	3,459,207	3,061,967	1,435,272	1,892,725	1,832,090
	Liberia	–	–	–	163,149	420,532	827,404
	Madagascar	–	–	2,561,034	1,274,809	2,895,058	2,895,058
	Mali	–	–	420,580	497,122	440,815	697,512
	Zambia	–	3,600,000	4,200,000	6,500,000	4,056,930	4,056,930
TOTAL	2,097,056	18,827,709	25,157,408	26,965,164	27,199,063	28,344,173	

1 The data reported in this table are up-to-date as of September 30, 2011, and include only those PMI focus countries that have data to report for this indicator.

During FY 2011, USAID also provided support for an IRS campaign in Burkina Faso, which protected 110,064 people.

2 Angola, Madagascar, Malawi, Mozambique, 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 A cumulative count of the number of people protected is not provided because many areas have been sprayed on more than one occasion.

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

HOUSES SPRAYED WITH PMI SUPPORT ^{1,2,3}							
Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)*	
Round 1	Angola	107,373	110,826	189,259	102,731	135,856	135,856
	Tanzania	203,754	247,712	308,058	422,749	889,981	833,269
	Uganda	103,329	446,117	575,903	567,035	878,875	908,627
Round 2	Malawi	–	26,950	24,764	74,772	97,329	97,329
	Mozambique	–	586,568	412,923	571,194	618,290	618,290
	Rwanda	–	159,063	189,756	295,174	303,659	358,804
	Senegal	–	169,743	153,942	176,279	254,559	240,770
Round 3	Benin	–	–	142,814	156,223	166,910	145,247
	Ethiopia	–	778,000	1,793,248	1,935,402	646,870	858,657
	Ghana	–	–	254,305	284,856	342,876	354,207
	Kenya	–	1,171,073	764,050	517,051	503,707	485,043
	Liberia	–	–	–	20,400	48,375	87,325
	Madagascar	–	–	422,132	216,060	576,320	576,320
	Mali	–	–	107,638	126,922	127,273	202,821
	Zambia	–	657,695	762,479	1,189,676	1,102,338	1,102,338
TOTAL	414,456	4,353,747	6,101,271	6,656,524	6,693,218	7,004,903	

1 The data reported in this table are up-to-date as of September 30, 2011, and include only those PMI focus countries that have data to report for this indicator.

During FY 2011, USAID also provided support for an IRS campaign in Burkina Faso, which sprayed 33,832 houses.

2 Angola, Madagascar, Malawi, Mozambique, 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 A cumulative count of the number of houses sprayed is not provided because many areas have been sprayed on more than one occasion.

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

SPRAY PERSONNEL TRAINED WITH PMI SUPPORT ^{1,2,3}							
	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)*
Round 1	Angola	350	582	2,104	585	834	834
	Tanzania	536	734	688	2,806	5,890	4,397
	Uganda	450	4,062	4,945	4,412	5,171	1,771
Round 2	Malawi	–	300	309	462	929	929
	Mozambique	–	1,190	1,282	1,343	1,996	1,996
	Rwanda	–	655	2,091	2,276	2,088	2,357
	Senegal	–	275	706	570	1,024	911
Round 3	Benin	–	–	335	347	459	617
	Ethiopia	–	–	1,198	3,017	4,049	3,855
	Ghana	–	–	468	577	572	636
	Kenya	–	4,697	1,452	1,719	2,496	2,118
	Liberia	–	–	–	340	480	793
	Madagascar	–	–	1,673	851	1,612	1,612
	Mali	–	–	413	424	549	816
	Zambia	–	1,300	1,413	1,935	2,396	2,396
	TOTAL	1,336	13,795	19,077	21,664	30,545	26,038

1 The data reported in this table are up-to-date as of September 30, 2011, and include only those PMI focus countries that have data to report for this indicator.

During FY 2011, USAID also provided support for an IRS campaign in Burkina Faso, which trained 315 people.

2 Angola, Madagascar, Malawi, Mozambique, 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 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.

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

2. INSECTICIDE-TREATED MOSQUITO NETS

INSECTICIDE-TREATED MOSQUITO NETS (ITNS) PROCURED AND DISTRIBUTED WITH PMI SUPPORT^{1,2}

		ITNs Procured						
		ITNs Distributed						
Country		Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)*	Cumulative
Round 1	Angola	540,949	294,200	734,198	395,748	1,353,298	1,011,800	3,318,393
		540,949	0	339,440	446,348	294,169	630,000	2,250,906
	Tanzania	130,000	0	143,560	1,468,966	623,441	0	2,365,967
		130,000	0	113,560	1,498,966	1,495,121	0	3,237,647
	Uganda	376,444	1,132,532	480,000	765,940	1,009,000	709,000	3,763,916
		305,305	683,777	999,894	651,203	294,139	221,325	3,152,466
Round 2	Malawi	–	1,039,400	849,578	1,791,506	850,000	1,659,700	6,190,184
		–	211,995	849,578	851,436	457,822	1,142,938	3,345,499
	Mozambique	–	786,000	720,000	1,450,000	500,000	1,200,000	4,656,000
		–	565,000	842,802	930,000	500,000	1,494,277	4,224,916
	Rwanda	–	0	550,000	912,400	100,000	390,000	1,952,400
		–	0	0	500,000	962,400	0	1,462,400
	Senegal	–	200,000	790,000	408,000	1,025,000	2,880,000	3,593,000
		–	196,872	792,951	380,000	28,000	1,546,617	2,944,440
Round 3	Benin	–	221,000	385,697	875,000	634,000	905,000	3,020,697
		–	215,627	45,840	879,415	315,799	699,300	2,155,981
	Ethiopia	–	102,145	22,284	1,559,500	1,845,200	1,845,200	3,529,129
		–	102,145	22,284	559,500	1,000,000	1,845,200	3,529,129
	Ghana	–	60,023	350,000	955,000	2,304,000	1,994,000	4,189,023
		–	60,023	0	350,000	955,000	2,313,546	3,316,469
	Kenya	–	–	60,000	1,240,000	455,000	2,212,500	3,967,500
		–	–	60,000	550,000	690,000	2,589,180	3,568,380
	Liberia	–	197,000	0	430,000	830,000	650,000	1,757,000
		–	0	184,000	430,000	480,000	350,000	1,444,000
Madagascar	–	–	351,900	1,875,007	1,715,000	0	3,941,907	
	–	–	351,900	1,005,007	2,579,720	2,217,074	3,936,627	
Mali	–	369,800	858,060	600,000	2,110,000	3,037,150	5,435,010	
	–	369,800	258,060	600,000	0	2,040,964	3,268,824	
Zambia	–	808,332	186,550	433,235	1,800,000	1,760,146 ³	3,588,263	
	–	550,017	444,865	433,235	400,000	1,760,146	3,588,263	
Round 4	DRC	–	–	–	–	824,100	2,000,000	2,824,100
		–	–	–	–	589,553	314,111	854,699
	Nigeria	–	–	–	–	614,000	1,000,000	1,614,000
		–	–	–	–	0	614,000	614,000
TOTAL		1,047,393	5,210,432	6,481,827	15,160,302	18,592,039	23,254,496	59,706,489
		976,254	2,955,256	5,305,174	10,065,110	11,041,723	19,778,678	46,894,646

¹ The data reported in this table are up-to-date as of September 30, 2011, and include only those PMI focus countries that have data to report for this indicator.

During FY 2011, USAID also provided support for ITN activities in Burundi and Chad; 424,200 ITNs were procured and 415,000 were distributed.

² The cumulative column takes into account the three-month overlap between Year 5 (covering the 2010 calendar year) and Year 6 (covering the 2011 fiscal year).

³ In addition to these ITNs procured with USAID funds, 1 million ITNs were procured in FY 2011 for Zambia with a donation from DFID.

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

ITNS PROCURED BY OTHER DONORS AND DISTRIBUTED WITH PMI SUPPORT^{1,2}

	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)*	Cumulative
Round 1	Angola	–	0	109,624	17,089	540,851	0	667,564
	Tanzania	–	0	350,000	117,400	0	615,010	1,082,410
	Uganda	–	369,900	0	0	2,431,815	125,017	2,810,732
Round 2	Malawi	–	–	0	10,700	9,600	20,000	40,300
	Mozambique	–	–	78,000	179,730	0	0	257,730
	Senegal	–	–	0	1,875,456	621,481	385,427	2,882,364
Round 3	Ethiopia	–	–	–	475,000	0	0	475,000
	Ghana	–	–	750,000	0	82,600	0	832,600
	Madagascar	–	–	–	290,636	3,204,647	2,772,824	3,495,283
Round 4	DRC	–	–	–	–	3,966,000	0	3,966,000
	Nigeria	–	–	–	–	0	15,389,478	14,525,369
TOTAL		–	369,900	1,287,624	2,966,011	10,856,994	19,307,756	31,035,352

1 The data reported in this table are up-to-date as of September 30, 2011, and include only those PMI focus countries that have data to report for this indicator.

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

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

ITNS SOLD WITH PMI MARKETING SUPPORT^{1,2}

	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)*	Cumulative
Round 1	Uganda	586,284	932,033	1,115,074	281,955	0	0	2,915,346
Round 2	Senegal	–	158,060	57,832	57,929	0	0	273,821
Round 3	Benin	–	0	0	0	0	28,760	20,540
	Ghana	–	612,000	1,234,159	347,520	0	0	2,193,679
TOTAL		586,284	1,702,093	2,407,065	687,404	0	28,760	5,403,386

1 The data reported in this table are up-to-date as of September 30, 2011, and include only those PMI focus countries that have data to report for this indicator.

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

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

ITNS REDEEMED THROUGH VOUCHER PROGRAMS WITH PMI SUPPORT^{1,2}

	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)*	Cumulative
Round 1	Tanzania	–	362,194	1,034,711	596,275	623,441	529,908	3,047,686
Round 2	Senegal	–	134,413	168,206	72,234	0	0	374,853
Round 3	Ghana	–	–	236,789	102,833	86,579	0	426,201
TOTAL		–	496,607	1,439,706	771,342	710,020	0	3,318,832

1 The data reported in this table are up-to-date as of September 30, 2011, and include only those PMI focus countries that have data to report for this indicator.

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

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

3. MALARIA IN PREGNANCY

SULFADOXINE-PYRIMETHAMINE (SP) TREATMENTS PROCURED AND DISTRIBUTED WITH PMI SUPPORT^{1,2}

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)*	Cumulative
Round 1	Uganda	0	0	18,333	72,666	39,367	26,666	144,366
		0	0	2,556	45,780	40,063	26,666	107,270
Round 2	Mozambique	–	–	0	0	3,645,052 ³	0	3,645,052
		–	–	0	0	0	3,645,052	3,645,052
	Rwanda	–	583,333	0	0	0	0	583,333
		–	583,333	0	0	0	0	583,333
Round 3	Benin	–	0	766,666	0	0	405,863	1,172,529
		–	0	0	307,121	150,000	309,546	666,667
	Ghana	–	–	0	0	25,000	0	25,000
		–	–	0	0	0	25,000	25,000
	Kenya	–	–	0	840,000	0	0	840,000
		–	–	0	840,000	0	0	840,000
	Liberia	–	–	0	78,666	85,333	85,333	163,999
	–	–	0	78,666	0	71,333	149,999	
	Mali	–	–	1,000,000	0	0	0	1,000,000
		–	–	0	1,000,000	0	0	1,000,000
	Zambia	–	–	0	666,666	0	3,083,300 ⁵	3,749,966
	–	–	0	0	666,666	3,083,300	3,749,966	
Round 4	DRC	–	–	–	–	2,470,000 ⁴	1,100,000	2,470,000
		–	–	–	–	1,370,000	0	1,370,000
TOTAL		–	583,333	1,784,999	1,657,998	6,264,752	4,701,162	13,794,245
		–	583,333	2,556	2,271,567	2,226,729	7,160,897	12,137,287

1 The data reported in this table are up-to-date as of September 30, 2011, and include only those PMI focus countries that have data to report for this indicator.

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

3 All treatments were procured with non-malaria U.S. Government funds.

4 Of this total, 1,370,000 treatments were procured with non-malaria U.S. Government funds.

5 In addition to the SP treatments procured with USAID funds, 2,250,000 SP treatments were procured in FY 2011 for Zambia with a donation from DFID.

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

HEALTH WORKERS TRAINED IN IPTP WITH PMI SUPPORT^{1,2}

	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)*
Round 1	Angola	1,450	290	1,481	2,554	2,695	1,488
	Tanzania	376	1,158	2,532	2,288	2,157	4,634
	Uganda	168	807	649	724	870	5,341
Round 2	Malawi	–	–	2,747	348	181	0
	Rwanda ³	–	250	436	0	964	225
	Senegal	–	43	2,422	865	1,025	1,563
Round 3	Benin	–	605	1,267	146	80	0
	Ghana	–	–	464	1,170	2,797	7,577
	Kenya	–	–	0	5,107	93	1,844
	Liberia	–	–	417	750	535	404
	Madagascar	–	–	0	0	1,576	3,370
	Mali	–	–	142	0	1,173	1,983
Round 4	Zambia	–	–	–	63	0	0
	DRC	–	–	–	–	0	443
TOTAL		1,994	3,153	12,557	14,015	14,146	28,872

1 The data reported in this table are up-to-date as of September 30, 2011, and include only those PMI focus countries that have data to report for this indicator.

2 A cumulative count of individual health workers trained is not provided because some health workers have been trained on more than one occasion.

3 Health workers in Rwanda have been trained in focused antenatal care because IPTp is not national policy.

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

4. CASE MANAGEMENT

RAPID DIAGNOSTIC TESTS (RDTs) PROCURED AND DISTRIBUTED WITH PMI SUPPORT^{1,2}

		RDTs Procured						
		RDTs Distributed						
	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)*	Cumulative
Round 1	Angola	129,875	375,000	375,000	600,000	832,000	1,637,000	3,498,875
		0	101,000	380,875	975,000	282,000	1,518,250	3,257,125
	Tanzania	875,000	550,200	1,075,000	950,000	292,000	117,000	3,859,200
		250,000	1,025,200	425,000	989,500	661,900	194,574	3,481,674
Uganda	0	0	0	0	1,309,000	1,346,650	1,330,650	
	0	0	0	0	34,000	296,985	295,055	
Round 2	Mozambique	–	0	0	0	0	5,000,000	5,000,000
		–	0	0	0	0	3,452,550	3,452,550
	Rwanda	–	0	0	0	200,010	200,010	200,010
Round 3	Benin	–	178,400	0	0	600,000	600,000	778,400
		–	73,815	104,585	0	0	600,000	778,400
	Ethiopia	–	–	0	1,680,000	1,560,000	0	3,240,000
		–	–	0	820,000	2,420,000	0	3,240,000
	Ghana	–	–	0	74,000	725,600	725,600	799,600
		–	–	0	0	0	725,600	725,600
	Kenya	–	–	0	0	547,800	547,800	547,800
		–	–	0	0	0	292,040	292,040
	Liberia	–	–	0	850,000	1,200,000	0	2,050,000
		–	–	0	850,000	1,116,275	83,725	2,050,000
Madagascar	–	–	0	0	270,000	1,500,000	1,770,000	
	–	–	0	0	202,031	248,329	340,880	
Mali	–	–	0	30,000	500,000	500,000	1,030,000	
	–	–	0	0	530,000	500,000	1,030,000	
Zambia	–	979,000	1,639,000	2,070,000	4,804,500	2,337,450 ³	9,575,850	
	–	0	979,000	1,250,000	2,550,400	2,337,450	4,862,750	
Round 4	DRC	–	–	–	–	500,000	0	500,000
		–	–	–	–	0	400,425	400,425
	Mekong	–	–	–	–	–	61,000	61,000
		–	–	–	–	–	61,000	61,000
TOTAL		1,004,875	2,082,600	2,429,000	6,254,000	13,340,910	14,572,510	33,581,385
		250,000	1,200,015	1,889,460	4,884,500	7,796,606	10,820,919	24,377,490

¹ The data reported in this table are up-to-date as of September 30, 2011, and include only those PMI focus countries that have data to report for this indicator.

During FY 2011, USAID also provided support for case management activities in South Sudan and Burundi; 417,000 RDTs were procured.

² The cumulative column takes into account the three-month overlap between Year 5 (covering the 2010 calendar year) and Year 6 (covering the 2011 fiscal year).

³ In addition to the RDTs procured with USAID funds, 1,350,000 RDTs were procured in FY 2011 for Zambia with a donation from DFID.

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

HEALTH WORKERS TRAINED IN MALARIA DIAGNOSIS WITH PMI SUPPORT^{1,2}

	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)*
Round 1	Angola	–	374	1,356	691	1,022	1,028
	Tanzania	–	0	0	247	388	338
	Uganda	–	0	100	1,115	941	1,651
Round 2	Malawi	–	–	0	0	307	549
	Mozambique	–	391	0	136	0	0
	Rwanda	–	–	0	0	29	0
	Senegal	–	–	90	19	4,158	2,920
Round 3	Benin	–	605	0	24	583	232
	Ethiopia	–	–	0	0	0	7,666
	Ghana	–	–	0	46	4,511	8,680
	Kenya	–	–	77	0	485	210
	Liberia	–	–	0	22	906	39
	Madagascar	–	–	0	108	2,701	8,932
	Mali	–	–	40	412	1,276	1,957
	Zambia	–	–	0	36	0	37
Round 4	DRC	–	–	–	–	28	499
	Nigeria	–	–	–	–	0	2
	TOTAL	–	1,370	1,663	2,856	17,335	34,740

1 The data reported in this table are up-to-date as of September 30, 2011, and include only those PMI focus countries that have data to report for this indicator.

2 A cumulative count of individual health workers trained is not provided because some health workers have been trained on more than one occasion.

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

ARTEMISININ-BASED COMBINATION THERAPY (ACT) TREATMENTS PROCURED AND DISTRIBUTED WITH PMI SUPPORT^{1,2}

ACTs Procured

ACTs Distributed

	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)*	Cumulative
Round 1	Angola	587,520	2,033,200	3,035,520	5,572,860	3,767,040	3,770,010	14,996,140
		0	1,689,321	3,109,089	1,947,188	3,567,360	3,770,070	14,083,028
	Tanzania	380,160	694,050	146,730	4,001,760	8,751,150	7,608,900	18,011,190
		380,160	494,050	346,730	544,017	4,873,207	8,819,640	13,150,414
	Uganda	261,870	0	1,140,480	0	2,085,120	2,085,120	3,487,470
		227,827	0	0	1,140,480	0	545,310	1,913,617
Round 2	Malawi	–	4,695,450	8,449,920	1,169,280	1,634,520	214,500	15,949,170
		–	4,694,013	3,579,278	3,693,510	2,198,460	215,100	14,165,261
	Mozambique	–	218,880	4,988,160	0	5,331,840	7,064,040	14,797,800
		–	218,880	1,440,000	2,210,320	1,553,430	4,920,990	9,365,200
	Rwanda	–	714,240	0	0	0	0	714,240
		–	0	714,240	0	0	0	714,240
Round 3	Senegal	–	0	0	443,520	670,080	659,790	1,715,310
		–	0	0	0	443,520	455,756	899,276
	Benin	–	–	1,073,490	215,040	1,002,240	509,100	2,799,870
		–	–	326,544	812,232	1,002,600	470,749	2,605,079
	Ethiopia	–	–	600,000	1,081,000	2,268,000	0	3,949,000
		–	–	0	1,681,000	648,000	1,620,000	3,949,000
	Ghana	–	–	1,142,759	0	0	0	1,142,759
		–	–	0	1,028,000	114,759	0	1,142,759
	Kenya	–	–	1,281,720	7,804,800	6,997,080	6,960,390	20,413,590
		–	–	1,281,720	6,015,360	7,667,310	3,268,260	17,765,170
Liberia	–	496,000	0	1,303,175	1,631,625	4,444,875	7,304,075	
	–	0	496,000	1,303,175	1,631,625	1,623,781	5,054,581	
Madagascar	–	–	0	0	0	100,025	100,025	
	–	–	0	0	0	0	0	
Mali	–	–	0	241,720	739,200	1,289,190	1,530,910	
	–	–	0	241,720	0	1,289,190	1,530,910	
Zambia	–	–	495,360	0	2,390,400 ³	1,688,160 ⁴	3,936,960	
	–	–	80,640	173,160	2,257,920	1,688,160	3,562,920	
Round 4	DRC	–	–	–	–	3,780,000	0	3,780,000
		–	–	–	–	639,075	855,948	1,398,884
	Nigeria	–	–	–	–	0	0	0
		–	–	–	–	1,043,352 ⁵	0	1,043,352
	Guinea ⁶	–	–	–	–	–	1,450,000	1,450,000
		–	–	–	–	–	0	0
Zimbabwe ⁶	–	–	–	–	–	744,120	744,120	
	–	–	–	–	–	520,884	520,884	
TOTAL		1,229,550	8,851,820	22,354,139	21,833,155	41,048,295	38,588,220	116,822,629
		607,987	7,096,264	11,374,241	20,790,162	27,640,618	30,063,838	92,864,575

1 The data reported in this table are up-to-date as of September 30, 2011, and include only those PMI focus countries that have data to report for this indicator.

During FY 2011, USAID also provided support for case management activities in Burkina Faso, Burundi, and Somalia; 3,644,250 ACTs were procured.

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

3 In addition to the ACTs procured with USAID funds, 1,599,360 ACTs were procured in 2010 for Zambia with a donation from DFID.

4 In addition to the ACTs procured with USAID funds, 3,805,560 ACTs were procured in FY 2011 for Zambia with a donation from DFID.

5 These ACTs were distributed in 2010 with USAID funds but were procured before Nigeria became a PMI focus country.

6 PMI central procurement funding was used to initiate ACT procurement for Guinea and Zimbabwe in advance of their start as PMI focus countries.

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

ACT TREATMENTS PROCURED BY OTHER DONORS AND DISTRIBUTED WITH PMI SUPPORT ^{1,2}								
	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)*	Cumulative
Round 1	Uganda	–	8,709,140	112,330	4,459,918	0	0	13,281,388
Round 2	Malawi	–	–	0	2,056,170	0	5,015,490	6,779,580
	Mozambique	–	–	0	1,423,350	2,857,590	1,428,630	4,951,070
	Rwanda	–	–	–	396,625	282,494	114,471	793,590
Round 3	Madagascar	–	–	–	519,338	396,470	124,118	1,025,306
Round 4	Nigeria	–	–	–	–	–	311,100	311,100
	TOTAL	–	8,709,140	112,330	8,855,401	3,536,554	6,993,809	27,142,034

1 The data reported in this table are up-to-date as of September 30, 2011, and include only those PMI focus countries that have data to report for this indicator.

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

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

HEALTH WORKERS TRAINED IN TREATMENT WITH ACTS WITH PMI SUPPORT ^{1,2}							
	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Year 6 (FY 2011)*
Round 1	Angola	1,283	290	1,357	2,784	2,868	238
	Tanzania	4,217	1,011	1,767	1,018	1,162	1,520
	Uganda	2,844	12,637	9,159	1,356	0	485
Round 2	Malawi	–	0	5,315	809	1,813	378
	Mozambique	–	174	422	16,768	219	0
	Rwanda	–	5,127	8,565	7,672	7,180	8,911
	Senegal	–	1,020	4,776	1,162	4,158	2,375
Round 3	Benin	–	605	–	762	1,178	1,207
	Ethiopia	–	–	2,786	0	1,740	7,666
	Ghana	–	–	368	1,144	2,952	7,954
	Kenya	–	–	–	4,747	390	0
	Liberia	–	–	595	746	1,008	498
	Madagascar	–	–	–	1,696	4,575	8,039
	Mali	–	–	101	412	1,283	1,957
	Zambia	–	–	186	197	0	493
Round 4	DRC	–	–	–	–	874	462
	Nigeria	–	–	–	–	5,058	0
	TOTAL	8,344	20,864	35,397	41,273	36,458	42,183

1 The data reported in this table are up-to-date as of September 30, 2011, and include only those PMI focus countries that have data to report for this indicator.

2 During FY 2011, USAID also provided support for case management activities in Burundi; 805 health workers were trained in ACT use.

2 A cumulative count of individual health workers trained is not provided because some health workers have been trained on more than one occasion.

* For Year 6, PMI transitioned from a calendar year to a fiscal year reporting schedule.

Appendix 3: PMI Country-Level Targets

The President's Malaria Initiative's (PMI's) goal to reduce the burden of malaria will be achieved by reaching and sustaining 85 percent coverage of the most vulnerable groups – children under five years of age and pregnant women – with proven preventive and therapeutic interventions, including insecticide-treated mosquito nets (ITNs), indoor residual spraying (IRS), intermittent preventive treatment for pregnant women (IPTp), and artemisinin-based combination therapies (ACTs). PMI has a single set of country-level targets for these four major control measures, which are the same for each focus country.

ITNs

- More than 90 percent of households with a pregnant woman and/or children under five will own at least one ITN.
- 85 percent of children under five will have slept under an ITN the previous night.
- 85 percent of pregnant women will have slept under an ITN the previous night.

IRS

- 85 percent of houses in geographic areas targeted for IRS will have been sprayed.
- 85 percent of pregnant women and children under five will have slept under an ITN the previous night or in a house that has been protected by IRS.

IPTp

- 85 percent of women who have completed a pregnancy in the last two years will have received two or more doses of IPTp during that pregnancy.

ACTs

- 85 percent of government health facilities will have ACTs available for the treatment of uncomplicated malaria.*

* PMI is working with the Roll Back Malaria Monitoring and Evaluation Reference Group to develop a new indicator to measure effective case management of malaria. Until a new indicator is approved, this one will be used in place of the standard, but now less relevant, case management indicator (treatment with an ACT within 24 hours of onset of fever). As the burden of malaria has been reduced and the proportion of fever illnesses not caused by malaria has increased, administering ACTs based solely on the presence of fever is no longer an acceptable practice.

Abbreviations and Acronyms

ACT	Artemisinin-based combination therapy
AL	Artemether-lumefantrine
BCC	Behavior change communication
CDC	U.S. Centers for Disease Control and Prevention
DFID	U.K. Department for International Development
DOD	U.S. Department of Defense
DRC	Democratic Republic of the Congo
FANC	Focused antenatal care
FBO	Faith-based organization
FELTP	Field Epidemiology and Laboratory Training Program
FY	Fiscal year
GHI	Global Health Initiative
Global Fund	The Global Fund to Fight AIDS, Tuberculosis and Malaria
HEW	Health extension worker
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
iCCM	Integrated community case management
IPTp	Intermittent preventive treatment for pregnant women
IRS	Indoor residual spraying
ITN	Insecticide-treated mosquito net
M&E	Monitoring and evaluation
MEEDS	Malaria Early Epidemic Detection System
MMV	Medicines for Malaria Venture
MVDP	Malaria Vaccine Development Program
NGO	Nongovernmental organization
NIH	National Institutes of Health
NMCP	National malaria control program
NMRC	Naval Medical Research Center
NRL	National Reference Laboratory
PEPFAR	U.S. President's Emergency Plan for AIDS Relief
PIRCOM	<i>Programa Inter-religioso Contra a Malaria</i>
PMI	U.S. President's Malaria Initiative
PSA	Public service announcement
RBM	Roll Back Malaria
RDT	Rapid diagnostic test
SP	Sulfadoxine-pyrimethamine
UNICEF	United Nations Children's Fund
USAID	U.S. Agency for International Development
WHO	World Health Organization
WRAIR	Walter Reed Army Institute of Research

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