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The President's Malaria Initiative

Fifth Annual Report to Congress
April 2011

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Cover Photo

Mothers and their children hold insecticide-treated nets they received during the Government of Tanzania's Under Five Coverage Campaign. To reduce the terrible burden of malaria in Africa, the President's Malaria Initiative targets those most vulnerable to malaria—children under the age of five and pregnant women.

Credit
Dan Albrecht/MEDA Tanzania

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Abbreviations and Acronyms

ACT	Artemisinin-based combination therapy
CDC	Centers for Disease Control and Prevention
DfID	Department for International Development (U.K.)
DRC	Democratic Republic of the Congo
FANC	Focused antenatal care
FY	Fiscal year
GHI	Global Health Initiative
Global Fund	The Global Fund to Fight AIDS, Tuberculosis and Malaria
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
MERG	Monitoring and Evaluation Reference Group
NGO	Nongovernmental organization
NMCP	National Malaria Control Program
PEPFAR	U.S. President's Emergency Plan for AIDS Relief
PMI	President's Malaria Initiative
RBM	Roll Back Malaria
RDT	Rapid diagnostic test
SP	Sulfadoxine-pyrimethamine
UNICEF	United Nations Children's Fund
USAID	U.S. Agency for International Development
USG	U.S. Government
WHO	World Health Organization

THE PRESIDENT'S MALARIA INITIATIVE

IMA World Health

A mother and daughter at a health center in the **Democratic Republic of the Congo** (DRC). In 2010, DRC and **Nigeria**, which together account for almost half of the burden of malaria on the African continent, became President's Malaria Initiative focus countries with the launch of important jump-start activities to prevent and treat malaria.

EXECUTIVE SUMMARY

Over the past five years, substantial reductions have been recorded in mortality in children under five years of age, buttressed by improvements in malaria-specific indicators in all President's Malaria Initiative (PMI)-supported countries where baseline and follow-up nationwide household surveys were conducted. These reductions are due in large part to a dramatic scale-up of malaria prevention and treatment measures since 2005, thanks to the collective efforts of national governments; the U.S. Government (USG); the Global Fund to Fight AIDS, Tuberculosis and Malaria; the World Bank; other international donors; and multilateral and nongovernmental organizations. This report describes the role and contributions of the USG to reduce the burden of malaria in Africa and its impact on health systems. The activities and results described below represent the effect of the first four years of PMI funding (fiscal years 2006–2009), or approximately 60 percent of the $1.265 billion requested for the Initiative.

PMI Contributions at a Glance

Indicator[1]	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	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)	N/A[2]
ITNs procured	1,047,393	5,210,432	6,481,827	15,160,302	17,532,839	45,432,793 (30,343,517 distributed)
ITNs procured by other donors and distributed with PMI support	—	369,900	1,287,624	2,966,011	10,856,994	15,480,529
IPTp treatments procured	—	583,333	1,784,999	1,657,998	6,264,752	10,291,082 (5,084,185 distributed)[3]
Health workers trained in IPTp/focused antenatal care	1,994	3,153	12,557	14,015	14,146[4]	N/A[5]
Rapid diagnostic tests procured	1,004,875	2,082,600	2,429,000	6,254,000	13,340,110	25,110,585 (16,104,306 distributed)[3]
Health workers trained in malaria diagnosis (RDTs and/or microscopy)	—	1,370	1,663	2,856	17,335	N/A[5]
ACT treatments procured	1,229,550	8,851,820	22,354,139	21,833,155	41,048,295	95,316,959 (67,509,272 distributed)[3]
ACT treatments procured by other donors and distributed with PMI support	—	8,709,140	112,330	8,855,401	3,536,554	21,213,425
Health workers trained in case management	8,344	20,864	35,397	41,273	36,458	N/A[5]

1 Data reported in this table are up to date as of January 1, 2011, and include 15 PMI focus countries, plus jump-start activities in DRC and Nigeria. In addition, during 2010, the USG provided support for malaria prevention and control activities in other countries. For data by country, see Appendix 2. With this 2011 report, some adjustments were made to previous years' procurement figures in order to reconcile quantities of commodities procured by each country in a given calendar year with the figures reported by implementing partners responsible for those procurements. These changes represent less than 2 percent of the total procurements for commodities.
2 A cumulative count of people protected by IRS is not provided because most areas are sprayed on more than one occasion.
3 Distributed to health facilities.
4 This total includes 964 health workers who were trained in focused antenatal care in Rwanda, where IPTp is not national policy.
5 A cumulative count of health workers trained is not provided because some health workers have been trained on more than one occasion.

Introduction

According to the World Health Organization (WHO) 2010 *World Malaria Report*, the estimated number of global malaria deaths has fallen from about 985,000 in 2000 to about 781,000 in 2009.[1] Similar improvements were also documented in the 2010 United Nations Children's Fund (UNICEF) *Progress for Children* report[2] and in a 2009 *Lancet* article, "Levels and trends in under-5 mortality, 1990–2008."[3]

In spite of this progress, malaria remains one of the major public health problems on the African continent, with about 80 percent of malaria deaths occurring in African children under five years of age. Malaria also places a heavy burden on individual families and national health systems. In many African countries, 30 percent or more of outpatient visits and hospital admissions in children under five are reported to be caused by malaria. Economists estimate that malaria accounts for approximately 40 percent of public health expenditures in some countries in Africa and causes an annual loss of $12 billion, or 1.3 percent of the continent's gross domestic product.[4] Because most malaria transmission occurs in rural areas, the greatest burden of the disease usually falls on families who have lower incomes and whose access to health care is most limited.

[1] World Health Organization. 2010. *World Malaria Report: 2010.* p. 60.

[2] UNICEF. 2010. *Progress for Children: Achieving the MDGs with Equity.*

[3] You, D., et al. 2009. Levels and trends in under-5 mortality, 1990–2008. *The Lancet*, 375 (9709): 100–103.

Esther Hsu/TAMTAM

Children carry home long-lasting ITNs they received free of charge during a universal coverage campaign in Eastern Region, **Ghana**. Over the past five years, PMI has protected millions of people from malaria by contributing to the dramatic scale-up of prevention and treatment coverage across its focus countries, including procurement of more than 45 million nets.

The President's Malaria Initiative was launched in June 2005 by President George W. Bush with a vision of five years of funding (fiscal year [FY] 2006–2010). This represented a $1.265 billion expansion of USG resources to reduce the intolerable burden of malaria and help relieve poverty on the African continent. The goal of PMI was to reduce malaria-related deaths by 50 percent in 15 countries that have a high burden of malaria by expanding coverage of four highly effective malaria prevention and treatment measures to the most vulnerable populations—pregnant women and children under five years of age.

PMI is a major component of the **U.S. Government's Global Health Initiative** (GHI) announced by President Barack Obama in May 2009. The GHI builds on the commitment of the USG to address major global health concerns—including malaria, HIV/AIDS, tuberculosis, maternal and child health, nutrition, and neglected tropical diseases. Under the GHI, PMI is expanding its integration with maternal and child health and HIV/AIDS programs, strengthening partnerships, and continuing to build capacity in health systems.

With the Lantos-Hyde United States Leadership against HIV/AIDS, Tuberculosis, and Malaria Act and the launch of the GHI, PMI's goal has been expanded 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 (see map on page 10).

In the past year, PMI has expanded its efforts as follows:

- Designed PMI programs and began implementation with jump-start activities in the Democratic Republic of the Congo (DRC) and Nigeria;
- Designed and implemented a nationwide expansion in Ethiopia (from a previous focus on Oromia Regional State alone); and

[4] Gallup, J., Sachs, J. 2001. The economic burden of malaria. *American Journal of Tropical Medicine and Hygiene*, 64 (1,2) S: 85–96.

- Designed a PMI program in the Greater Mekong Sub-region of Southeast Asia, where resistance to artemisinin drugs—the major component of the most widely used first-line malaria therapy in the world—has already been identified in several sites.

Further Scale-Up of Malaria Control Measures

Since 2006, contributions from PMI, together with prior USG assistance and the efforts of national governments and other donors, have resulted in a massive scale-up in the coverage of control measures across the original 15 PMI countries. During the last 12 months, in coordination with national malaria control programs (NMCPs) and other partners, PMI has assisted the 15 original focus countries to increase access to four proven malaria prevention and treatment measures: insecticide-treated mosquito nets (ITNs); indoor residual spraying with insecticides (IRS); intermittent preventive treatment for pregnant women (IPTp); and improved laboratory diagnosis and appropriate treatment, including artemisinin-based combination therapies (ACTs).

In 2010 alone, PMI procured more than 17 million long-lasting ITNs, protected more than 27 million residents by spraying their houses with residual insecticides, and procured more than 41 million ACT treatments (see PMI Contributions at a Glance on page 2). In addition, PMI assisted with the distribution of more than 10 million long-lasting ITNs and 3.5 million ACT treatments procured by other partners, attesting to the growing and productive collaboration between PMI and other donors. PMI also trained tens of thousands of people in key aspects of malaria control in 2010, including more than 36,000 health workers in the diagnosis and treatment of malaria with ACTs. In all 17 focus countries and the Greater Mekong Sub-region, PMI supported pharmaceutical management, laboratory diagnosis, and other health systems strengthening and capacity-building activities.

Increasing Coverage

Now, five years after PMI was launched, dramatic improvements in the coverage of malaria control measures are being documented in nationwide household surveys. Although such surveys are the best way to measure population coverage with health interventions, they are typically repeated only every two to three years. During the past four years, nine PMI countries, **Ghana**, **Kenya**, **Malawi**, **Mali**, **Rwanda**, **Senegal**, **Tanzania**, **Uganda**, and **Zambia**, have reported results of nationwide household surveys that allow a comparison with earlier nationwide household surveys used as the PMI baseline. In those nine countries, household ownership of one or more ITNs increased from the baseline range of 15 to 50 percent in 2004–2006 to 33 to 85 percent in 2007–2010. At the same time, usage of an ITN the night before the survey more than doubled from an average of 21 to 50 percent for children under five years and about the same amount for pregnant women. Over the same time period, the proportion of pregnant women who received two or more doses of IPTp for the prevention of malaria increased from an average of 24 to 43 percent.

James Gathany/CDC

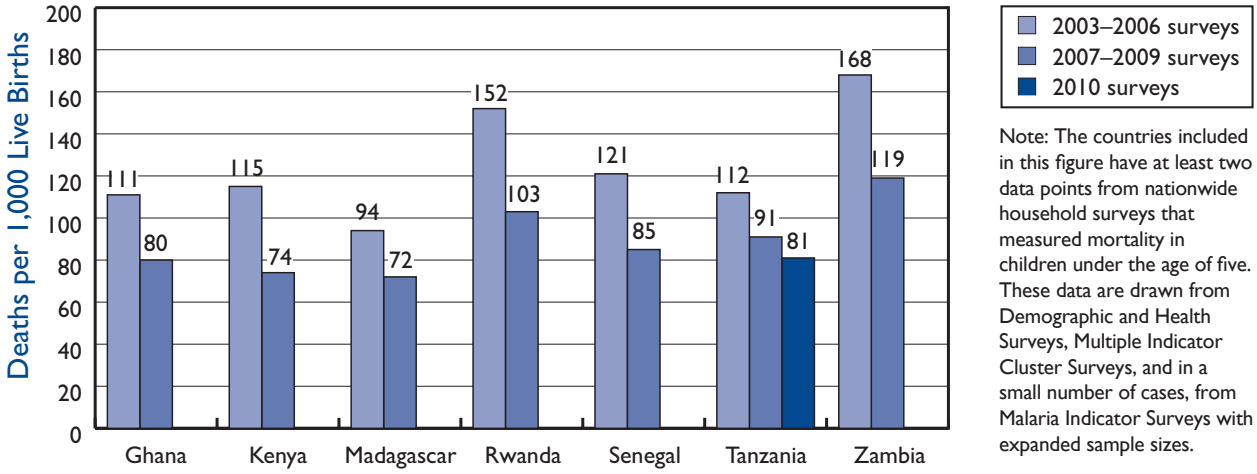
Malaria is a blood-borne parasitic infection transmitted by the bite of infected female *Anopheles* mosquitoes. In sub-Saharan Africa, the majority of infections are caused by *Plasmodium falciparum*, which causes the most severe form of the disease and almost all malaria deaths worldwide. Although all people living in malarious areas can be infected, children under five years of age, pregnant women, and people living with HIV/AIDS are most affected by malaria.

Due to the increases in ITN ownership and use, and IPTp uptake, together with the many millions of residents protected over the past four years 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. In the remaining PMI focus countries, follow-up nationwide household surveys will be completed between 2011 and 2013.

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 public health facilities throughout Africa. For example, nationwide surveys carried out in late 2008 and early 2009 in **Benin**, **Madagascar**, **Uganda**, and **Zambia** by ACT Watch[5] showed that between 66 percent (Benin)

[5] www.actwatch.info

Figure 1
Reductions in All-Cause Mortality Rates of Children Under Five



Note: The countries included in this figure have at least two data points from nationwide household surveys that measured mortality in children under the age of five. These data are drawn from Demographic and Health Surveys, Multiple Indicator Cluster Surveys, and in a small number of cases, from Malaria Indicator Surveys with expanded sample sizes.

and 86 percent (Madagascar) of public health facilities surveyed in the four countries had the country's first-line ACT in stock on the day of the survey.

Impact on Malaria and Mortality in Children Under Five Years of Age

Nationwide household surveys, such as the Demographic and Health Survey and the Multiple Indicator Cluster Survey, usually have large enough sample sizes to allow measurements of mortality in children under five years of age. Seven PMI focus countries have had at least two nationwide surveys that measured mortality in children under the age of five. These surveys reported reductions in mortality rates ranging from 23 to 36 percent (see Figure 1). In Tanzania, where a third data point is available from a 2010 nationwide survey, under-five mortality fell an additional 11 percent from the 2007 level. Similar reductions in other measures of malaria burden, such as the prevalence of malaria infections and severe anemia in young children, are also being documented. This progress in malaria control represents the cumulative effect of malaria funding and control efforts by PMI; targeted funding from the USG prior to PMI; national governments; the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund); World Bank; and other donors. Although it is not possible to measure malaria-related deaths in such surveys directly, and multiple factors may be influencing the decline in under-five mortality rates, strong and growing evidence suggests that malaria prevention and treatment are playing a major role in these unprecedented reductions in malaria burden. This dramatic reduction in malaria burden was a major factor in WHO's decision to modify its treatment policies. WHO now recommends that children should no longer be treated presumptively for malaria, but instead, that all suspected malaria illnesses be diagnosed with laboratory tests before treatment.

The country examples described below are characteristic of what is being seen in all seven PMI countries that have mortality data:

- In **Tanzania**, all-cause, under-five mortality fell by 28 percent between 2005 and 2010. Over the same time period, household ownership of at least one ITN increased from 23 to 64 percent, and ITN use among children under five years of age and pregnant women increased from 16 percent (both groups) to 64 percent and 57 percent, respectively. Nationwide prevalence of severe anemia in children six months to five years of age also fell by 50 percent between 2005 and 2010. In addition, malaria control has been extremely successful on the island of Zanzibar; less than 2 percent of patients at the 90 health facility surveillance sites that make up Zanzibar's malaria epidemic early-detection system now have blood smears positive for malaria parasites. The USG supported malaria control in Tanzania between 1999 and 2005, including $2 million in FY 2005. For the period FY 2006–2010, a total of $163.2 million in PMI funding was provided.

- In **Senegal**, a 30 percent reduction in all-cause mortality in children under five was documented between 2005 and 2008. Although several factors

may be involved, it is highly likely that this dramatic reduction is due, at least in part, to rapid increases in the coverage of malaria interventions. Household ownership of one or more ITNs increased from 36 percent in 2006 to 60 percent in 2008. After the 2009 national ITN distribution to children under age five, a post-campaign survey found household ITN ownership had increased to 82 percent. The proportion of pregnant women who received two or more doses of IPTp rose from 12 to 52 percent between 2005 and 2008. In late 2007, Senegal introduced rapid diagnostic tests (RDTs) for malaria in all of its health facilities, and in 2008, 73 percent of all suspected malaria cases were tested. Although no national-level baseline data are available for comparison, less than 6 percent of children under age five had malaria parasites in the 2008 nationwide survey, a level much lower than the 20 to 60 percent levels seen in longitudinal studies in Senegal.[6] The USG has supported malaria control in Senegal since 1999, including $2.2 million in FY 2006. For the period FY 2007–2010, PMI provided $75 million in funding.

PMI and the Global Health Initiative

Under the GHI, PMI has expanded work with partners, integrating malaria with maternal and child health activities, and strengthening health systems.

Partnerships for Malaria Control: The success of PMI is closely linked to the efforts of our many partners. In keeping with the principles of the GHI, PMI coordinates its activities with a wide range of organizations, including NMCPs; multilateral and bilateral institutions, such as WHO, UNICEF, World Bank, Global Fund, and the United Kingdom's Department for International Development (DfID); private foundations, such as the Bill & Melinda Gates and Clinton Foundations; and numerous nongovernmental organizations (NGOs) and faith-based organizations that have strong bases of operation in underserved rural areas where the burden of malaria is greatest. To date, PMI has supported more than 215 nonprofit organizations, nearly one-third of which are faith-based.

- During the past four years, PMI, the ExxonMobil Foundation, Malaria No More, and many other partners contributed funding to the Roll Back Malaria Harmonization Working Group to improve the quality of Global Fund malaria proposals from African countries. As a result, the success rate of malaria proposals that received technical support from the Working Group more than doubled. In Round 10, 87 percent of the 15 country proposals the Harmonization Working Group assisted with were successful.

- In 2010, DfID channeled £7 million (about $10.5 million) in emergency commodity funding through PMI in **Zambia** by means of a memorandum of understanding with the U.S. Agency for International Development (USAID). The funding allows the NMCP and PMI to reduce stockouts of ITNs, RDTs, ACTs, and other malaria medicines.

- In **Angola**, the ExxonMobil Foundation continued its direct funding to USAID/Angola in support of PMI objectives—a total of $4 million over the past five years.

- 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 2010, PMI assisted six 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 more than $8 million of malaria commodities,

Alison Bird/USAID

A woman attends to her child who is being treated for severe malaria in a hospital in **Angola**. PMI works with NCMPs to encourage caregivers to seek medical attention promptly for children with fever, so that uncomplicated malaria does not progress to severe malaria, a life-threatening illness.

[6] Smith, T., et al. 2006. An epidemiologic model of the incidence of acute illness in *Plasmodium falciparum* malaria. *American Journal of Tropical Medicine and Hygiene*, 75 (2, Suppl): 56–62.

Arturo Sanabria

In **Zambia**, pregnant women wait at a clinic for antenatal care. Malaria prevention measures are some of the most equitable child survival interventions. UNICEF's report, *Progress for Children: Achieving the MDGs with Equity* (September 2010), states that in most countries ITN ownership and IPTp use tend to be equitable—poorer, rural households show coverage rates similar to those for richer, urban households.

including more than 1 million long-lasting ITNs and 5.3 million ACT treatments. PMI's responsiveness and flexibility in its commodity procurement and management systems minimized or prevented dangerous stockouts, saving countless lives.

Integration with Maternal and Child Health Programs: Malaria prevention and control are 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. This approach helps attract increasing numbers of women to these facilities and campaigns. PMI also funds focused 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 rapid, effective treatment of malaria in Africa is 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 played a leading role in expanding this program to cover the major causes of fever in children under five in Africa—pneumonia, malaria, and diarrhea. In FY 2010, PMI provided funds to iCCM programs in 14 focus countries. **Ethiopia**, **Madagascar**, **Malawi**, **Rwanda**, and **Senegal** have moved quickly to implement nationwide or large-scale iCCM programs, while many of the remaining focus countries are piloting iCCM in more circumscribed areas, with plans to expand in the coming years.

Building Capacity of National Health Systems: PMI resources and activities help strengthen the overall capacity of health systems, both indirectly and directly. By reducing the burden of malaria in highly endemic countries, where malaria typically accounts for 30 to 40 percent of outpatient visits and hospital admissions, PMI's contributions free up critical resources and enable overstretched health workers to concentrate on controlling 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. PMI is 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 2010, PMI efforts to strengthen health systems included:

- Providing funds for strengthening supply chain management systems across all PMI countries. In almost all of these countries, PMI has been able to complement investments by the President's Emergency Plan for AIDS Relief (PEPFAR) and other USG programs.

- Funding to train more than 36,000 health care workers in case management with ACTs, 17,000 in malaria laboratory diagnostics, and 14,000 in IPTp and focused antenatal care.

- Collaborating with NMCPs and other partners, such as PEPFAR and WHO, to strengthen laboratory diagnosis of malaria and improve the overall quality of health care.

Building a cadre of ministry of health staff with technical skills in the collection, analysis, and interpretation of data for decision-making, epidemiologic investigations, and operational research in **Ethiopia**, **Kenya**, **Mozambique**, **Nigeria**, and **Tanzania** through support to the Centers for Disease Control and Prevention's (CDC's) Field Epidemiology and Laboratory Training Program.

Malaria Research

The USG is committed to reducing the global burden of malaria by supporting research through a coordinated and collaborative approach that includes operational research to answer questions relevant to program implementation, as well as more basic research into new and improved malaria prevention and treatment measures. USG malaria research involves the National Institutes of Health, CDC, Walter Reed Army Institute of Research, and USAID, all of which work with a wide range of partners including research organizations, universities, private companies, and NGOs. Examples of USG-funded malaria research activities include the following:

- A trial of iCCM in which community health workers provided with RDTs for malaria and counters for measuring respiratory rates for detection of pneumonia reduced the use of ACTs for treatment from nearly 100 percent of fever cases to just 28 percent (i.e., those children who had a positive diagnostic test) and increased appropriate antibiotic treatment of pneumonia from 13 to 68 percent;

- Establishment of 10 International Centers of Excellence for Malaria Research in Africa, Asia, and Latin America to generate evidence-based strategies to support malaria prevention and treatment; and

- Development and licensure of a new dispersible ACT formulation, which simplifies administration to young children, through funding to the Medicines for Malaria Venture.

Challenges

The reduction in malaria burden already being seen in African countries strongly suggests that malaria can be controlled and removed as the major public health problem on the continent. In spite of this progress, however, the global malaria partnership must remain vigilant. Weak national health infrastructures hamper malaria and other disease-control programs and threaten the sustainability of these efforts. Continuing challenges to progress can be expected, such as the examples described below.

Antimalarial Drug and Insecticide Resistance: Resistance to artemisinin drugs has not yet been documented in sub-Saharan Africa, but if artemisinin-resistant malaria parasites were imported to Africa from Southeast Asia—as has occurred in the past with chloroquine resistance—it would represent a major setback for malaria control efforts on the continent. Resistance of the mosquito vector to the pyrethroid family of insecticides, which are widely used in IRS and are the only recommended insecticides for ITNs, is already being seen at multiple sites in Africa. PMI supports NMCPs in the routine monitoring of both antimalarial drug and insecticide resistance. Additionally, PMI is considering approaches, such as rotation of insecticides for IRS, to delay development of further resistance to the pyrethroids and prolong their effectiveness on ITNs.

Antimalarial Drug Loss and Diversion: In several PMI countries, ACTs that were purchased by the USG and intended for public sector use have been stolen and subsequently found in street markets in Nigeria, Cameroon, and Benin. This diversion of ACTs appears to be well organized and also involves ACTs financed by other donors. The USG is taking aggressive steps to combat thefts and diversion of antimalarial medicines. As a matter of practice, PMI works through host-country governments to build local capacity, and will first work with host governments and partners to establish tighter controls—with a systematic oversight and review system. When clear evidence of theft, corruption, or fraud exists, the USG takes strong action to safeguard PMI-funded commodities and their intended recipients. This action includes shifting storage and transportation of PMI-funded commodities to a parallel, nongovernmental system as a temporary solution until national systems are sufficiently strong to manage commodities on their own.

Transient Upswings in Reported Cases of Malaria: During the past year, two countries, where considerable progress in control has already been achieved, reported an upswing in malaria cases in some areas. In **Rwanda**, for example, a transient increase in the number of reported, confirmed malaria cases occurred during 2009. This increase was followed in 2010 by a reduction in cases to previous levels after a mass distribution of long-lasting ITNs. Such problems highlight the fragility of progress in malaria control and the importance of strengthening routine surveillance and epidemic response.

Together with its partners, PMI is tackling these challenges. With increased funding from the Lantos-Hyde Act, the USG has seized the opportunity to expand malaria prevention and treatment across the African continent, and we expect to see further advances in the fight against malaria in the coming years. For more information about PMI and to access the full annual report, please visit: http://www.pmi.gov.

Background Information

PMI and the Global Health Initiative

Malaria prevention and control are major national security and foreign assistance objectives of the USG. In May 2009, President Barack Obama unveiled the Global Health Initiative (GHI), a six-year, comprehensive effort to reduce the burden of disease and promote healthy communities and families around the world. Through the GHI, the United States will help partner countries improve health outcomes, with a particular focus on improving the health of women, newborns, and children.

PMI is a core component of the GHI. As part of the USG Malaria Strategy 2009–2014, an expanded PMI strategy has been developed to achieve Africa-wide impact, thereby removing malaria as a major public health problem and promoting economic growth and development throughout the region. Since its launch in 2005, PMI has reinforced principles that are part of the GHI, including:

- Focus on women, girls, and gender equality
- Encourage country ownership and invest in country-led plans
- Build sustainability through health systems strengthening
- Strengthen and leverage key multilateral organizations, global health partnerships, and private sector engagement
- Increase impact through strategic coordination and integration
- Improve metrics, monitoring, and evaluation
- Promote research and innovation

PMI Structure

PMI is an interagency initiative led by USAID and implemented together with the Centers for Disease Control and Prevention of the Department of Health and Human Services (HHS). It is overseen by the U.S. Global Malaria Coordinator, who is advised by an Interagency Steering Group made up of representatives of USAID, CDC/HHS, Department of State, Department of Defense, National Security Council, and Office of Management and Budget.

PMI Country Selection

The 15 original focus countries were selected and approved by the Coordinator and the Interagency Steering Group using the following criteria:

- High malaria disease burden
- National malaria control policies consistent with the internationally accepted standards of WHO
- Capacity to implement such policies
- Willingness to partner with the United States to fight malaria
- Involvement of other international donors and partners in national malaria control efforts

Passage of the Lantos-Hyde Act of 2008 authorized an extension of PMI funding for five additional years (FY 2009–2013). With the launch of the GHI and a congressional authorization of extended funding, PMI's goal was expanded 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. This allowed PMI to expand into DRC, Nigeria, and the Greater Mekong Sub-region.

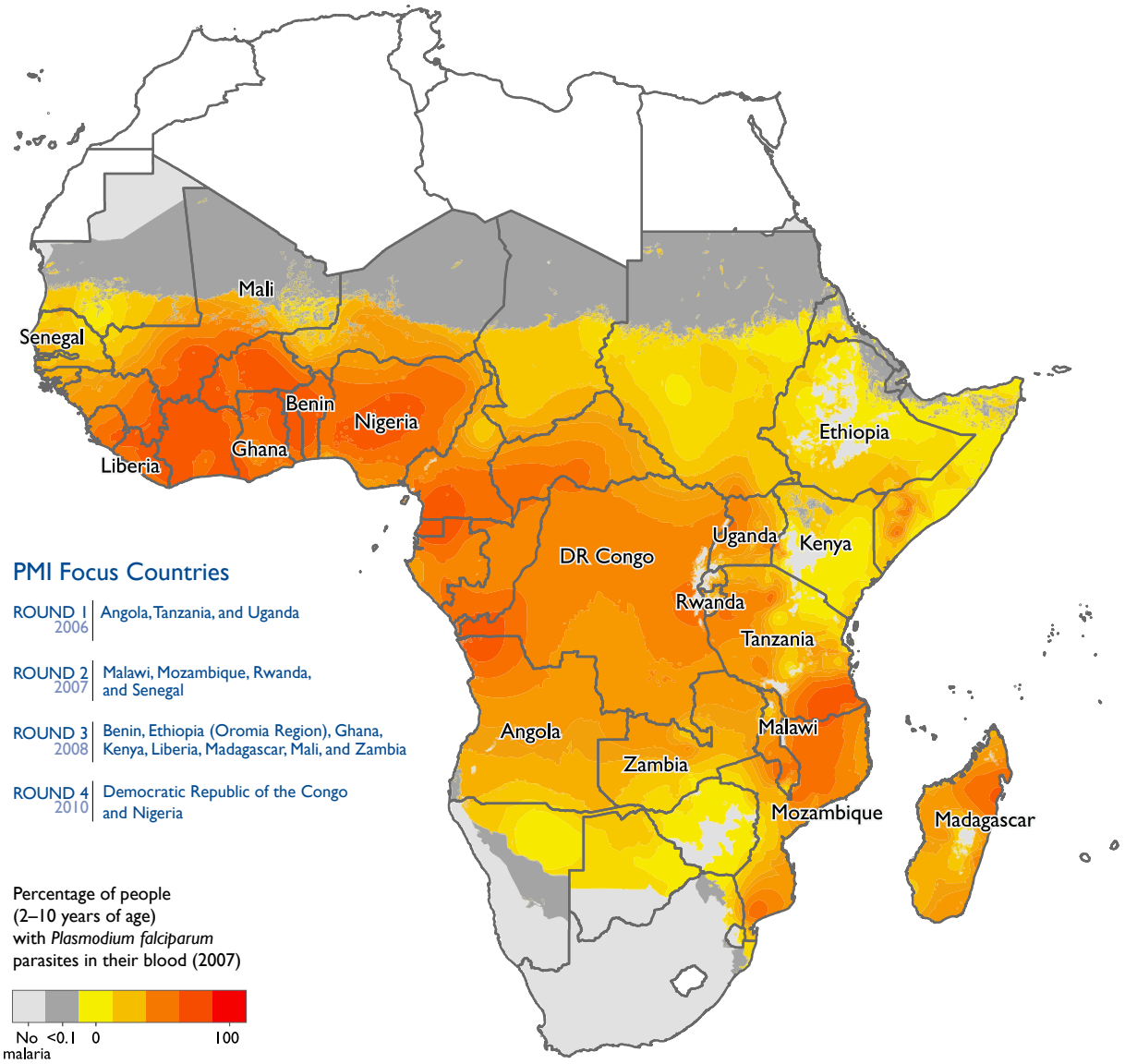
PMI Approach

PMI is organized around four operational principles based on lessons learned from more than 50 years of USG experience in fighting malaria, together with experience gained from implementation of PEPFAR, which began in 2003. The PMI approach involves:

- Using a comprehensive, integrated package of proven prevention and treatment interventions
- Strengthening health systems and integrated maternal and child health services
- Strengthening NMCPs and building capacity for country ownership of malaria control
- Coordinating closely with international and in-country partners

PMI works within the overall strategy and plan of the host country's NMCP, and planning and implementation of PMI activities are coordinated closely with each ministry of health.

PMI Focus Countries and Malaria Distribution in Africa



Citation: Hay, S.I. et al. (2009). A world malaria map: *Plasmodium falciparum* endemicity in 2007. *PLoS Medicine*. 6(3): e1000048. **Projection:** Plate carrée.

CHAPTER 1

André Roussel/USAID

In a village in **Benin**, community health workers demonstrate the proper way to hang and use an insecticide-treated net. PMI supports communication activities to ensure that residents use their insecticide-treated mosquito nets correctly and consistently to protect against the dangers of malaria.

Prevention—Insecticide-Treated Nets

Introduction

In the swamplands of Apac District, Uganda, located between Lake Kwania and the Nile River, residents can experience more than 1,500 bites each year from mosquitoes infected with malaria parasites. This is one of the highest infective biting rates in the world. Children living in such areas have a greater risk of death from malaria, but sleeping under an insecticide-treated mosquito net (ITN) can protect children, as well as adults, and greatly reduce the risk of infection. Research shows that high ownership and use of ITNs reduces all-cause mortality in children under five by about 20 percent and malarial infections among children under five and pregnant women by up to 50 percent. Consequently, since its launch in 2005, the President's Malaria Initiative (PMI) has focused a large proportion of its resources on procuring and distributing nets, educating people about the dangers of malaria, and encouraging them to sleep under a net every night.

In addition to protecting the people who sleep under an ITN, high rates of net use in a community can protect those who do not sleep under an ITN as a result of the impact the nets have on the malaria vector population. This "community effect" may play a role in reducing malaria transmission, even in areas where only 50 to 65 percent of the population uses an ITN regularly.

During the past two years, PMI; the Global Fund to Fight AIDS Tuberculosis and Malaria (Global Fund); United Nations Children's Fund (UNICEF); International Federation of Red Cross and Red Crescent Societies; World Bank; and others have made enormous strides in increasing the number of nets distributed in sub-Saharan Africa with the aim of reaching the goal of universal ITN coverage. This goal, which was set by the Secretary General of the United Nations in 2008, aims to protect all people living in malaria-endemic areas with an ITN, and is most commonly defined as one net per two persons at risk.

Malaria prevention measures are some of the most equitable child survival interventions. UNICEF's report, *Progress for Children: Achieving the MDGs with Equity* (September 2010), states that in most countries, ITN ownership tends to be equitable, with no differences in coverage between genders and with poorer and rural households showing coverage similar to that of richer and urban households. UNICEF attributes this equity to the campaigns to distribute free nets. In addition, the Roll Back Malaria (RBM) malaria impact evaluation in Tanzania shows that initial disparity in ITN ownership between the richest and poorest households had almost disappeared by 2009, when large-scale campaigns for ITN distribution were mostly completed. PMI has been

PMI ITN Summary Table

Indicator[1]	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Cumulative
Procured by PMI	1,047,393	5,210,432	6,481,827	15,160,302	17,532,839	45,432,793 (30,343,517 distributed)[2]
Procured by other donors and distributed with PMI support	—	369,900	1,287,624	2,966,011	10,856,994	15,480,529
Distributed through PMI-supported voucher programs	—	496,607	1,439,706	771,342	710,020	3,417,675
Sold with PMI marketing support	586,284	1,702,093	2,407,065	687,404	—	5,382,846

1 The data reported in this table are up to date as of January 1, 2011, and include 15 PMI focus countries plus jump-start activities in DRC and Nigeria. In addition, during 2010, the USG funded ITN activities in other countries. For data by country, see Appendix 2.

2 ITNs are primarily distributed through mass ITN distribution campaigns and at health facilities (antenatal clinics and child health clinics). Since 2005, PMI has procured long-lasting ITNs, which remain effective for up to three years and do not need to be re-treated with insecticides after washing.

a leader in procuring and delivering long-lasting ITNs to the 15 original focus countries, primarily through mass campaigns, free of charge to recipients.

PMI's ITN Strategy

PMI tailors its ITN distribution approach to local conditions and capacities of each country, while adhering to the following general principles:

- **Achieving high ITN ownership** through mass distribution of ITNs free of charge to all those at risk of malaria, an approach shown to achieve high and equitable coverage among the most vulnerable groups—pregnant women and children under the age of five;
- **Sustaining high ITN ownership** by making ITNs available on a continuing basis to all segments of the population through multiple distribution channels, including free delivery through health facilities and community-based approaches, as well as subsidized and commercially available ITNs;
- **Promoting regular net use** through behavior change communication and community mobilization activities; and
- **Monitoring the physical integrity and insecticide longevity of long-lasting ITNs** to better advise countries when nets should be replaced.

While following these principles, PMI endorses the universal coverage goal of protecting all individuals at risk of malaria when this goal is in line with the national strategy and adequate resources exist to achieve that goal. Three PMI focus countries, **Liberia**, **Madagascar**, and **Rwanda**, have achieved their goal of distributing long-lasting ITNs to all malaria-endemic regions in their respective countries, and results of nationwide household surveys will determine if they have achieved universal coverage. Several other PMI countries are nearing this milestone.

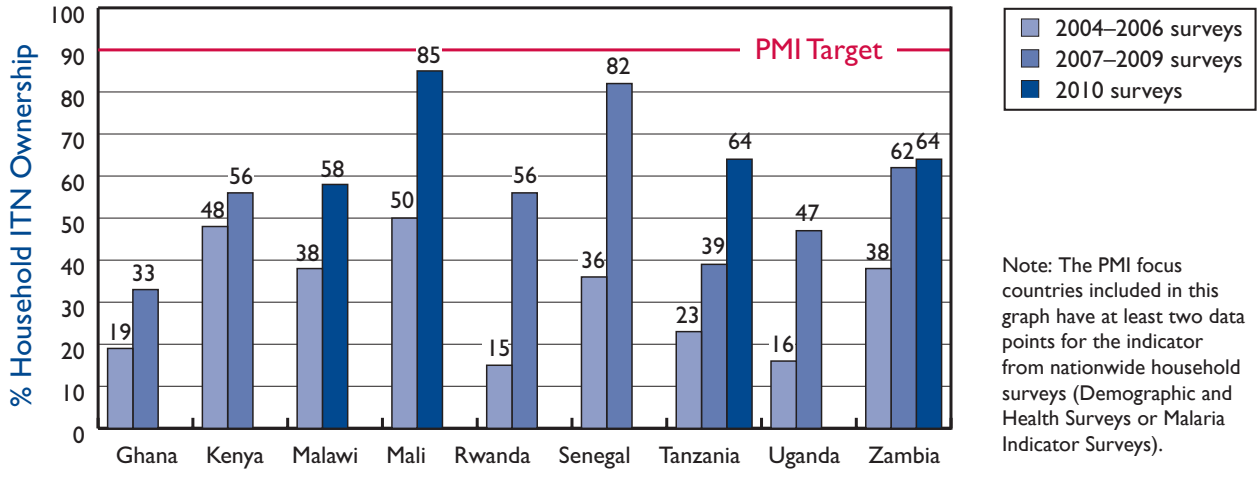
PMI ITN Activities

Since its launch in 2005, PMI has procured more than 45 million ITNs and has distributed more than 30 million, primarily free of charge through mass ITN distribution campaigns and antenatal and child health clinics. In addition, PMI funded the distribution of 15 million ITNs procured by other donors and nearly 3 million nets redeemed at retail outlets through subsidized voucher programs (see Summary Table on page 12).

ITN Ownership and Use

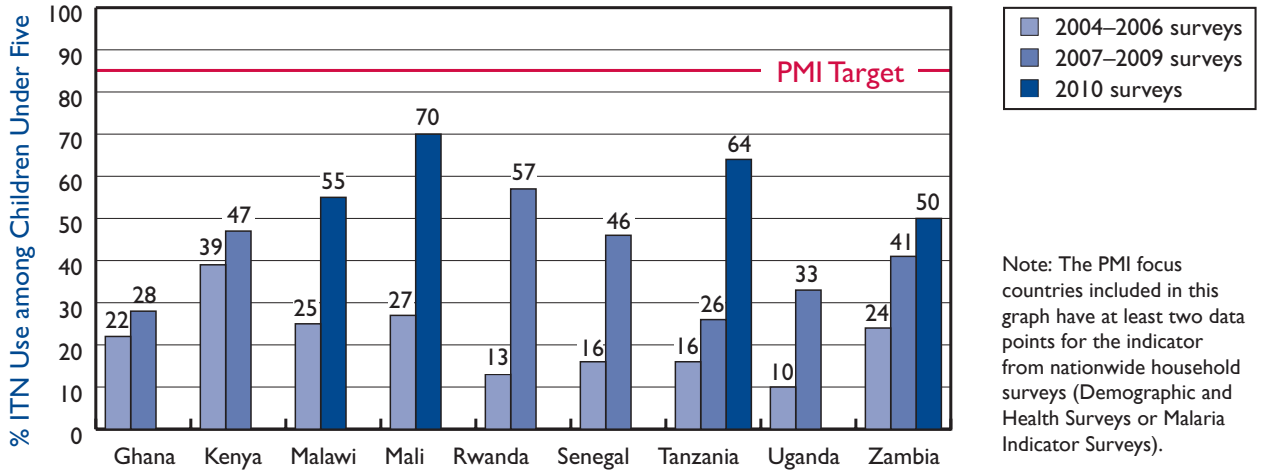
The 15 original PMI focus countries have made rapid progress in scaling up ITN ownership. In the nine countries that have baseline and follow-up household surveys, ownership has increased significantly since PMI's launch, from an average of 31 percent in 2004–2006 baseline surveys to an average of 61 percent in surveys completed in 2007–2010. PMI's target for net ownership is that 90 percent of households with pregnant women or children under the age of five will own at least one ITN. In seven of these countries, more than half of all households now own an ITN: **Kenya**, **Malawi**, **Mali**, **Rwanda**, **Senegal**, **Tanzania**, and **Zambia** (see Figure 1.1).

Figure 1.1
Increasing ITN Ownership



Note: The PMI focus countries included in this graph have at least two data points for the indicator from nationwide household surveys (Demographic and Health Surveys or Malaria Indicator Surveys).

Figure 1.2
Increasing ITN Use among Children Under Five



Note: The PMI focus countries included in this graph have at least two data points for the indicator from nationwide household surveys (Demographic and Health Surveys or Malaria Indicator Surveys).

Nationwide household surveys also show that ITN use among children under five years of age (Figure 1.2) and pregnant women has also increased significantly. Use among children under five rose from an average of 21 percent in baseline surveys completed in 2004–2006 to an average of 50 percent in surveys completed in 2007–2010; use by pregnant women rose similarly from 18 to 47 percent. PMI's target is that 85 percent of pregnant women and children under the age of five will have slept under an ITN the previous night.

An analysis based on households that own at least one ITN showed even higher net usage, ranging from 42 to 76 percent in children under five years of age and from 46 to 85 percent in pregnant women across these seven countries. These results highlight the need to focus on increasing access to and ownership of ITNs.

Achieving Universal Coverage through Mass Distribution Campaigns

In 2010, PMI participated in mass ITN campaigns in most focus countries. For example:

- In **Ghana**, under the leadership of the National Malaria Control Program (NMCP), PMI partnered with Malaria No More; Comic Relief; UNICEF; the World Health Organization (WHO); Nets for Life; ADDRO, a local nongovernmental organization (NGO); and others to launch the first in a series of long-lasting ITN distribution campaigns designed to reach all the regions in the country by the end of 2011. In May, more than 10,000 volunteers walked door to door in every community in the Northern Region, distributing and hanging 560,000 long-lasting ITNs to cover children under the age of five and pregnant women. In November 2010, PMI helped launch the second phase of the ITN campaign, distributing more than 440,000 ITNs in 10 districts of Eastern Region using the same door-to-door distribution and hang-up method, but shifting to universal coverage. In 2010, PMI contributed 955,000 long-lasting ITNs, logistics support, training, technical assistance, and post-campaign evaluations to the Ghanaian ITN program.

- In **Madagascar**, PMI collaborated with the NMCP, Global Fund, UNICEF, WHO, the Principality of Monaco, Alliance for Malaria Prevention, and other RBM partners to distribute more than 5.6 million long-lasting ITNs (PMI provided 2.5 million of these nets) in 71 districts in the north, west, and south of the country in late 2010. Together with a mass campaign in 19 districts in late 2009, enough nets should have been delivered to achieve universal coverage by the end of 2010. Building on experience and lessons learned in the initial phases of the campaign, the National ITN Coordination Committee, with representatives of all participating partners, revised and improved the methods used to plan and implement the campaign. This committee, using funds from PMI and Global Fund, worked

through local NGOs to carry out training and net distribution, and with regional and district-level coordination committees to ensure the success of the campaign at the local level.

- In **Senegal**, PMI has joined with the Peace Corps, the World Bank, Islamic Relief France, and the Islamic Development Bank to support the NMCP strategy of providing a long-lasting ITN for every sleeping space (Senegal's goal for universal coverage). This strategy, based on a model pioneered by the Peace Corps and expanded with support from World Vision, Tostan, Malaria No More, the Youssou Ndour Foundation, and PMI in Senegal, involves a household census of residents, sleeping spaces, and existing nets, followed by a community-level validation of the results and a distribution of enough long-lasting ITNs to cover any sleeping space without a net. The NMCP is implementing the strategy in phases: during Phase 1, they distributed more than 620,000 long-lasting ITNs in the four regions with the highest malaria incidence. Phase 2 will cover two additional regions between January and March 2011, with subsequent phases covering the remaining eight regions in the country by early 2012.

Alexis Ayelepuni/ProMPT

Mrs. Azara Haruna and two of her children received this green ITN during the May 2010 ITN distribution in her Northern Region village of Nantong Zuo in **Ghana**. Mrs. Haruna had not owned an ITN for two years because nets were not available in her village.

Maintaining High Net Coverage through a Continuous Supply of ITNs

Even after universal ITN coverage has been achieved, a continuous supply of new ITNs is still needed to sustain high net ownership. These new nets will cover new members of the population added through births and immigration, as well as the ongoing attrition of nets over time. PMI promotes a woman-centered approach that integrates delivery of replacement ITNs with routine antenatal and immunization clinics to reach pregnant woman and children under the age of five. This approach strengthens the health care system by providing an incentive for women to attend antenatal clinics and to bring their children to immunization clinics. This, and other continuous distribution channels to deliver free and subsidized nets through health facilities and the community, will play an increasingly important role in filling future net needs and may ultimately replace the requirement for mass campaigns.

PMI facilitated continuous distribution activities in all focus countries in 2010, including:

- In **Ethiopia**, PMI and UNICEF collaborated with the Oromia Regional Health Bureau to develop a micro-plan to identify and respond to local ITN needs. The plan includes district- and community-level data about the number of malaria cases and availability of key malaria commodities, including long-lasting ITNs, antimalarial drugs, and insecticide. For ITNs, the plan projects the 12-month need and identifies gaps, including the number of new and replacement ITNs needed in all malaria-affected villages. This database now serves as a model for other regional states, because it helped streamline, coordinate, and track commodity procurement and distribution. Using this plan, more than 3.85 million long-lasting ITNs were distributed in Oromia Regional State in 2010, including 1 million procured by PMI.

- In **Malawi**, ownership of at least one ITN increased from 38 percent in 2006 to 58 percent in 2010. Much of this increase in ownership results from the routine systems that PMI supported to provide free, long-lasting ITNs to pregnant women and children through antenatal and immunization clinics. The demand for ITNs through these channels remains high, and on average, clinics distribute 100,000 ITNs monthly, nationwide. With distribution costs under 75 cents per ITN, this remains a very cost-effective approach.

Promoting Regular Use of Nets

Household surveys indicate that although ITN ownership has increased dramatically in the past five years, gaps still exist between net ownership and use. PMI works with NMCPs and partners to increase use of ITNs through a combination of behavior change and community mobilization activities, which include post-campaign household visits by community workers to help homeowners hang their nets properly and ensure their correct use. Behavior change communication campaigns include radio messages and talk shows, community mobilization events, and interpersonal communication.

MEDA/Tanzania

In **Tanzania**, a pregnant woman exchanges a voucher for an ITN provided through the National Voucher Scheme, which has distributed millions of nets to pregnant women and infants. Pregnant women and caregivers of infants receive their vouchers at health facilities; the vouchers can then be redeemed for a long-lasting ITN at private sector net retail shops with a top-up fee of just 45 cents. The retail market takes all responsibility for transporting and maintaining stocks of those nets in private shops.

- **Ethiopia:** In Oromia Regional State, PMI assisted with the development of four essential malaria actions as a facet of the Model Families Program, through which health workers help families to improve their knowledge and actions around disease prevention. The four essential malaria actions are simple but doable steps that a family can take to prevent malaria: 1) sleep under an ITN every night, 2) seek care promptly for children with fever, 3) take all doses of your malaria medicine, and 4) assist indoor residual spraying (IRS) teams when they come to your community. Families track each action on a scorecard, provided by a health worker, who also gives guidance in completing the actions. The scorecard then becomes a record for the family as well as health workers to measure their progress toward earning a "Malaria Protection Sticker" to display on their front door, which encourages neighbors to strive to become a "Model Family."

- In **Liberia**, when they distributed long-lasting ITNs in a door-to-door campaign in Montserrado and Nimba Counties in July and August, community health volunteers encouraged recipients to use their nets every night. Two of PMI's Malaria Community Program NGO grantees, EQUIP and MENTOR, focused their activities on behavior change communication and training community health agents to promote net use. A sub-national survey carried out after the campaign in seven of the country's 15 counties indicated that net use had increased to 70 percent among net owners, considerably higher than the 51 percent reported in the nationwide Malaria Indicator Survey in 2009.

- In **Uganda**, PMI funded the development of multiple communication approaches to promote net use. Efforts have included the development of information and education materials tailored to community health workers on the correct and consistent use of ITNs, a series of radio spots discussing ITNs, and distribution of a newsletter, *Everyday Health Matters*. PMI also supports a marketing strategy for private-sector ITNs that includes the popular "Squito" malaria-focused cartoon strip, mobile promotion units, and brand-specific campaigns to promote use of ITNs.

Monitoring Physical and Insecticidal Longevity of Long-Lasting ITNs

Nets with holes or reduced insecticidal activity offer less protection from mosquito bites, and homeowners are also less likely to use old or damaged nets because they may perceive them to be less effective. To maintain long-term reductions in malaria, owners must replace nets that have exceeded their useful life. To help determine the optimal time for net replacement, PMI is evaluating the physical durability and insecticide longevity of long-lasting ITNs under field conditions at two or more sites in eight PMI focus countries. Results from these and similar studies done by other groups will be used to guide net replacement strategies.

Challenges

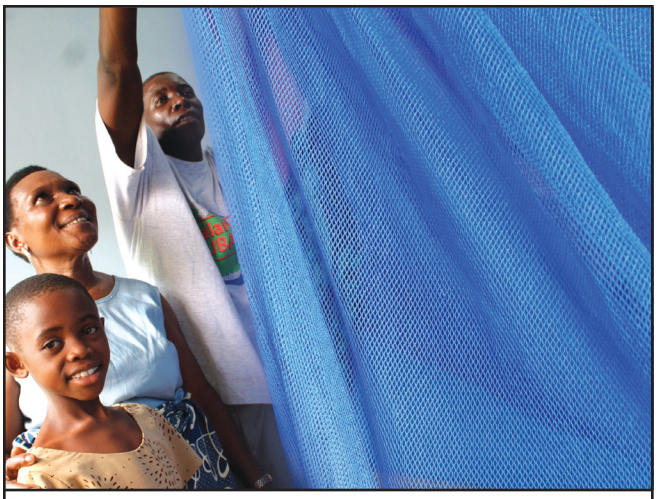
Over the past few years, net ownership has increased dramatically across all countries in sub-Saharan Africa, and millions of people are now protected from malaria. At the same time, several new challenges have emerged:

- Identifying the best approaches for sustaining high rates of ownership of ITNs over time through effective net replacement strategies, by combining free delivery through health facilities, community-based distribution approaches, and subsidized and commercially available ITNs;

- Prolonging the useful life of nets by providing guidance to net owners on how to care for their nets properly, including clear instructions on how to hang, use, and wash nets to avoid damage, and how to repair holes; and

- Dealing with the impact of increasing resistance of *Anopheles* vector mosquitoes to pyrethroid insecticides used in ITNs.

For more information, please visit the ITN section of the PMI website: http://www.pmi.gov/technical/itn/index.html.



Dan Albrecht/MEDA Tanzania

In **Tanzania**, a volunteer helps a family hang the new long-lasting ITN they received through a campaign. A month after distribution of nets, trained volunteers visit every household to help hang nets and to educate the community to sleep under a net every night. PMI and U.K.'s Department for International Development (DfID) funded this hang-up program following the Under Five Coverage Campaign, which ended in March 2010.

Voices from the Field

PMI Helps Protect All at Risk of Malaria

Although the most effective and equitable way to reach universal coverage quickly is through mass distribution of free nets, these campaigns are extremely labor intensive, requiring months of planning and coordination with partners, ranging from the large multilateral organizations to local NGOs. As an example, planning for the 2010 ITN campaign in **Uganda** began in 2007 with an application to the Global Fund detailing the number of nets required, the districts that would be covered, and the NGOs that would be involved in the distribution. In August 2008, the Government of Uganda signed the grant to purchase and distribute 17.7 million long-lasting ITNs over five years. In late 2008, the NMCP, PMI, and other malaria partners met to develop and resubmit an updated strategy to the Global Fund for approval. Macro-planning began in November 2009, to deal with the logistical challenges of receiving, storing, and then transporting the large quantity of nets arriving in the country. District-level micro-planning was no less challenging and consisted of 40 different tasks. Finally, in late 2009, a total of 7.2 million nets were procured and started arriving in-country in March 2010. By the end of May, 1.4 million nets were distributed to pregnant women and children under the age of five in Central Region. Distribution of an additional 5.8 million nets for the rest of the country was completed in December 2010. By that time, planning was already under way for a follow-up campaign to achieve universal coverage, so that all those at risk in Uganda will be protected against the threat of malaria.

The photos below were taken during several mass campaigns that were supported by PMI.

Simplice Takoubo/USAID Benin

In **Benin**, workers store nets before the campaign.

Lisa Kramer/PMI

Campaign workers prepare to distribute nets in **Ghana**.

ADPP

In **Angola**, a mother registers her child so that she can receive a long-lasting ITN.

Debbie Gueye/PMI

Net recipients in **Senegal** listen to messages on the importance of sleeping under an ITN every night.

Dan Albrecht/MEDA Tanzania

In **Tanzania**, a mother rests with her young child under the protection of a long-lasting ITN.

CHAPTER 2

Abt Associates/Uganda

A spray operator applies insecticide to the interior wall of a home during an indoor residual spraying (IRS) campaign in northern **Uganda**. In 2010, PMI-funded IRS operations protected more than 27 million people.

Prevention—Indoor Residual Spraying

Introduction

Over the past 60 years, the spraying of interior walls of houses with insecticides for malaria control—known as indoor residual spraying (IRS)—has saved millions of lives around the world. Female *Anopheles* mosquitoes, which are the only type of mosquito that transmits human malaria, tend to rest on interior walls after feeding because they are too heavy to fly far; IRS targets these mosquitoes by killing them before they have a chance to transmit malaria to others in the community. Thus, the greatest impact of IRS is not protection of individual residents, but community-level protection, which it accomplishes by cutting short the malaria transmission cycle. For IRS programs to be fully effective at the community level, WHO recommends spraying at least 80 percent of houses in a targeted area. This coverage is usually accomplished through IRS campaigns conducted once or twice a year according to the duration of the insecticide's effectiveness and the length of the malaria transmission season.

Prior to PMI's 2006 launch in Angola, Tanzania, and Uganda, only a small number of NMCPs in southern African countries, Ethiopia, and Eritrea implemented IRS; a few private spray programs also operated in Equatorial Guinea, Ghana, and Zambia. Since then, and in part due to the observed impact of IRS in PMI focus countries, the use of IRS in Africa has grown substantially, both within PMI focus countries where spraying has expanded to larger geographic areas, and in other countries, where in some cases NMCPs implemented IRS programs for the first time.

Although PMI tailors its IRS activities to the local conditions and capacities of each country, its programs apply the following approaches and best practices in all countries:

- **Conducting entomological assessments** before, during, and after IRS operations to measure the quality of operations and the impact of IRS on mosquito populations, and to monitor mosquito resistance to insecticides;
- Before spraying, **completing environmental assessments** and developing plans for the appropriate handling and safe use of insecticides, including disposal of insecticide waste;
- **Recruiting and training** local village staff and government health staff to carry out and supervise IRS in their own communities;
- Making house-to-house visits before spray campaigns to **educate residents about IRS and foster cooperation** with the spray teams; and
- **Building in-country capacity** for planning and managing future spraying activities.

PMI IRS Activities

During 2010, PMI-supported IRS programs protected more than 27 million people from malaria in the 15 original PMI focus countries (see Summary Table). This included funding to train more than 30,000 people who facilitated the spraying of more than 6.6 million structures.

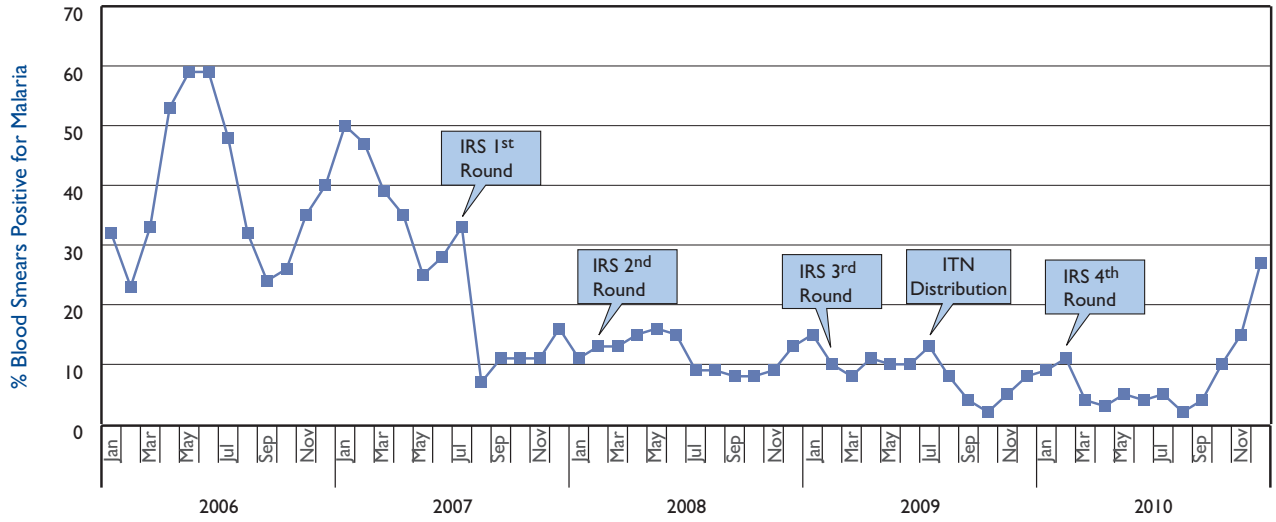
PMI IRS Summary Table

Indicator[1, 2]	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)
People protected by IRS	2,097,056	18,827,709	25,157,408	26,965,164	27,199,063
Spray personnel trained[3]	1,336	13,795	19,077	21,664	30,545
Houses sprayed	414,456	4,353,747	6,101,271	6,656,524	6,693,218

1 The data reported in this table are up to date as of January 1, 2011, and include 15 PMI focus countries (PMI did not fund IRS in DRC and Nigeria). In addition, during 2010, the USG funded IRS activities in other countries. 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 most areas are 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.

Figure 2.1

Decline in Malaria Infections in Muleba District, Tanzania (2006–2010)



In 2007, working with the National Malaria Control Program, PMI initiated an IRS program in Muleba District in northwest **Tanzania**. Since then, the proportion of patients attending the district hospital with positive malaria blood smears fell from an average of 40 percent before IRS (median 1997–2007) to less than 8 percent in 2010 after four rounds of IRS and an ITN campaign. An increase in reported cases beginning in October 2010 is unexplained and is being investigated.

IRS Coverage

PMI's goal for IRS is that 85 percent of all enumerated houses in a targeted geographic area will be sprayed. IRS programs funded by PMI have consistently reached, and in most cases exceeded, this target, indicating very high acceptance of IRS by local communities.

Working with National Governments

In addition to providing material support for IRS (e.g., procuring insecticides, spray equipment), PMI works with NMCPs to build their capacity to implement spraying campaigns. This includes developing and refining policies and best practices to maximize the success and efficiency of spraying, ensuring that NMCPs conduct IRS within the context of integrated vector management, addressing the growing challenges of insecticide resistance, and integrating safe handling of insecticides at every stage of IRS. PMI's assistance has enabled NMCPs in many African countries to establish, for the first time, the complex and logistically challenging systems that IRS requires (see IRS Management Cycle, Figure 2.2).

Policy

PMI works with NMCPs and other partners to develop guidelines for monitoring insecticide susceptibility in vector mosquitoes, promote the judicious use of insecticides, and manage resistance in mosquitoes. Efforts are directed at ensuring that workers handle the chemicals used for IRS and other vector control measures—from the moment of procurement, through application, and until the final piece of spray equipment is cleaned and waste disposed of—in a safe and secure fashion. In many instances, such as the handling of waste-water from equipment cleaning, PMI has set new standards in insecticide management that other programs are beginning to adopt.

As an example of 2010 activities, PMI started working with the Government of **Zambia** and other stakeholders to develop an integrated vector management strategy with IRS and long-lasting ITNs as the main interventions. The national strategy is to prioritize IRS in urban and peri-urban areas because it is a cost-effective way to cover large numbers of more densely spaced households. Many houses in these areas have plastered walls, which retain insecticides better than the thatched or mud/pole huts that are more common in rural areas. In addition, people living in rural areas often build new huts as frequently as every three to six months, jeopardizing the effects of IRS. Logistics are also an issue in rural areas where spray teams need to travel long distances between villages. In 2010, non-IRS districts and villages were prioritized for ITN distribution.

Capacity Building

PMI builds national capacity for the key activities involved in an IRS program, including planning, entomological surveillance, environmental compliance, and training of spray personnel.

PMI's level of involvement in IRS programs varies depending on local needs. In countries such as **Zambia**, which had long-standing IRS programs in place prior to PMI involvement, PMI provides targeted support for insecticide-resistance monitoring, insecticide management, and environmental monitoring with a focus on improving IRS planning and implementation. In **Ethiopia**, PMI provides targeted assistance to IRS operations at three levels. At the national level, help includes refining strategies, policies, and guidelines, as well as providing technical assistance and equipment for IRS operations and for entomological monitoring. At the regional level, PMI funds procurement of insecticides, annual IRS micro-planning, training workshops, and contributes some operational funds for implementation and supervision. At the district level within Oromia Regional State, PMI provides full logistics and operational support for IRS operations.

In other countries, PMI provides broad management and implementation assistance for IRS programs, while gradually building national capacity. For example, in **Ghana**, PMI helped establish a national vector control oversight committee, helped draft the country's standard operating procedures for IRS, and contributed to a successful Global Fund grant application for a major scale-up of IRS to 40 percent of the districts in the country.

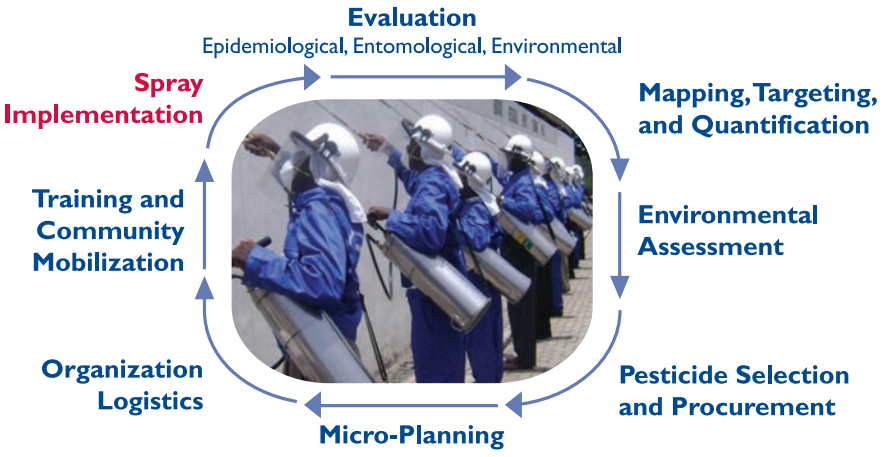
Other examples of PMI's capacity-building efforts in 2010 include:

- In **Liberia**, PMI works with the NMCP to build capacity in IRS and vector control management and with a private steel company, ArcelorMittal, to train spray operators for their IRS program. (See Voices from the Field on page 26.)

- PMI successfully piloted IRS in Nkhotakota District, **Malawi**, for the past three years, and as a result, the Government of Malawi scaled up the program to seven districts along Lake Malawi and the Shire Valley with assistance from the Global Fund. In cooperation with the NMCP, PMI continued to support IRS in Nkhotakota and neighboring Salima District while the government financed operations in the remaining five districts.

- PMI development of an insectary and entomological laboratory in **Rwanda** enabled the country's Malaria Unit to establish an entomological monitoring program to evaluate IRS quality, efficacy, and duration. With this help from PMI, the Malaria Unit determined that one round of spraying with a long-lasting insecticide formulation was sufficient to provide protection to residents through the two long transmission seasons. As a result, the country has now transitioned away from spraying twice a year to a single, annual round of spraying.

Figure 2.2
IRS Management Cycle



IRS campaigns are logistically complex and challenging. To succeed, program managers must oversee a series of individual activities according to a precise timeline, including: maintaining financial and information management systems; managing entomology and environmental monitoring; planning and coordinating commodity procurement; arranging transportation of supplies, equipment, and workers; training (as shown in this photo); coordinating mobilization and communication campaigns; and conducting spraying and cleanup just as the rains and the malaria transmission season begin.
(photo credit: RTI)

Richard Reithinger/PMI

In **Ethiopia**, spray operators, wearing personal protective equipment, gather at the start of the day's work. Spray operators participate in a six-day training program and work in squads of four spray operators and one porter, supervised by a squad leader. Each district employs approximately five spray squads during a 40-day period immediately prior to the start of the rainy season or the malaria transmission season. Limited motorized transportation requires spray teams to camp in the vicinity of spray operations and to use mules when vehicles are unavailable or access is difficult. An operator can spray 10 to 13 houses per day.

Safe Management of Insecticides

All IRS activities supported by PMI adhere to United States Government (USG) and international regulations and treaties regarding the safe storage, transport, use, and disposal of insecticides. These regulations ensure that development programs not only use insecticides in an economically sustainable manner, but also protect the host country's residents, malaria control workers, and the environment. Because insecticide management is relatively new to most ministries of health in Africa, PMI works with them, as well as with ministries of agriculture and environment, to build capacity and create awareness of the need for safe management of insecticides. For example, during 2010, PMI:

- Developed a manual on management practices for IRS (available at www.pmi.gov) that covers environmental assessment; safety; insecticide storage, stock control, inventory, and transport; spraying techniques; waste disposal; spill response; and special considerations for the use of DDT.

- Supported the development and implementation of two regional workshops (in English and French) to train in-country environmental assessors and representatives from ministries of health and the environment in safe application of IRS. Fifty participants, representing 16 countries, benefited from the training and have become more involved in environmental oversight of IRS operations.

- Disposed of all IRS insecticide-related waste in 14 countries through a combination of in-country incinerators, shipping to countries with existing incinerators, and in one case, procurement of a mobile incinerator. The remaining country plans to purchase an incinerator for burning IRS-related waste. Ministries of health now have the knowledge and access to such facilities to promote safe disposal beyond PMI-supported IRS activities.

Targeting Resources for IRS as Transmission Decreases

PMI also assists ministries of health to address the challenge of targeting and using IRS resources judiciously. IRS has proven to be very popular, both among policymakers and the communities they represent. As transmission levels and malaria burdens decrease, PMI will continue to work with NMCPs to transition to more focal spraying and a more surveillance-driven approach to consolidate and maintain the gains achieved with large-scale IRS campaigns.

Innovations

As national management systems for IRS mature, a number of countries have started to use electronic databases that allow real-time monitoring and evaluation of spray operations. For example, **Uganda** and **Ethiopia** are piloting the use of global positioning and geographic information systems to plan and monitor operations in the field. In another innovation, **Uganda** piloted the use of mobile banks, which allow spray personnel to receive their wages on time and without having to travel long distances, and save the IRS implementing partner from having to handle large sums of money in the field.

Oliver Lulembo/PMI

In 2010, PMI continued to strengthen the laboratory capacity of the **Zambia** Bureau of Standards by installing and calibrating equipment, procuring start-up laboratory supplies, and providing onsite staff training. To assist the national IRS program, the Bureau of Standards has started to perform DDT analysis on soil and crop samples to monitor DDT levels in the environment, as shown above.

Mosquito Resistance to Insecticides

Mosquito resistance to one or more classes of insecticides is emerging as a major threat to IRS and ITNs across Africa. Pyrethroid insecticides have historically been among the most effective, safest, and least expensive insecticides available. As a result, they are also commonly used in agriculture, public health, and domestic pest control. Pyrethroids are the only class of insecticide potent and safe enough to treat mosquito nets. With PMI support, national programs now conduct more rigorous monitoring of insecticide resistance. Globally, PMI works with WHO, industry, and partners from African academic and research institutions to develop international guidelines to manage insecticide resistance for malaria control.

Although several new formulations of insecticides are under development and may soon be available for IRS, over time, resistance is likely to develop for each new insecticide. Therefore, PMI will continue to work with other USG agencies, such as the Environmental Protection Agency and Department of Agriculture, focus countries' governmental agencies, and insecticide manufacturers to promote the judicious use of insecticides. In 2010, PMI supported the following activities:

- When initial entomological data suggested emerging resistance in **Zambia**, PMI started working with the Ministry of Health and other stakeholders to develop and implement an insecticide-resistance management strategy.
- In **Ethiopia**, **Malawi**, and **Uganda**, PMI assisted the NMCP to change the class of insecticide used for IRS after testing showed resistance to first-line insecticides.

Working with Partners

PMI's IRS activities involve a broad set of partnerships across many sectors. At the national level, ministries of the environment and agriculture are, in many cases, new partners for ministry of health malaria control operations. Universities and national research institutions are key collaborators, particularly in building entomological monitoring capacity. Some of the organizations PMI collaborates with include the Noguchi Memorial Institute for Medical Research in **Ghana**, Université Cheikh Anta Diop and the Pasteur Institute in **Senegal**, the Malaria Research and Training Centre in **Mali**, the Malaria Action Center in **Malawi**, Institut Pasteur de **Madagascar**, the Center for Entomology Research–Cotonou in **Benin**, and the Addis Ababa University Aklilu Lemma Institute of Pathobiology in **Ethiopia**.

PMI also facilitates partnerships with the private sector, such as mining companies in **Zambia**, **Liberia** (see Voices from the Field on page 26), and **Ghana**, and

Abt Associates

To reduce transportation costs during an IRS campaign in **Uganda**, spray operators used their bicycles to reach remote households.

commercial agricultural concerns in **Malawi**. PMI also works closely with communities. IRS programs employ large numbers of staff, spray operators, supervisors, and transport and management teams, most of whom are recruited from the areas where they serve. Along with the extensive communication and mobilization during the actual spray operations, community support underlies all IRS programs.

Challenges

As IRS programs mature, PMI will help NMCPs meet two strategic challenges:

- Continuing to build the technical and management capacity of NMCPs to ensure the sustainability of IRS programs and to expand sources of funding; and

- Helping programs graduate to a more focused and surveillance-driven vector control operation as transmission levels and malaria burden decrease.

Malaria vector control is a long-term investment and PMI will continue its support to ensure robust and sustained IRS programs as countries bring malaria under control.

For more information, please visit the IRS section of the PMI website: http://www.pmi.gov/technical/irs/index.html.

RTI

Information and education materials play an important role in mobilizing communities to understand and accept IRS. This poster from **Ethiopia** illustrates steps community members need to take to help ensure a successful IRS campaign: 1) registering for spraying; 2) clearing their houses; 3) cooperating with spray personnel; 4) staying out of their houses for two hours to let the insecticide dry; and 5) sweeping up and discarding any dead insects and avoiding re-plastering of walls.

Voices from the Field

PMI Teams up with the World's Largest Steel Producer to Fight Malaria in Liberia

In many countries, PMI works closely with private sector organizations to extend the reach of malaria control, having collaborated with ExxonMobil Foundation in **Angola** for delivery of malaria services, Illova Sugar Estates in **Malawi** and AngloGold Ashanti in **Ghana** for IRS, and with Selecomwireless in **Zanzibar** for malaria case reporting via text messaging. PMI recently worked with ArcelorMittal, the world's largest steel producer, to conduct IRS in Yekepa, Nimba County, **Liberia**. ArcelorMittal, one of the first major foreign investors in post-conflict Liberia, plans to operate iron ore mines in Nimba County, which lacks the basic infrastructure as a result of the civil war that ended in 2003. While the company has not yet started mining activities, it has repaired roads and re-opened the local hospital. To protect its workforce, the company is committed to tackling the malaria problem in communities around their mining sites.

In August 2010, PMI joined with ArcelorMittal to distribute ITNs and conduct IRS for residents in the village where most of the workers' families live. PMI supplied the insecticide and the spraying equipment as well as training for ArcelorMittal employees selected as spray operators. In addition, throughout the spraying program, PMI provided technical assistance to ensure its success. Besides providing the spray operators, ArcelorMittal also engaged volunteer community mobilizers who worked with the residents to accept IRS. The program covered nearly 1,200 houses, protecting over 6,700 residents.

USAID Liberia

Spray pumps stand ready for use at the start of an IRS campaign in Yekepa, **Liberia**.

USAID Liberia

A spray operator applies insecticide to the walls of a home in Yekepa, **Liberia**, during an IRS campaign, on which PMI collaborated with ArcelorMittal.

CHAPTER 3

Alisha Horowitz/Jhpiego

Women at a health center in Vavatenina, **Madagascar**, hold the long-lasting insecticide-treated nets they received during their first antenatal care appointments. PMI promotes the regular use of such nets by pregnant women, who are especially vulnerable to malaria infections.

Prevention—Malaria in Pregnancy

Introduction

Across Africa, each year nearly 32 million pregnant women are at risk from malaria. The dangers of malaria in pregnancy are serious and include maternal anemia, miscarriage, stillbirth, and low birth weight in newborns. In sub-Saharan Africa, malaria causes up to 400,000 cases of severe maternal anemia, which contributes significantly to high rates of maternal mortality and may account for an estimated 10,000 deaths each year, leaving families devastated by the loss of their primary caregiver. Dangers to the fetus and the pregnant woman occur when malaria parasites infect the placenta. Malaria may account for up to 30 percent of preventable low birth weight in newborns in sub-Saharan Africa and may result in as many as 200,000 infant deaths each year—a tragic and preventable loss.

To reduce the risks to expectant mothers and their fetuses, WHO recommends a multipronged approach to manage malaria in pregnancy that includes long-lasting ITNs, intermittent preventive treatment for pregnant women (IPTp), prompt diagnosis and effective treatment of confirmed cases, and prevention and treatment of maternal anemia. IPTp is a highly effective intervention that reduces the serious consequences of malaria during pregnancy. It involves the administration of at least two doses of the antimalarial drug, currently sulfadoxine-pyrimethamine (SP), at least one month apart starting in the second trimester. Pregnant women usually receive IPTp during routine antenatal clinic visits under direct observation of health care workers.

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

- **Training** health care workers on malaria in pregnancy and focused antenatal care;
- **Integrating** malaria activities with maternal health and HIV/AIDS programs;
- Supporting **behavior change communication** at the community level to promote early attendance at antenatal clinics, acceptance of IPTp, and regular use of ITNs, and to overcome community and cultural barriers that prevent pregnant women from accessing services to prevent and treat malaria;
- **Strengthening** supply chain management systems to deliver and track commodities; and
- **Procuring SP** when national needs are not met by the government or other donors.

PMI Malaria in Pregnancy Activities

In 2010, PMI trained more than 14,000 health care workers in the control of malaria in pregnancy and focused antenatal care (FANC) (see Summary Table). PMI also facilitated integration of malaria control activities with maternal and child health, reproductive health, and HIV/AIDS activities. Since its launch in 2005, PMI has distributed nearly 30 million ITNs, mostly through health clinics, mass

PMI Malaria in Pregnancy Summary Table

Indicator[1]	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Cumulative
IPTp treatments procured[2]	—	583,333	1,784,999	1,657,998	6,264,752	10,291,082 (5,084,185 distributed)
Health workers trained in IPTp/FANC[3]	1,994	3,153	12,557	14,015	14,146	N/A[4]

1 The data reported in this table are up to date as of January 1, 2011, and include 15 PMI focus countries plus jump-start activities in DRC and Nigeria. In addition, during 2010, the USG funded malaria in pregnancy activities in other countries. For data by country, see Appendix 2.
2 In most countries, national governments and other donors meet SP needs for IPTp.
3 IPTp is usually given as part of a larger package of FANC.
4 A cumulative count of health workers trained is not provided because some health workers have been trained on more than one occasion.

distribution campaigns that target pregnant women and children under the age of five, and universal coverage campaigns—which benefit all family members. PMI distributes a large proportion of the ITNs it procures to pregnant women during their first antenatal care visit.

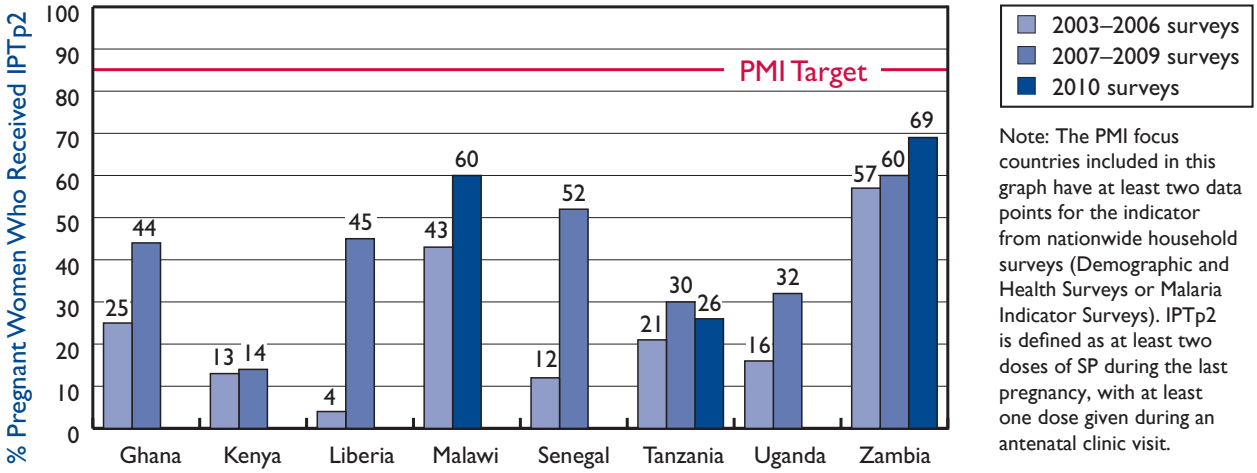
Most SP needs are met by national governments or other donors; however, since 2005, PMI has procured more than 10 million IPTp treatments. In 2010 alone, PMI procured 6 million IPTp treatments to fill gaps in stocks of SP.

Although SP costs only 10 cents per treatment and is relatively easy to administer as a single dose, problems with stockouts of SP hamper progress toward meeting IPTp targets. PMI works with NMCPs and partners to strengthen the ability of national supply chain management systems to forecast drug needs, monitor stock levels, and respond quickly to potential stockouts.

Malaria in Pregnancy Coverage

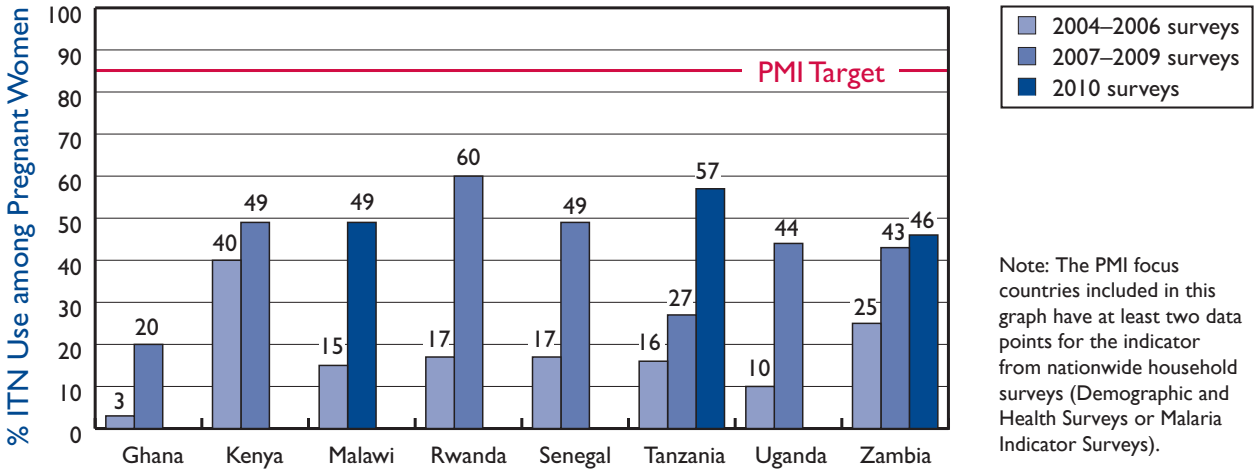
PMI's target for IPTp coverage is for 85 percent of women who have completed a pregnancy in the past two years to receive at least two doses of IPTp. While the proportion of pregnant women who have received at least one IPTp dose during their last pregnancy has increased rapidly across Africa since 2004–2005, the percentage of pregnant women who receive at least two doses of IPTp (IPTp2) has lagged behind. In spite of this, eight PMI countries have reported increases in IPTp2 from their baseline nationwide household surveys (see Figure 3.1).

Figure 3.1
Increasing IPTp2 Rates



Note: The PMI focus countries included in this graph have at least two data points for the indicator from nationwide household surveys (Demographic and Health Surveys or Malaria Indicator Surveys). IPTp2 is defined as at least two doses of SP during the last pregnancy, with at least one dose given during an antenatal clinic visit.

Figure 3.2
Increasing ITN Use among Pregnant Women



Note: The PMI focus countries included in this graph have at least two data points for the indicator from nationwide household surveys (Demographic and Health Surveys or Malaria Indicator Surveys).

PMI's target is for 85 percent of pregnant women to have slept under an ITN the night before the survey. Nationwide household surveys show that ITN use among pregnant women has increased significantly (Figure 3.2), rising from an average of 18 percent in baseline surveys completed in 2004–2006 to an average of 47 percent in surveys completed in 2007–2010.

Training

In collaboration with NMCPs, reproductive health divisions of the ministries of health, and their partners, PMI funds training of health care workers to provide quality antenatal care and to prevent, diagnose, and treat malaria in pregnant women.

To ensure that future health care workers provide high-quality care, PMI and partners have collaborated with human resources divisions and pre-service institutions, including nursing, medical, midwifery, and pharmacy schools, to update their curricula with the latest advances in control of malaria in pregnancy. In addition, these programs strengthen skills of teachers and clinical instructors to ensure continuity between pre-service education and in-service training.

PMI also funds development of in-service training materials related to malaria in pregnancy for health care workers, supervisors, and trainers. These materials are translated into local languages to improve understanding and adherence.

To follow up, oversee, and coach antenatal care providers, PMI provides funds for supervisory visits and for strengthening the capacity of regional and district reproductive health and malaria coordinators. PMI has developed checklists to measure and assess the quality of service provided by health care workers and to highlight areas for improvement.

The following examples highlight training activities that PMI supported in 2010:

- In **Benin**, antenatal care clinic attendance is high, but IPTp use has historically been very low. Because midwives and nurses provide 80 percent of antenatal care consultations, to increase IPTp uptake, PMI funded training of more than 1,500 midwives and nurses from both public and private clinics on FANC and IPTp and their follow-up support supervision.

- PMI worked with the NMCP in **Senegal** to extend the reach of antenatal care services by providing for both refresher training and training for new staff in IPTp, the importance of long-lasting ITN use, diagnosis and management of malaria in pregnancy, and counseling and interpersonal communication skills. PMI also funded training of health post nurses to provide an integrated package of services, including antenatal care during outreach visits to community health huts. This training brings antenatal care services closer to the population.

What Is Focused Antenatal Care (FANC)?

To serve expectant mothers in developing countries more effectively, a comprehensive package of antenatal care services that consists of patient interviews, examinations, interventions, and counseling during antenatal care visits has been developed. PMI endorses this array of services, often termed focused antenatal care, or FANC, which includes several malaria prevention and treatment interventions. The major goal of FANC is to help ensure normal pregnancies by:

- Identifying pre-existing health conditions, including malaria;
- Detecting complications early (for example, anemia, which can be fatal if left untreated);
- Promoting health and disease prevention, including the prevention of malaria in pregnancy through IPTp, ITN distribution at the first antenatal care appointment, and prompt diagnosis and correct treatment of malaria; and
- Preparing for birth and planning for complications.

Integrating Control of Malaria in Pregnancy with Maternal Health and HIV/AIDS Programs

Co-infection with HIV and malaria increases a pregnant woman's and her baby's risk from malaria. These risks include maternal anemia, placental malaria, and low birth weight in newborns. HIV also increases a person's risk of malaria and reduces the response to standard antimalarial treatment. Additionally, co-infected people tend to have higher viral loads, which may speed the progression of HIV.

Since its launch in 2005, and in line with the Global Health Initiative (GHI), PMI has supported activities to prevent and treat malaria in pregnancy within the context of HIV/AIDS programs and broader maternal child health services. PMI has collaborated with the President's Emergency Plan for AIDS Relief (PEPFAR) and USAID maternal and child health programs to scale up FANC in many countries. For example, in 2010:

- With support from PMI and other partners in **Rwanda**, USAID's Maternal and Child Health Integrated Program, the NMCP, the Community Health Program, and the Expanded Programme for Immunization have developed an integrated approach to deliver quality health care for pregnant women. Health centers in 26 of 30 districts nationwide now provide the FANC package of services to pregnant women.

- In **Tanzania**, PMI, in partnership with PEPFAR, has enabled more than 3,000 health facilities (64 percent of all antenatal clinics in Tanzania) to provide integrated care for pregnant women, including IPTp, ITNs, messages on improving early diagnosis for malaria, and links to HIV/AIDS-related services. In 2010, PMI contributions helped increase the number of health workers who provided IPTp as part of FANC from 2,600 in 2009 to 4,500, a 73 percent increase. Both PMI and PEPFAR provide funding to many of the antenatal clinics, and these programs have worked closely to maximize synergies and integrate activities.

Behavior Change Communication

In many African countries, women start their antenatal clinic visits late in their pregnancies because they tend to hide their pregnancies in response to cultural and community barriers. This late ANC attendance reduces adherence to IPTp and could result in increased complications, with poor outcomes for mother and child. PMI's behavior change communication programs work to engage and mobilize communities to reduce these barriers to early antenatal clinic attendance and IPTp. For example, in 2010:

- To encourage women to attend antenatal clinics for the recommended number of visits and at the appropriate times during pregnancy, in **Malawi** PMI funded community mobilization activities through small grants to 19 community-based organizations and NGOs. PMI also sponsored a communications campaign at the national level using radio and other mass media, which reached more than 3 million people. As part of an integrated package addressing all malaria interventions, these messages include information on the importance of receiving at least two doses of SP at the appropriate times during pregnancy.

- PMI supported an innovative program in **Mali** that works with influential religious leaders to include messages in their public addresses that emphasize the importance of antenatal care, risk of malaria in pregnancy, and overcoming cultural barriers to taking IPTp. These teachings also educate and promote dialogue among couples about malaria in pregnancy and encourage husbands to accompany their wives on antenatal care visits.

- **Uganda**: To help district health education units and community-level advocacy in encouraging pregnant women to attend antenatal care clinics and complete their IPTp doses, PMI provided for the distribution of more than 13,900 behavior change communication materials to communities and 180 radio spots and talk shows on IPTp, as well as more than 40,000 community- and facility-level talks about IPTp.

- The majority of households in **Zambia** own a radio, making it an ideal tool for disseminating IPTp messages. As part of an integrated campaign that also includes ITNs and artemisinin-based combination therapies (ACTs), PMI has helped develop messages for local and national radio regarding IPTp use.

Improving Clarity of IPTp Guidelines

National IPTp guidelines can be confusing to health care workers and therefore prevent pregnant women from obtaining the correct number of IPTp doses. Even though many countries have adopted simpler guidelines, a few countries still require health care workers to administer IPTp at specific weeks of a woman's pregnancy (first dose at 20 to 24 weeks; second dose at 28 to 32 weeks). The dates are difficult to calculate because women may not know the date of conception and many pregnant women make their first antenatal visit later than recommended. Thus, health care workers who are unable to calculate the correct timing for IPTp may withhold treatment. (See Voices from the Field on page 32.)

In 2010, PMI worked with NMCPs and ministries of health to revise and simplify guidelines to give IPTp at every routine antenatal care visit after quickening (first detection of fetal movement) if doses are at least one month apart. Under the FANC platform, this will result in three doses of IPTp if it is correctly timed and administered. WHO currently recommends three doses of IPTp in countries with high HIV/AIDS prevalence, to ensure adequate protection throughout a woman's pregnancy and to counter any severity associated with HIV/AIDS and malaria co-infection.

Malaria Parasite Resistance to SP

The efficacy of SP, the only antimalarial drug approved by WHO for IPTp, is declining in many African countries

due to increasing drug resistance in malaria parasites. However, a review of IPTp efficacy trials in sub-Saharan Africa has shown that two doses of IPTp with SP continues to provide substantial benefits to semi-immune pregnant women, even in areas with SP resistance levels as high as 50 percent. For this reason, WHO continues to recommend that in areas of moderate to high, stable malaria transmission, countries already implementing IPTp with SP should continue to do so, but should periodically evaluate SP effectiveness in reducing maternal anemia, placental malaria, and low birth weight in newborns. In this regard, PMI and its partners are currently funding SP/IPTp efficacy studies in **Malawi**, **Uganda**, and **Zambia** to determine whether parasite resistance to SP in pregnant women is associated with reductions in the efficacy of IPTp.

Future Directions

As countries scale up their measures to prevent and treat malaria, and malaria prevalence falls, PMI will assist NMCPs with periodic reassessments of their IPTp policies. In **Rwanda**, a reduction in malaria cases and increasing resistance to SP have prompted the NMCP to discontinue IPTp. PMI and other partners are aiding the NMCP's efforts to measure the current burden of malaria in pregnancy and focus on prevention and prompt screening and treatment of fevers that occur in pregnant women. In **Zanzibar**, where the prevalence of malaria in the general population is less than 2 percent, PMI is funding operational research studies to guide policies on malaria in pregnancy.

For more information, please visit the malaria in pregnancy section of the PMI website: http://www.pmi.gov/technical/pregnant/index.html.

Voices from the Field

A Memo Makes a Difference: Doubling the Number of Women Receiving IPTp2 in Kenya

In sub-Saharan Africa, antenatal clinic attendance is quite high, and many women visit antenatal clinics several times during their pregnancies. These visits offer excellent opportunities for IPTp dosing. Nevertheless, the proportion of pregnant women who receive at least two treatment doses of IPTp is well below PMI's target of 85 percent.

In 2005, as part of research into low IPTp rates, the **Kenya** Medical Research Institute/Centers for Disease Control and Prevention (KEMRI/CDC) conducted a survey in Gem District of western Kenya that showed that only 7 percent of pregnant women had received two doses of IPTp. The survey also showed that a primary reason for this problem was health worker confusion over when to give pregnant women IPTp. As a result, the Kenyan Division of Malaria Control and KEMRI/CDC, with funding from PMI, piloted a simple intervention to improve IPTp coverage in Gem District. A memorandum sent to all government health facilities located in Gem restated the current, simplified IPTp guidelines, instructed health workers to follow these guidelines, and informed them that there would be an evaluation in a year. To reinforce these instructions, Ministry of Health staff made half-day supervisory visits in March 2009 to all health facilities providing antenatal care services in Gem. Approximately six months later, the Ministry of Health re-sent the same memo to all health facilities.

A year later, KEMRI/CDC and the Division of Malaria Control conducted a household survey of a sample of women who had given birth recently. The survey showed that, of all participants, 43 percent of pregnant women had received the recommended two or more doses of IPTp, well above the 7 percent figure from 2005. This intervention could be a practical way to improve IPTp coverage and save lives of pregnant women and their newborn babies in other districts of Kenya and elsewhere in Africa where IPTp is government policy.

Samantha Lobis/HealthRight International

As part of routine antenatal care, a health worker checks the blood pressure of a pregnant woman in a clinic in **Kenya**, where malaria is a major health problem.

CHAPTER 4

Arturo Sanabria/JSI

In **Zambia**, a mother receives instructions from a health care worker on the proper administration of antimalarial drugs for her baby. Children under the age of five and pregnant women are most vulnerable to the dangers of malaria.

Diagnosis and Treatment of Malaria

Introduction

In spite of the progress made over the past five to 10 years, malaria remains one of the most important public health problems in sub-Saharan Africa. In fact, WHO estimates that 176 million cases of malaria and more than 700,000 malaria-related deaths occurred in Africa alone during 2009.[1] About 80 percent of these deaths occurred in children under five years of age.

In collaboration with NMCPs and other partners, PMI works to ensure that people with suspected malaria are properly diagnosed and treated by:

- Helping countries **develop or update their diagnostic and treatment policies and guidelines**;
- **Building and extending the capacity of health systems** so that health workers can rapidly diagnose and treat malaria at all levels of the health care system; and
- **Supporting the procurement, distribution, and rational use** of diagnostic commodities and antimalarial drugs.

[1] World Health Organization. 2010. *World Malaria Report: 2010.* p. 61.

PMI Diagnosis and Treatment Activities

To facilitate the diagnosis and treatment of malaria, in 2010, PMI purchased more than 13 million rapid diagnostic tests (RDTs) and more than 41 million ACT treatments, and distributed 3.5 million treatments procured by other donors. In addition, PMI funded the training of more than 17,300 laboratory staff in malaria diagnosis and more than 36,000 health workers in the correct use of ACTs (see Summary Table). PMI also continued to support the purchase of drugs and other commodities for treating severe malaria and the training of health workers in managing this deadly form of malaria.

Malaria Treatment

PMI continues to assist countries in a wide range of technical and programmatic areas to improve the quality and availability of malaria treatment, both at the health facility and community levels. PMI also

PMI Diagnosis and Treatment Summary Table

Indicator[1]	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Cumulative
Diagnosis						
RDTs procured	1,004,875	2,082,600	2,429,000	6,254,000	13,340,110	25,110,585 (16,104,306 distributed)
Health workers trained in diagnosis (RDTs and/or microscopy)	—	1,370	1,663	2,856	17,335	N/A[2]
Treatment						
ACT treatments procured	1,229,550	8,851,820	22,354,139	21,833,155	41,048,295	95,316,959 (67,509,272 distributed)
ACT treatments procured by other donors and distributed with PMI support	—	8,709,140	112,330	8,855,401	3,536,554	21,213,425
Health workers trained in case management	8,344	20,864	35,397	41,273	36,458	N/A[2]

1 The data reported in this table are up to date as of January 1, 2011, and include 15 PMI focus countries plus jump-start activities in DRC and Nigeria. In addition, during 2010, the USG funded case management activities in other countries. For data by country, see Appendix 2.
2 A cumulative count of individual health workers trained is not provided because some health workers have been trained on more than one occasion.

helps countries update their malaria treatment policies, guidelines, and training materials. As a major supplier of antimalarial drugs, PMI provides technical and financial assistance to improve the capacity of the logistics systems to deliver an uninterrupted supply of drugs to front-line health providers. PMI also supports the training and supervision of health workers in the correct use of malaria treatment for both uncomplicated and severe malaria. Finally, PMI provides resources for communication and behavior change activities that promote early care-seeking for fever and full adherence to recommended treatments.

Examples of PMI's work related to malaria treatment in 2010 include the following.

- In **Kenya**, PMI collaborated with the NCMP to revise and launch national malaria treatment guidelines, which emphasize a diagnosis-based treatment policy and the introduction of 2.2 million treatments of dispersible ACTs, which children can easily swallow.

- In **Angola**, where private sector facilities treat 40 to 60 percent of all fever cases, PMI funded a pilot study to improve the uptake of ACTs in the private sector. The program, which was conducted with 95 private pharmacies in Huambo Province, provided subsidized ACTs for the treatment of uncomplicated malaria in children under the age of five. Nearly 300 private medicine sellers received training along with comprehensive monitoring and supervision visits. Preliminary project results showed: stable availability of ACTs (93 percent of private drug shops had regular stocks); decreased availability and purchase of monotherapies; increased awareness and acceptance of ACTs by users and providers; no public sector thefts or counterfeit ACTs in targeted pharmacies; maintenance of the subsidized price; and improved skills of private drug sellers in clinical diagnosis of malaria and appropriate treatment or referral.

- In **Benin**, to help prevent the majority of malaria-related deaths that occur within 24 hours of admission, the Ministry of Health initiated an innovative approach that aims to identify and treat sick children promptly upon arrival at the health facility. To facilitate this process, all staff—from the entry port, the waiting room, and records office, as well as midwives and nurses—are trained to check airways, consciousness movement, and dehydration. Based on these symptoms, sick children are grouped according to three categories upon arrival at a health facility: urgent, priority, and ordinary. This strategy reduces deaths of children and improves the flow of patients in outpatient clinics with high activity. In 2010, the Ministry of Health, with support from PMI, introduced the strategy at 13 sites and trained 30 coaches and 258 providers.

The MENTOR Initiative/Angola

A medicine seller from Pharmacy Rio Queve in Huambo, **Angola**, receives a box of branded ACTs as part of a pilot study to improve the uptake and use of ACTs in the private sector.

Treatment at the Community Level

One of the greatest barriers to rapid and effective treatment of malaria in Africa is lack of access to health facilities for people living in rural areas. Rather than walking for hours to reach a health facility and waiting to see a clinician, many caregivers seek whatever help they can afford from pharmacies and informal drug sellers closer to home. The result is often incorrect diagnosis or treatment with inappropriate, poor quality, or counterfeit drugs.

Recognizing the limitations of their existing health care infrastructure, many countries have begun to introduce and scale up integrated community case management (iCCM) for malaria and other major childhood illnesses (see box on page 36). Extending malaria case management services to rural areas also requires new tools, such as RDTs, which can be used in the most peripheral health facilities and even by trained community health workers. In collaboration with the USAID maternal and child health program, PMI has been a leader in supporting the scale-up of iCCM programs in many African countries. PMI now funds

iCCM in nearly all focus countries, providing training and supervision of community health workers, supply chain management down to the community level, and design and implementation of systems for monitoring, reporting, and evaluation.

- In **Malawi**, PMI procured and assisted with the distribution of ACTs to 500 hard-to-reach village health clinics in seven districts. In the first eight months of 2010, these clinics treated more than 280,000 children. The Malawian Government has now scaled up distribution to more than 2,000 of the 4,000 targeted communities nationwide.

- In **Rwanda**, all 10 of the PMI-supported districts in the country launched iCCM; community health workers treated more than 353,000 children for malaria in 2010.

Building Capacity for Malaria Case Management

PMI invests heavily in strengthening the health systems that deliver malaria diagnostic and treatment services. These investments, which benefit malaria as well as other health programs, include strengthening supply chain management systems to ensure a steady supply of high-quality, essential drugs and supplies, and providing support to train and supervise health workers in management of patients with fever.

Ensuring Quality Drugs and Diagnostics: All medical commodities procured through PMI undergo rigorous quality assurance/quality control testing prior to delivery, and only those drugs that have been approved by a stringent regulatory authority or the WHO prequalification program are procured with PMI funding. To further ensure the quality of RDTs, PMI played a key role in a task force of major donors—including the Global Fund, the World Bank, WHO, UNICEF, and Doctors without Borders—that procure large quantities of RDTs. The task force developed a unified set of quality standards, based on the WHO-led product testing, for all stakeholders to follow for RDT procurements.

An emerging problem throughout much of the developing world is the sale of counterfeit, adulterated, and poor-quality drugs. Not only do these drugs fail to deliver the appropriate treatment to individual patients—putting their lives at risk—but they also contribute to the emergence of drug-resistant strains of malaria. In **Ethiopia**, PMI helped the Drug Administration and Control Authority establish a drug quality monitoring program. PMI supported similar post-marketing antimalarial drug quality control programs and assessments in **Benin**, **Ghana**, **Madagascar**, **Senegal**, and **Uganda**. In **Kenya**, PMI assisted with the design and implementation of a post-marketing surveillance system by providing portable drug-testing kits and reagents to five strategically placed sites around the country. In addition, PMI trained selected officers from the NMCP, National Quality Control Laboratory, and provincial and district facilities.

End-Use Verification: To verify that malaria commodities are available in health facilities and are reaching their intended beneficiaries, PMI funds

What Is Integrated Community Case Management?

Equip Liberia

Two-year-old Patience, sick with malaria, is carried by her older sister Kou. A volunteer in their home village, trained in community case management, tested and then treated Patience for malaria. The nearest health facility is more than a four-hour walk from their village in **Liberia**.

Integrated community case management (iCCM) is an approach that brings health care to children in hard-to-reach communities using trained, supervised community workers. ICCM targets the leading causes of death among children under five in developing countries: pneumonia, diarrhea, malaria, and neonatal conditions. ICCM relies on child survival interventions, including prompt care-seeking for children with fever and treatment with antimalarial drugs, antibiotics for pneumonia, and oral rehydration therapy and zinc for diarrhea.

quarterly surveys of commodity stocks in a sample of health facilities in PMI focus countries. To date, surveys have been conducted in 12 PMI countries, with encouraging results. For example, surveys in **Kenya** during 2010 showed that an average of 80 percent of 174 public health facilities visited had adequate stocks of ACTs on the day of the survey.

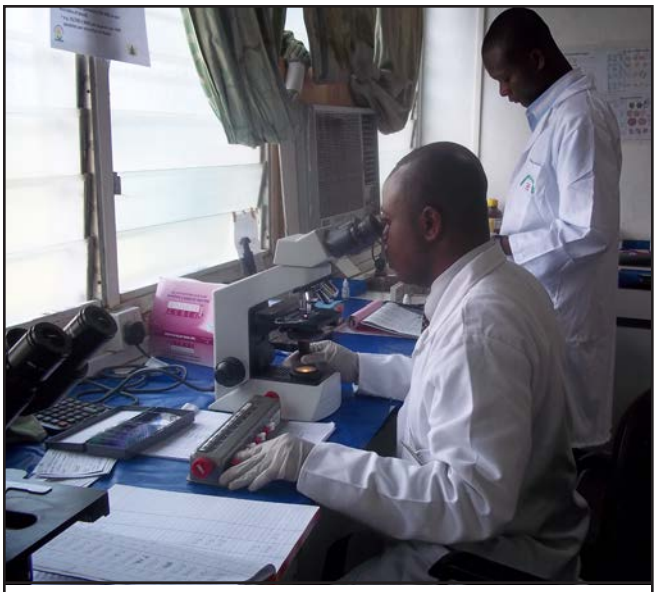
Diagnostic Testing for Malaria

Although WHO's updated policy guidance promoting universal diagnostic testing for malaria was not issued until mid-2010, PMI has been working to scale up malaria diagnosis with microscopy and RDTs in all of its focus countries for several years. PMI has funded the procurement of RDTs, microscopes, and laboratory supplies; refurbishment of laboratories; revision of national malaria diagnostic policies, standard operating procedures, job aids, and training and supervision materials; strengthening of quality control programs for laboratories; and training and supervision of laboratory technicians and clinicians. The following are examples of the work PMI supported in malaria diagnostics in 2010.

- Since 2007, CDC and PMI have worked with the NMCP in **Angola** to organize training workshops for senior, provincial-level malaria laboratory technicians. Currently, a cadre of 14 senior-level malaria laboratory technicians conduct refresher trainings and supervision across the provinces and municipalities in the country.

- Since 2008, PMI has supported regular supervisory visits to an increasing number of health facilities in **Benin**. During each round of visits, 24 supervisors from the Ministry of Health, who were previously trained in health facility evaluations, collect information on the quality of malaria diagnosis and treatment. Supervisors provide on-the-job training for staff members who are deficient in laboratory diagnosis, record keeping, stock management, quality assurance/quality control, or the treatment of malaria. Through these visits, supervisors provided 751 individual trainings to laboratory staff and 537 trainings to clinical staff. In 2010, after four rounds of supervision, the percentage of targeted health facilities performing malaria microscopy in line with national guidelines increased from 58 percent to 100 percent.

- In **Ghana**, PMI partnered with the NMCP, the National Public Health Reference Laboratory, and the newly formed Ghana Health Service Clinical Laboratories Unit to conduct refresher training of laboratory technicians who work in health facilities, and their supervisors. These partners also established a national reference bank of blood smears that will be used for training and quality assurance. In addition, a national program was scaled up rapidly to provide outreach training and supportive supervision to 82 percent of the districts; the remaining laboratories will enroll in the program in 2011.



IMaD

A supervisor for laboratory outreach training and supervision in **Ghana** re-checks slides as part of the quality assurance program. The program provides onsite microscopy training, which covers preparing and reading thick and thin blood smears, and the use of RDTs.

Communicating Appropriate Behavior

Because uncomplicated malaria can quickly progress to severe malaria and life-threatening illness, it is critical that patients be tested and appropriately treated within the first 24 to 36 hours of onset of a fever. Patients and caregivers of patients also need to follow the recommendations of the health care worker after treatment has been provided. PMI funds a range of communications and behavior change programs in all focus countries to improve the quality of malaria case management. PMI facilitates the development of print materials and their translation into local languages, production of radio and television spots, community outreach and mobilization activities, and integration of malaria prevention messages into school curricula and educational materials for expectant mothers. For example:

- Through a small grants project in **Kenya**, PMI has helped local and international NGOs educate their

target populations on appropriate treatment-seeking for malaria. In one of those communities, the proportion of children seeking prompt care within 24 hours increased from 50 to 90 percent between 2009 and 2010.

- In **Malawi**, a PMI-funded small grants program scaled up assistance to community-based and faith-based organizations engaging in malaria behavior change communication activities at the community level in 26 of Malawi's 28 districts. Grantees focus on ITNs and IPTp for prevention, early treatment-seeking behavior, the use of ACTs instead of older drugs, and the importance of taking the full course of treatment. Because the malaria season coincides with the farming season, in their interpersonal communications, some grantees talk about the cost of not treating malaria, illustrating the toll that inaction can take on a family's food and income security.

- In an effort to mobilize support for malaria prevention and treatment activities in **Tanzania**, PMI facilitated the establishment of the Journalists' Network for Malaria, which helps print, radio, and TV journalists access malaria information to improve reporting on malaria. This partnership has yielded positive results in the form of expanded coverage on malaria topics through newspaper articles, editorials, comics, and radio and TV reports.

New Challenges in Malaria Case Management

With the scale-up in malaria control measures, the burden of malaria has declined in many parts of sub-Saharan Africa. In response to this situation, WHO updated its guidance on the management of malaria in 2010. WHO now recommends that, where diagnostic testing is available, everyone with suspected malaria, regardless of age or the epidemiologic setting, undergo diagnostic testing for malaria, and only those with a positive test receive malaria treatment. Under the new guidance, treatment for malaria based solely on clinical findings is recommended only in areas where diagnostic testing is unavailable. Diagnostic testing for malaria helps distinguish children whose fever is caused by malaria—who need treatment with an antimalarial

How Is PMI Addressing Antimalarial Drug Resistance?

The spread and intensification of antimalarial drug resistance represents one of the most serious challenges to malaria control worldwide. Resistance is defined as the ability of parasites to survive in patients who have received correct and complete administration of treatment, resulting in a patient's inability to clear the parasites or to resolve clinical symptoms. In many parts of Africa, *Plasmodium falciparum* parasites are already resistant to chloroquine and sulfadoxine-pyrimethamine (SP). In Southeast Asia, strains of this species have developed resistance to almost all antimalarial drugs currently in use, and recently, evidence of resistance to artemisinin drugs has been reported along the Thai-Cambodian border. This development is particularly alarming because artemisinin resistance could potentially spread from Southeast Asia to Africa, as happened with chloroquine resistance in the 1980s.

PMI is taking a multipronged approach to dealing with antimalarial drug resistance. On the policy front, PMI has worked with NMCPs to ensure that their treatment guidelines recommend only ACTs and to remove artemisinin monotherapies from the market. PMI supports antimalarial drug resistance monitoring systems in most PMI focus countries. PMI also helps establish capabilities to monitor drug quality and provide evidence to aid authorities in removing sub-standard or counterfeit drugs from the market.

In addition to these programs, USG funds support two regional malaria control programs that focus their efforts on identifying and containing the spread of antimalarial drug resistance: the Amazon Malaria Initiative, made up of seven countries in the Amazon Basin of South America, and the Mekong Malaria Programme, whose members include five countries in the Greater Mekong Sub-region.

If history is any guide, malaria parasites will sooner or later develop some level of resistance to all currently used antimalarial drugs. For that reason, USAID also helps fund the Medicines for Malaria Venture, a public-private partnership dedicated to developing new antimalarial compounds. In 2011, two new ACTs, pyronaridine-artesunate and dihydroartemisinin-piperaquine, are likely to receive regulatory approval and become available for clinical use. Other classes of drugs, particularly synthetic peroxides, will soon enter human testing, and if successful, would be available within five to 10 years.

JSI Deliver/Tanzania

ACTs procured by PMI arrive in **Tanzania** by air freight. The Ministry of Health and Social Welfare requested assistance in procuring ACTs to prevent stockouts of these lifesaving drugs when buffer stocks fell below minimum levels. The average consumption of ACTs in Tanzania is about 1.3 million treatments per month.

drug—from those whose fever has other causes. Thus, the new guidance has the potential to improve not only the management of malaria, but also the management of other childhood illnesses, and to save the lives of more children.

A related challenge is that health care workers may not always accept and adhere to a negative test result when those results conflict with their clinical impression. For this reason, PMI places particular emphasis on improving clinicians' use of and adherence to diagnostic test results through training, supervision, and the use of job aids.

As countries expand diagnostic testing for malaria, they are observing a reduction in the percentage of people with fever who receive treatment for malaria, because patients without malaria are being screened out. Therefore, PMI's original ACT coverage target—treatment of children under five within 24 hours of onset of fever—no longer accurately reflects progress toward ACT scale-up. PMI is working with the RBM Monitoring and Evaluation Reference Group to develop and assess better indicators to measure the scale-up of effective case management of malaria.

For more information, please visit the diagnosis and treatment section of the PMI website: http://pmi.gov/technical/acts/index.html.

Voices from the Field

Community Case Management of Malaria—Reaching the Hard to Reach in Senegal

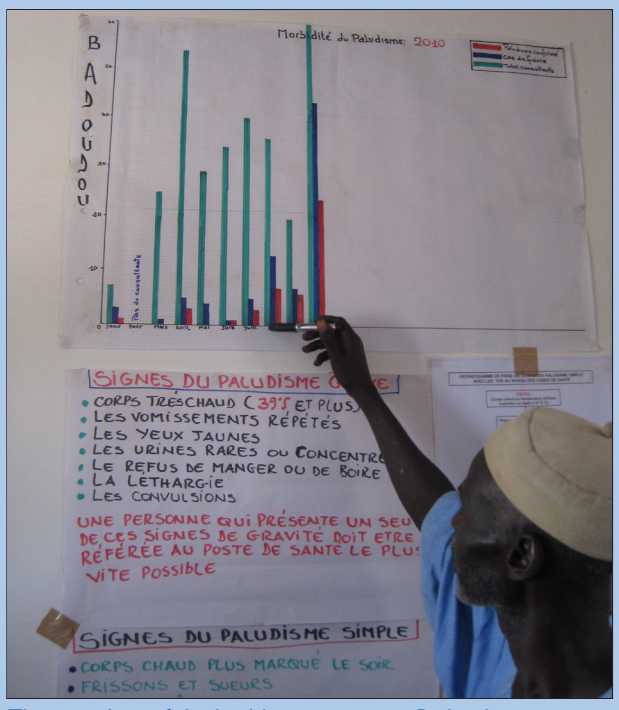
Across **Senegal**, small one- or two-room huts in remote, rural areas, far from government health facilities, provide health care to local residents. Although not a part of the formal government system, Senegal's health care pyramid rests on a foundation of almost 1,400 of these health huts. Local communities establish and manage the health huts, which provide services to nearly 20 percent of the country's population.

Because malaria transmission is higher in rural areas, support to community-based care is critical to successful malaria control. PMI and the USAID maternal and child health program have assisted these huts by offering training and a package of services. Although the services vary from village to village, most huts offer diagnosis and treatment of malaria and treatment for diarrhea, de-worming, growth monitoring and promotion, vitamin A supplementation, management of malnutrition, and family planning and reproductive health services. Literate community health workers can provide pneumonia case management with an antibiotic.

Malaria case management training includes the use of RDTs and ACTs, the recognition of danger signs, and referral of serious cases or any malaria in pregnant women or young infants to higher-level facilities. Overall, community health workers at health huts in Senegal have demonstrated excellent adherence to the treatment protocol and malaria rates have plummeted. Not only is better case management reducing the number of unnecessary treatments, which are expensive, but it also allows community health workers to focus on the other illnesses that were previously confused with malaria.

Caritas/Senegal

In Badoudou, **Senegal**, the volunteer staff, health committee members, district health team staff, and supervisors gather outside their health hut.



Caritas/Senegal

The president of the health committee in Badoudou, **Senegal**, shows the health data the committee has been tracking since the beginning of the year. The green bars show all consultations, the blue bars the cases of fever, and the red bars the confirmed malaria cases.

CHAPTER 5

USAID

Workers at a dock in the **Democratic Republic of the Congo** unload bales of long-lasting ITNs. PMI provided funds for the distribution of these nets.

Health Systems Strengthening and Integration

Introduction

Across malaria-endemic countries in Africa, malaria accounts for an average of 25 to 35 percent of all outpatient clinic visits and between 20 and 45 percent of all hospital admissions. Where countries have achieved effective malaria control in high-burden areas, clinics report fewer outpatient visits and a dramatic reduction in hospitalizations for malaria. This unburdening of the health system frees up health care workers and hospital beds, creating opportunities for the health care system to function more efficiently and allowing health workers to focus their attention on other important health issues.

Since its inception, PMI has recognized the importance of well-functioning health systems in achieving its goals and targets. PMI-funded activities directly support the mandate under the GHI to ensure sustainability by strengthening health systems and to increase impact through strategic coordination and integration. PMI's approach to strengthening health systems has focused on three critical areas where progress can be made and results documented. These areas benefit the fight against malaria, as well as broader maternal and child health efforts:

- Strengthening pharmaceutical and supply chain management systems;
- Improving laboratory diagnostic services; and
- Building capacity for monitoring and evaluation within ministries of health and NMCPs.

PMI's approach to integration includes:

- Integrating malaria control interventions with antenatal care and maternal and child health services at the health facility level; and
- Implementing iCCM.

Integrating Malaria Control with Maternal and Child Health Services

Although PMI supports focused training in malaria case management for pregnant women and prevention of malaria in pregnancy, PMI also integrates its assistance with USAID's maternal and child health and reproductive health programs to address all key aspects of antenatal care and case management of sick children. In many countries, PMI promotes IPTp and malaria case management through programs that are scaling up FANC and integrated management of childhood illnesses at both health facility and community levels.

Examples of PMI's activities in 2010 include the following:

- In **Tanzania**, in partnership with USAID's Maternal and Child Health Integrated Program and PEPFAR, PMI has supported about 60 percent of antenatal clinics nationwide to provide integrated care for pregnant women—including IPTp and ITNs—and to link patients to HIV/AIDs-related services. Over the past year, PMI's contribution has increased the proportion of staff trained to provide directly observed IPTp from 76 percent to 96 percent in health facilities offering FANC.

- In **Ethiopia**, PMI integrated its funding for case management supervision and epidemic surveillance into USAID's maternal and child health and reproductive health programs in six out of the country's 11 regional states, reaching 13,000 community-level health extension workers. The introduction of RDTs—which allow the differentiation of non-malarious fevers from those caused by malaria—together with improved availability of drug supplies, has made it possible for community health extension workers to manage other major causes of fever, such as pneumonia and diarrhea.

- Working under the GHI and with about $700 million in combined funds from PMI, PEPFAR, family planning, and maternal and child health programs, USG partners in **Kenya** are implementing an integrated package to improve maternal and child health through better access to services for prevention of mother-to-child transmission of HIV, family planning, and malaria in pregnancy.

Integrated Community Case Management

Integrated Community Case Management (iCCM) is an approach that provides diagnosis and treatment for

malaria, acute respiratory infections, and diarrhea to children under five years of age through community health workers (see box on page 36). In collaboration with USAID's maternal and child health program, PMI has played a major role in providing countries with resources to pilot and scale up iCCM. Technical and financial assistance from both PMI and USAID's maternal and child health program has helped with:

- Policy change (e.g., adoption of iCCM);
- Development of guidelines and training materials;
- Training and supervision of community health workers;
- Development and implementation of supply chain management systems that can deliver essential drugs and commodities at the community level; and
- Development of reporting and monitoring and evaluation systems.

In FY 2010, PMI provided $19 million to 14 countries to develop and roll out iCCM. **Ethiopia**, **Madagascar**, **Malawi**, **Rwanda**, and **Senegal** quickly scaled up iCCM to cover all or significant portions of their countries. Other countries— including **Benin**, **Ghana**, and **Mali**—are piloting iCCM with plans to scale up in the coming years.

Strengthening Pharmaceutical and Supply Chain Management Systems

All malaria control interventions are dependent on the availability of key commodities. Without predictable supplies of essential drugs and diagnostics, ITNs, insecticides, and other supplies for IRS, malaria control measures cannot be implemented. PMI has provided assistance with:

- Selecting appropriate drugs and commodities;
- Ensuring quality control of those drugs and other commodities;
- Quantifying drug and commodity requirements;
- Developing and implementing logistics management information systems;
- Strengthening stock management systems; and
- Training and supervising health workers.

In fiscal year (FY) 2010, PMI programmed more than $9 million for activities to strengthen supply chain management systems across the 17 PMI countries. In almost all of these countries, PMI has been able to leverage additional investments by PEPFAR and other USG programs. This joint support has enabled countries to make considerable progress in developing comprehensive supply chain management systems.

USAID/DELIVER

Getting supplies of essential commodities to remote health centers can be challenging. During the rainy season, when malaria transmission peaks, an ox cart carries health commodities across a flooded plain in Western Province, **Zambia**.

During the past year, PMI's efforts included:

- In **Kenya**, PMI provided assistance for a national quantification of malaria medicines needs to cover the period of July 2010 to June 2011, and for a five-year forecast of RDT needs. PMI also supported the monthly monitoring of stocks of all medicines, including ACTs, at the central level and the logistics management information system at the national, regional, and district levels. This system is now fully operational in all districts in Kenya. As a result of these activities, in 2010, Kenya recorded no central-level stockouts of ACTs, and 63 percent of health facilities reported monthly drug stock levels on time, up from only 15 percent in 2009.

- In **Tanzania**, funds from PMI, PEPFAR, and USAID's family planning program are being used to help mitigate stockouts of essential health commodities (including ACTs) at health facilities and to decrease diversions of commodities throughout the public sector distribution system. Specifically, PMI funds are being used to: 1) review the Medical Stores Department's health facility list and develop an up-to-date listing

of all operating health facilities; 2) conduct monthly physical stock counts of ACTs in all department warehouses; 3) promote supervision and accountability among local government authorities at the district level; 4) improve stock reporting rates at district and health facility levels; and 5) engage district health management teams to monitor the supply chain from the Medical Stores Department's zonal stores to facilities, via districts. PMI is also supporting four new supply chain management advisors to work with department staff and individual health facilities to forecast needs and order ACTs in time to avoid stockouts.

- In **Zambia**—with PMI, PEPFAR, and other USG funding, together with support from DfID and the World Bank—the Ministry of Health is rolling out a new essential medicines logistics system. In a pilot study, this system nearly eliminated essential medicine stockouts in the trial districts. The system enables health facilities to place orders directly with central medical stores, while district offices coordinate pickup or delivery of commodities, thus decreasing the time lag between orders and deliveries.

Improving Laboratory Diagnostic Services

Because of the dramatic reductions of malaria burden across Africa during the last five years, in March 2010, WHO issued revised guidelines for malaria treatment. These revised guidelines call for all patients with suspected malaria to undergo diagnostic testing with microscopy or an RDT before treatment is prescribed. Even before this recommendation was disseminated, PMI had been working with NMCPs to establish programs to deliver quality-assured malaria diagnostic testing in most focus countries. PMI emphasizes building the systems that will support laboratories and their staff, including: upgrading laboratory facilities, ensuring steady supplies of laboratory commodities, and training and supervising laboratory staff. PMI also works to change the behaviors of clinicians who frequently do not trust or comply with laboratory results. In addition, PMI helps countries update their malaria laboratory policies and guidelines, develop training and supervision materials, procure and distribute microscopes as well as RDTs and other laboratory supplies, and implement quality assurance systems.

PMI integrates its efforts in laboratory strengthening with those of PEPFAR and USG tuberculosis programs so that PMI's support benefits the broader laboratory system beyond malaria. For example, in **Ethiopia** and **Mozambique**, PMI's program to strengthen malaria diagnostic services is being carried out by implementing partners that were already receiving USG HIV/AIDS and tuberculosis funding.

Specific examples of PMI-funded activities in 2010 include:

- In **Kenya**, PMI is working with a U.S. Army Walter Reed Institute for Medical Research field station to revise and disseminate new national malaria treatment guidelines. PMI also assisted with the development of a national plan for laboratory system strengthening and RDT rollout in support of malaria diagnosis.

- In **Senegal**, PMI assisted with the development and nationwide implementation of quality assurance/quality control procedures for microscopic diagnosis of malaria. Technicians from all health districts

Efforts to Stop Drug Loss and Diversion

In several PMI countries, ACTs that were purchased by the USG 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 USG and other donors. The USG is taking aggressive steps to combat antimalarial medicine and pharmaceutical theft and diversion. As a routine practice, PMI works through the national governments to build local capacity, and when problems occur, will first work with host governments and partners to establish tighter controls through systematic oversight and review. If evidence of theft, corruption, or fraud is found, the USG has taken strong action to safeguard PMI-funded commodities and their intended recipients. For example, in one country—after three thefts of ACTs from central government warehouses and repeated efforts to strengthen security at those sites, a fourth theft occurred—PMI reluctantly made the decision to bypass the central warehouses and rent private storage space for PMI-procured ACTs. Currently, PMI-procured ACTs in that country are shipped by private companies to the provincial level where the drugs re-enter the government system and are distributed to health facilities. In other countries, PMI is working with partners to strengthen stock monitoring and improve internal controls to minimize diversions.

were trained and provided with microscopes and supplies. In addition, technicians from all 14 regional reference laboratories were trained to perform quality control for microscopic diagnosis of malaria and now have conducted supervisory visits. When samples of malaria blood smears—originally made and examined in peripheral laboratories in 41 districts—were sent to the NMCP for quality control, the results from the peripheral laboratories agreed with expert microscopists in 85 percent of cases.

Building Capacity for Monitoring and Evaluation within NMCPs

One of the greatest needs for NMCPs in developing countries is the capacity to collect and use information on the progress of their programs and then make informed decisions about how to adjust program approaches. PMI is addressing this problem by providing technical assistance, training, computers, and software. In some cases, PMI is seconding staff with monitoring and evaluation expertise to work in NMCP offices. In **Kenya**, **Mozambique**, **Nigeria**, and **Tanzania**, PMI is also providing funds to the Ministry of Health's two-year Field Epidemiology and Laboratory Training Program. This program aims to build a cadre of Ministry of Health staff with technical skills in data collection, analysis, and interpretation for decision-making. The program will also train staff to perform epidemiologic investigations and operational research (see box below).

In 2010, PMI activities included:

- Assisting the **Kenya** Ministry of Public Health and Sanitation to develop a standardized approach for conducting and reporting on supportive supervision for malaria control that has now been rolled out to all provinces. To ensure efficient monitoring, evaluation, and reporting of progress in malaria control, PMI supported critical elements of the Division of Malaria Control's monitoring and evaluation framework, including capacity building of personnel, provision of hardware and software, coordination of meetings between partners, data quality assurance, and guidance on using data for decision-making.

- Strengthening **Rwanda's** monitoring and evaluation systems in cooperation with PEPFAR through funding for a National Monitoring and Evaluation Task Force and a technical advisor at the Ministry of Health. Data from the health management information system are now sufficiently complete and are reported in time to be used for routine program monitoring. NMCP staff members analyze these data and produce maps and charts that show the geographic distribution and trends in malaria cases.

Tanzania Training Program Graduates First Cohort

On December 11, 2010, the first cohort of 10 students graduated from the **Tanzania** Field Epidemiology and Laboratory Training Program (FELTP), a competency-based, two-year Master of Science program in Applied Epidemiology and Public Health Laboratory Management. The School of Public Health at the Muhimbili University of Health and Allied Sciences awarded the degrees. The program was implemented in 2008—in collaboration with the Ministry of Health and Social Welfare in Tanzania—to cultivate public health professionals who could provide epidemiological and laboratory services and support public health systems at the national, regional, and local levels. FELTP is supported with funding from PEPFAR and PMI. Two additional cohorts totaling 23 students are currently enrolled in the program. All but one of the recent graduates have returned to their former employment or accepted new positions at the Ministry of Health.

Peter McElroy/PMI

Voices from the Field

PMI Contributes to Improving Governance and Transparency at Benin's Central Medical Stores

A steady supply of antimalarial drugs and other malaria commodities is critical to the fight against malaria. However, in **Benin**—as in many other sub-Saharan countries—ensuring an uninterrupted supply of drugs has been a major challenge for the health system.

Central Medical Stores (CAME) is the principal pillar of Benin's pharmaceutical system—the institution responsible for the procurement and distribution of essential drugs and consumables for the public health system nationwide. However, frequent stockouts at public health facilities and the illicit sale of over-priced antimalarial products have undermined the efforts of the Government of Benin and international donors to combat malaria. These problems have also discouraged vulnerable populations from seeking treatment at public health facilities.

In 2008, the Government of Benin initiated a reform process to improve CAME's efficiency and requested PMI's help. The PMI-supported assessment team recommended overhauling the legal framework of CAME's operations, including its statutes, internal regulations, and the partnership agreement that binds it to the government. PMI then collaborated with the Ministry of Health to develop a new legal framework for CAME. In early 2010, the government adopted new laws that redefined the legal framework governing CAME's operations.

Ghislaine Djidjoho, MSH/SPS Benin

Newly elected members of **Benin's** Central Medical Stores Management Committee are pictured at a capacity-building workshop on governance and transparency. PMI helped coordinate this workshop in August 2010.

CAME is now an independent, nongovernmental, not-for-profit organization. Under its new status, CAME has gained financial autonomy. In April 2010, CAME elected a new management committee. With PMI support, a capacity-building workshop was held to provide committee members with the skills needed in their new role. PMI also helped design an electronic logistics management tool to improve the management of commodities within the health system. This tool is now being used in 31 of 34 health districts nationwide.

CHAPTER 6

Luke Paundi/ADPP Angola

In **Angola**, students hold up their "Malaria Won't Catch Me" books. Students in 200 schools are receiving weekly lessons on malaria prevention through a partnership between PMI and a local nongovernmental organization.

Partnerships

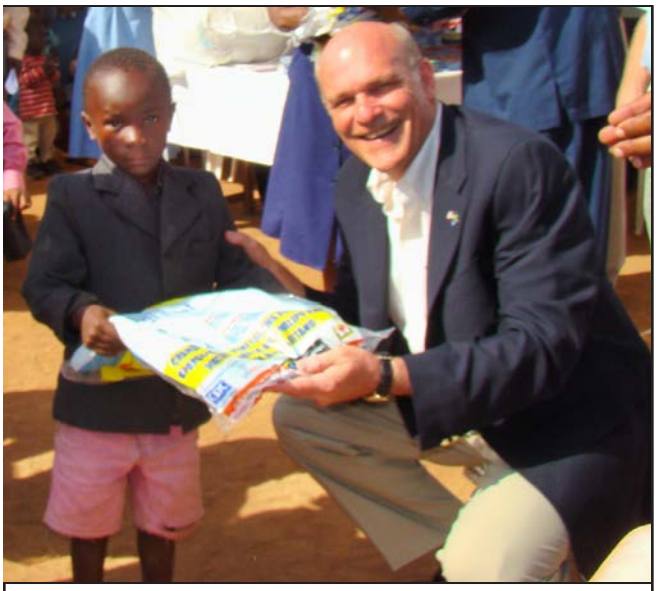
Introduction

Much of PMI's success is linked to partnerships at national and international levels. The PMI approach to scaling up sustainable malaria control programs embodies the core principles of President Obama's Global Health Initiative. PMI invests in country-led malaria control plans while coordinating with and leveraging the support of key multilateral organizations, and working with other USG agencies, the private sector, and community-based organizations.

Multilateral and Bilateral Collaboration

Global Fund: All 17 PMI countries have received significant malaria financing from the Global Fund. Coordinating PMI investments with local initiatives financed by Global Fund grants is critical to the success of the Global Fund and PMI. The USG is the Global Fund's largest contributor (with a donation of roughly $1 billion each year) and has a seat on the Global Fund board. The U.S. Global Malaria Coordinator is a member of the U.S. delegation to Global Fund board meetings, and the Deputy Global Malaria Coordinator represents the USG on the policy and implementation committee. Through this participation, 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 at the country level, and sharing information with Global Fund Secretariat staff on grant implementation issues. PMI staff members also participate on the Technical Review Panels for Global Fund proposals and on Global Fund Country Coordinating Mechanisms.

Roll Back Malaria: At the global level, PMI is an active member of the RBM Partnership, a global alliance of governments, multilateral organizations, private sector companies, foundations, and academic institutions seeking to harmonize the international response to malaria. PMI provides financial support for numerous RBM activities, serves on the partnership's board of directors, and participates in several of its working groups. PMI staff co-chair meetings of RBM's Case Management Working Group and Integrated Vector Control Working Group, and finance the involvement of the chair of the Procurement and Supply Management Working Group. PMI also supports regular meetings of RBM's Monitoring and Evaluation Reference Group.



Chris Thomas/USAID

In March 2010, the Malaria Policy Center, a project of the nongovernmental advocacy group Malaria No More, honored the U.S. Global Malaria Coordinator, Admiral R. Timothy Ziemer (USN, Ret.), with the "Malaria Action Award," which recognizes leaders who translate policy into action and results.

During 2010, PMI continued to provide technical support to African countries through the RBM Harmonization Working Group to prepare their Global Fund malaria grant applications. Overall, the Working Group supported 15 Global Fund malaria proposals from Africa in Round 10. Of these proposals, 89 percent were successful, up from 32 percent in Round 6. The overall success rate of all malaria proposals in Round 10 was 79 percent, the highest percentage ever recorded for malaria grant applications.

To maximize the potential of the USG'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.

WHO: PMI also provides financing to the WHO Global Malaria Program to support activities related to antimalarial drug resistance, vector control, and monitoring and evaluation. Outside of Africa, USAID supports malaria control efforts in the Greater Mekong Sub-region through funding to WHO's Southeast Asia

and Western Pacific Regional Offices and in the Amazon region through the Pan American Health Organization.

Examples of PMI's collaboration with partners include:

- In **Benin**, combined inputs of PMI, the Global Fund, and UNICEF are helping to roll out a large-scale iCCM program.

- In **DRC**, PMI provided 17 percent of the operational costs for the distribution of 5.5 million long-lasting ITNs procured by UNITAID, the voluntary financing mechanism that raises money by levying a small tax on passengers on international flights. PMI's funding covered transportation of the nets from the port of entry to distribution points, community mobilization, communication, and data gathering.

- In **Kenya**, PMI worked with a broad coalition of partners, including the Ministry of Health's Division of Malaria Control, DfID, UNICEF, Population Services International, the World Bank, the Global Business Coalition, the Office of the UN Special Envoy for Malaria, and the Federation of Kenya Employers, to develop a comprehensive plan of action for the 2011 long-lasting ITN mass distribution campaign. This well-organized partnership played a key role in securing funding for the campaign rollout; of the 10.6 million nets required to reach universal coverage in Kenya, 9.7 million were procured through this partnership.

- In **Liberia**, the combined efforts of PMI, Global Fund, and UNICEF supported the procurement and distribution of malaria drugs throughout the country. PMI and the Global Fund also supported the development of a supply chain national master plan for the Ministry of Health in Liberia.

- In **Madagascar**, PMI supported the distribution—at the community level and in the private sector—of more than 396,000 ACTs donated by UNITAID.

- In **Uganda**, representatives from three major donors (PMI, Global Fund, and World Bank) were able to negotiate an agreement so that a delay in the procurement of 7.2 million ITNs for a mass campaign targeting children under five could be resolved. This agreement allowed the campaign to proceed on time, and Uganda received an RBM award for its success with the campaign.

- DfID provided emergency funding to PMI in **Zambia** to allow the NMCP to respond to stockouts of long-lasting ITNs, RDTs, ACTs, and other malaria medicines. DfID's total investment under a memorandum of understanding developed with USAID is £7 million (about $11.1 million).

- For the past three years, PMI, the Global Fund, and the World Bank Malaria Booster Program have convened an annual meeting that brings together major global malaria donors to discuss bottlenecks that their respective programs are facing. Examples of joint actions include harmonizing procurement specifications for malaria commodities, collaborating on jointly funded long-lasting ITN campaigns, and addressing bottlenecks to grant disbursements.

Rick Scavetta, U.S. Army

Major Eric Wagar, head of the U.S. Army Medical Research Unit—**Kenya's** Malaria Diagnostics and Control Center of Excellence in Kisumu—observes a student participating in a training program to improve malaria identification and microscopy skills. The center has trained hundreds of African laboratory specialists since it was established in 2004. Part of the center's annual budget is provided by PMI. The U.S. Department of Defense, NGOs, and pharmaceutical companies contribute additional funding.

Cooperation with Other USG-Supported Health Programs

In accordance with the principles of the GHI, PMI is integrating its activities with other USG-funded global health activities to maximize health sector investments and reduce duplication. In many countries, PMI collaborates with PEPFAR, the U.S. Department of Defense, the Peace Corps, and other programs funded by USAID and CDC. For example, during 2010:

- In **Ethiopia**, PMI supported hang-up campaigns for long-lasting ITNs in two remote areas of Oromia Regional State in partnership with the U.S. Department of Defense Combined Joint Task Force – Horn of Africa, local health officials, and community volunteers. During the campaigns, 40,000 long-lasting ITNs were hung in households, and residents received information on how to use and maintain their nets correctly. Residents also received information on malaria symptoms, where to seek treatment, and the importance of adhering to malaria treatment.

- In **Rwanda**, PMI cooperated with PEPFAR to improve the country's monitoring and evaluation system. As a result, the NMCP now receives data on a timely basis. These data are used to produce maps and charts that show the geographic distribution and trends in malaria cases.

- In **Tanzania**, PMI provided funding to the U.S. Department of Defense Walter Reed Army Institute of Research to support the National and Zanzibar Malaria Control Programs in establishing quality assurance/quality control systems for malaria diagnostics. This combined support from the USG is being used to create a state-of-the-art National Reference Laboratory and Quality Assurance Training Centre, which will ensure that malaria diagnosis in Tanzania is of high quality.

- Building on experiences in several countries—where Peace Corps Volunteers have assisted national malaria control programs with malaria prevention measures—PMI and the Peace Corps have completed planning for a joint initiative to reduce malaria in the 14 sub-Saharan African countries where the Peace Corps and PMI overlap. The initiative will recruit experienced Peace Corps Volunteers who will work—in close collaboration with PMI in-country advisors—to support national malaria control program efforts and expand malaria activities in their respective countries.

Public-Private Partnerships

PMI reaches out to private sector partners to help leverage their capabilities and resources and coordinate their programs with government strategies and plans. Examples of PMI collaboration with the private sector in 2010 include:

- In **Angola**, PMI has established an effective partnership with the ExxonMobil Foundation that has resulted in donations to PMI totaling $4 million over the past five years. These funds are being used, together with PMI funds, to support the scale-up of training and supervision for health workers and delivery of malaria prevention and treatment services in eight provinces in Angola. Thanks to this partnership, in 2009 alone, more than 2,385 health workers were trained in malaria prevention or treatment, and more than 2,000 supportive supervisory visits were conducted to public health facilities in these provinces. In addition, PMI partnered with the Corporate Alliance for Malaria in Africa and the Global Business Coalition—particularly Chevron, Halliburton, Bayer, Marathon Oil, Cameron, Sumitomo, and Vestergaard Frandsen—to train 43 entomology technicians in Angola.

- In **Liberia**, PMI entered into an agreement with a steel company, ArcelorMittal, to collaborate on an IRS campaign. During this campaign nearly 1,200 houses were sprayed and over 6,700 people were protected in Nimba County (see Voices from the Field on page 26).

Community-Based Organizations

NGOs and faith-based and community-based organizations have strong bases of operation in underserved, rural areas of most African countries—where malaria is a major public health problem and formal health services are limited. Through support to these groups, PMI helps build local capacity and program sustainability and improve access to critical malaria prevention and treatment services at the community level. To date, PMI has supported more than 215 nonprofit organizations; nearly one-third of these are faith-based organizations. Many of these are new USG partners and are funded through the Malaria Communities Program (see Voices from the Field on page 52). For example, during 2010:

- In **Ghana**, under the leadership of its NMCP, PMI partnered with Malaria No More, Comic Relief, UNICEF, WHO, Nets for Life, the Anglican Diocesan Development and Relief Organization, and others to launch the first in a series of long-lasting ITN distribution campaigns designed to reach every region in Ghana over the coming year. PMI's contribution included providing more than 950,000 long-lasting ITNs, logistics support, training, technical assistance, and post-campaign evaluation. In May 2010, more than 10,000 volunteers walked door to door in every community in Northern Region, distributing and

hanging more than 560,000 long-lasting ITNs to cover children under five and pregnant women. Based on preliminary findings from the post-campaign evaluation in Northern Region, household ownership of at least one ITN increased from 28 percent in 2008 to 82 percent in 2010, ITN use among children under five years old increased from 11 percent to 52 percent, and ITN use among pregnant women increased from 7 to 39 percent.

- In **Madagascar**, where the USG suspended all non-humanitarian assistance and direct assistance to the Government of Madagascar following the *coup d'état* in March 2009, PMI has expanded its collaboration with nongovernmental groups and international partners to assist in implementation of the National Strategic Plan for Malaria Control. A National Coordination Committee, which includes all local RBM partners involved in net distribution, manages all aspects of campaigns; regional and district-level coordination committees working with local private organizations and NGOs ensure campaign success at the local level. This partnership was crucial in implementing a phased rollout of a free mass ITN distribution between November 2009 and December 2010. More than 7.3 million ITNs were distributed at the community level, which allowed Madagascar to achieve universal coverage by the end of 2010. PMI contributed nearly half of all nets distributed. In 2010, with the assistance of more than 16 NGO and faith-based partners, PMI also contributed toward scaling up iCCM activities to approximately one-third of all rural villages located within five kilometers of a primary health care facility.

PIRCOM

A volunteer from PIRCOM, a faith-based organization in **Mozambique**, educates members of his community about ways to protect their families from the dangers of malaria.

Voices from the Field

School Children Deliver Malaria Interventions in Angola

In **Angola**, the NGO Ajuda de Desenvolvimento de Povo para Povo (ADPP) implements a school-based malaria control program in Zaire Province where malaria prevalence is high. PMI supports ADPP's activities through a $1.5 million grant awarded through PMI's Malaria Communities Program. The three-year program, run in cooperation with the Ministry of Education, covers all municipalities in the province and reaches about 100,000 people.

Some 12,000 school children from 200 schools across the province are organized into Malaria Control Patrols. At each school, a Malaria Control Teacher and Malaria Control Committee organize lessons and activities with the patrols. The students, who are in third to ninth grades, learn key messages about malaria: recognize the symptoms, seek treatment early, and sleep under an ITN. The patrols then pass these messages on to the wider community through information campaigns, open days, games, theatre, and song. An annual competition rewards the best students, teachers, and schools for their efforts to promote community control of malaria.

The Malaria Control Patrols have also distributed 40,000 ITNs, primarily for use by pregnant women and children under the age of five. Families are visited a number of times by a Malaria Control Patrol member who offers assistance and information on malaria, including how to use and care for the nets properly.

Debra M. Prosnitz/MCHIP

These enthusiastic school children, who are involved in all aspects of the program, take their responsibilities very seriously. Among other activities, they distribute ITNs and educate recipients on how to hang their nets and the importance of sleeping under them every night.

CHAPTER 7

Bonnie Gillespie/Voices for a Malaria Free Future

In **Madagascar**, a health worker tests a young boy for malaria using a rapid diagnostic test. PMI is helping to scale up malaria diagnostic capabilities in its focus countries so that antimalarial treatment can be targeted to those who are infected with malaria parasites.

Outcomes and Impact

Introduction

Over the past five years, substantial reductions have been recorded in mortality in children under the age of five across a wide range of PMI focus countries in association with a dramatic scale-up of malaria prevention and treatment measures. This scale-up is the result of the collective efforts of national governments and a broad range of partners, including PMI, other USG programs, the Global Fund, the World Bank, other multilateral and bilateral organizations, private foundations, and many NGOs.

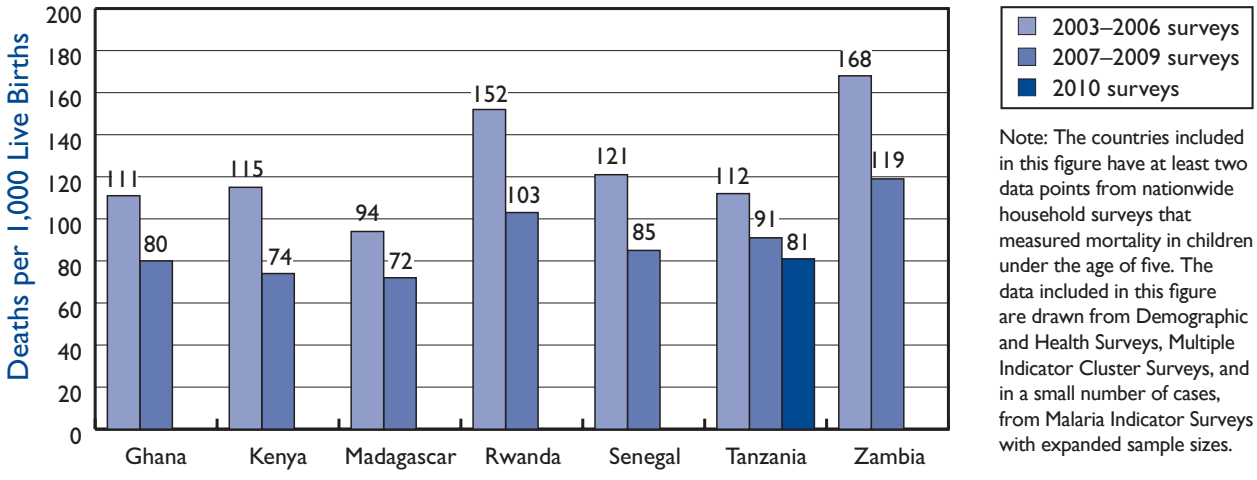
Country-Specific Impact in PMI Focus Countries

Although nationwide household surveys that allow reliable estimates of under-five mortality (e.g., the Demographic and Health Survey or Multiple Indicator Cluster Survey) are usually carried out only once every three to five years, seven of the 15 original PMI countries (**Ghana**, **Kenya**, **Madagascar**, **Rwanda**, **Senegal**, **Tanzania**, and **Zambia**) have already conducted two nationwide household surveys. Baseline surveys were conducted in 2003–2006 (when USG funding for malaria control in Africa was increasing rapidly), and follow-up surveys were carried out in 2007–2010. Working with national governments and other donors and technical agencies, PMI—supplemented by previous USG malaria assistance— has helped scale up malaria prevention and treatment measures rapidly in each of these countries. In all seven of these countries, substantial reductions in all-cause mortality (ranging from 23 to 36 percent) have been documented in children under the age of five (see Figure 7.1). Six additional PMI countries will complete their nationwide follow-up surveys during the next 12 months.

Several factors could account for these impressive reductions in under-five mortality (e.g., the deployment of other lifesaving interventions—especially for pneumonia or diarrhea—rapid improvements in nutrition and correction of micronutrient deficiencies, and improvement in vaccination coverage). However, the timing of these reductions, in close association with the massive scale-up of malaria prevention and treatment measures, strongly suggests that malaria is playing a major role in this improvement. For example, during the past five years, the number of people protected by IRS in PMI countries increased from less than 3 million to more than 25 million. And acceptance rates of spraying by homeowners has been maintained at 85 to 95 percent in all countries.

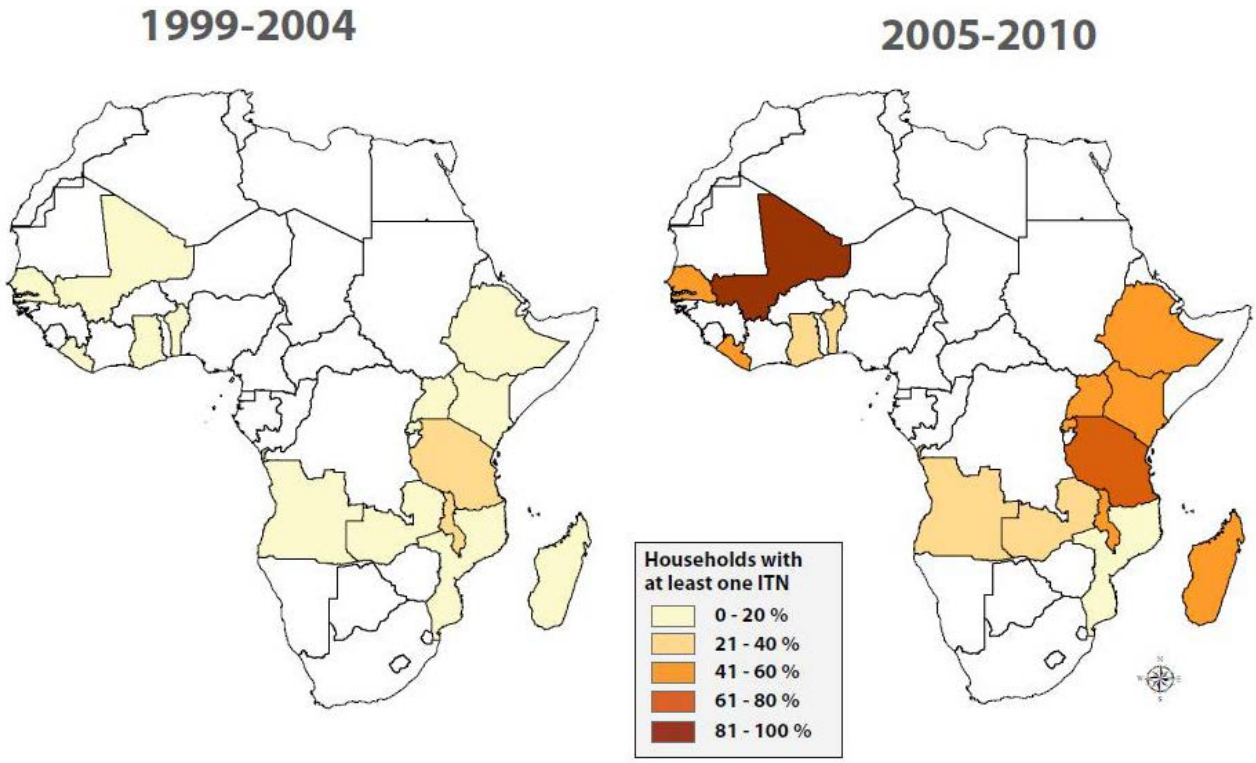
During the same time period, the percentage of families owning at least one ITN increased from less than 10 percent to greater than 50 percent across the 15 original PMI countries (see Figure 7.2).

Figure 7.1
Declines in Mortality Rates in Children Under Five



Note: The countries included in this figure have at least two data points from nationwide household surveys that measured mortality in children under the age of five. The data included in this figure 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.

Figure 7.2
Percentage of Households in 15 PMI Countries with at Least One ITN



Data Sources: MIS, DHS, MICS, IHME
Date: March 15, 2011
Created by Matthew Phelps

Note: DRC and Nigeria are not included in these maps because PMI activities started there in 2010.

Nationwide household surveys also show that ITN use among pregnant women and children under five years of age has also increased significantly in all countries where surveys have been completed (see Figure 7.3).

The four country examples described below are characteristic of what is being seen in PMI focus countries.

In **Tanzania**, all-cause mortality in children under the age of five fell by 28 percent between 2005 and 2010. Over the same time period, household ownership of at least one ITN increased from 23 percent to 64 percent, and ITN use among children under five and pregnant women increased from 16 percent (in both groups) to 64 and 57 percent, respectively. Nationwide prevalence of severe anemia (hemoglobin < 8 g/dL) in children six months to five years of age also fell by 50 percent between 2005 and 2010. In addition, malaria control efforts have been successful on the island of Zanzibar, where less than 2 percent of blood smears—taken from patients at the 90 health facility surveillance sites that make up Zanzibar's malaria epidemic early detection system—were positive for malaria parasites. The USG has supported malaria control efforts in Tanzania between 1999 and 2005, including $2 million in FY 2005. For the period FY 2006–2010, a total of $163.2 million in PMI funding was provided.

In **Senegal**, a 30 percent reduction in all-cause mortality in children under five was documented between 2005 and 2008. Although several factors may be involved, it is highly likely that this dramatic reduction is due at least in part to rapid increases in the coverage of malaria interventions. Household ownership of at least one ITN increased from 36 percent in 2006 to 60 percent in 2008. And after the 2009 national ITN distribution to children under five, a post-campaign survey found household ITN ownership had increased to 82 percent.

In addition, the proportion of pregnant women who received two or more doses of IPTp rose from 12 to 52 percent between 2005 and 2008.

In late 2007, Senegal introduced RDTs for malaria in all of its health facilities, and in 2008, 73 percent of all suspected malaria cases were confirmed by laboratory testing. Although no national-level baseline data are available for comparison, less than 6 percent of children under age five had malaria parasites in the 2008 nationwide survey—a level much lower than the 20 to 60 percent levels that have been seen in longitudinal studies in Senegal.[2] The USG has supported malaria control efforts in Senegal since 1999, including $2.2 million in FY 2006. For the period FY 2007–2010, PMI provided $75 million in funding.

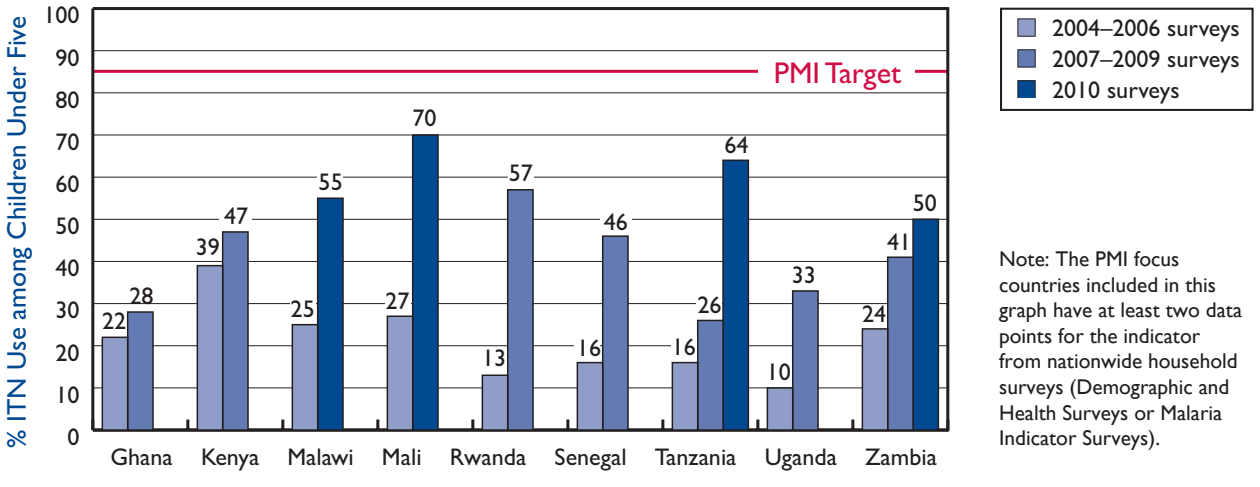
In **Zambia**, between 2006 and 2010, the prevalence of severe anemia among children six months to five years of age declined from 14 to 9 percent, and malaria parasite prevalence dropped from 22 to 16 percent. These improvements paralleled an unprecedented nationwide scale-up of ITN ownership and use. The proportion of households with at least one ITN has increased from 38 percent in 2006 to 64 percent in 2010. More important, the use of ITNs by children under five years more than doubled from 24 percent in 2006 to 50 percent in 2010.

During 2010, Zambia reported a slight upswing in malaria cases in two of its 10 provinces. The cause of these increases is being investigated, but reduced ITN availability with a subsequent fall in net coverage may have played a role. In the interim, the National Malaria Control Program, with PMI support, sent 1.7 million ITNs to the two affected provinces and has begun testing for insecticide resistance in local mosquitoes. In spite of the upswing in cases, malaria control in Zambia is making steady progress. And it is highly likely that the overall reduction in malaria since 2002 has contributed significantly to a 30 percent drop in all-cause, under-five mortality between 2003 and 2007. The USG has supported malaria control efforts in Zambia since 2002, including $7.6 million in FY 2006 and $9.5 million in FY 2007. PMI funding for the period FY 2008–2010 totaled $51.2 million.

In **Rwanda**, according to two national household surveys, all-cause mortality among children under five dropped by 32 percent between 2005 and 2008. Over the same time period, malaria transmission fell sharply, most likely associated with targeted long-lasting ITN distribution (use among children under five rose from 13 to 57 percent) and the introduction of ACTs. During 2009, however, an apparent increase in the number of confirmed malaria cases was reported by the routine health information system. The cause of this increase is unclear, but reported cases of malaria are declining once again and initial results for 2010 show a marked reduction in confirmed malaria cases. The USG has

[2] Smith T., et al., 2006. An epidemiologic model of the incidence of acute illness in *Plasmodium falciparum* malaria. *American Journal of Tropical Medicine and Hygiene* 75 (2, Suppl): 56–62.

Figure 7.3
Increasing ITN Use among Children Under Five



Note: The PMI focus countries included in this graph have at least two data points for the indicator from nationwide household surveys (Demographic and Health Surveys or Malaria Indicator Surveys).

Manoj Menon/PMI

A young girl waits at a health facility in **Uganda**, where malaria accounts for 25 to 40 percent of outpatient visits and 15 to 20 percent of all hospital admissions. Effective malaria control through ITNs, IRS, and diagnosis and treatment would unburden the health system and allow health care workers to focus their attention on other important health issues.

supported malaria control efforts in Rwanda since 2002, including $1.5 million in FY 2006. PMI funding for the period FY 2007–2010 totaled $71.7 million.

PMI's Monitoring and Evaluation Strategy

The Paris Coordination Accords provide the foundation for PMI's work in monitoring and evaluation. This foundation comprises one agreed-upon action framework that provides the basis for coordinating the work of all partners; one national coordinating authority (i.e., the NMCP) with a broad-based, multisectoral mandate; and one country-level monitoring and evaluation system. PMI—in coordination with other donors and technical agencies—supports monitoring and evaluation plans developed in collaboration with NMCPs. PMI's efforts in monitoring and evaluation build local capacity with the aim of ensuring long-term sustainability.

PMI is an active member of the global RBM Monitoring and Evaluation Reference Group (MERG) and supports standardizing approaches to the monitoring and evaluation of malaria prevention and treatment measures. PMI monitoring and evaluation personnel participate in various MERG task forces and have collaborated in the development of indicators and tools that are used globally.

PMI provides technical and financial support for the implementation of Demographic and Health Surveys, Malaria Indicator Surveys, and Multiple Indicators Cluster Surveys. These randomized and nationally representative household surveys provide valuable data to all stakeholders for evaluating malaria control efforts. To date, 29 of these surveys have been supported in the 15 original PMI countries. PMI also supports the improvement of routine health management information systems as a way to monitor day-to-day implementation of malaria control activities more effectively. PMI has worked with WHO in the development and rollout of technical guidelines for assessing and improving routine information systems. PMI has also worked with the RBM MERG in designing a monitoring and evaluation curriculum for training NMCP monitoring and evaluation officers.

Measuring Impact

Impact evaluations are the ultimate measure of whether a particular health intervention has had an effect. By definition, they explore a cause-and-effect relationship and seek to determine to what extent an observed result can be attributed to an intervention rather than to secular trends or unrelated factors. In the case of PMI, the expected effect of malaria interventions is a reduction in malaria morbidity and mortality in the targeted populations. Thus, PMI defines impact in two ways:

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

Unlike malaria morbidity, which can be assessed through well-functioning, routine information systems and population-based surveys, it is not possible to obtain accurate data on malaria-specific mortality. This is because, in Africa, most deaths in children under age five occur outside of health facilities. These deaths are not registered, and an accurate, specific cause of death is not assigned. Even within the health system, it can be difficult to determine whether or not malaria was the primary cause of death because young children are affected by a variety of health problems, the symptoms of malaria are non-specific, and many countries lack laboratory diagnostic capacity.

Because of these difficulties, PMI is using a multipronged approach recommended by the RBM MERG to measure impact on malaria burden across its 15 original focus countries.[3] This approach consists of monitoring: trends

[3] Rowe, A., et al. 2007. Evaluating the impact of malaria control efforts on mortality in sub-Saharan Africa. *Tropical Medicine and International Health*, 12 (12): 1524–1539.

in the coverage of malaria control interventions; the multiple factors that could influence childhood mortality; malaria-related morbidity (i.e., parasitemia and anemia); and all-cause mortality in children under five years of age. If reductions in all-cause under-five mortality can be demonstrated together with improvements in the coverage of malaria interventions and reductions in malaria parasitemia and anemia—and no other explanations for these reductions can be identified—then it is likely that the reductions in all-cause mortality are due in large part to malaria control efforts.

Over the next two to three years, PMI will support impact evaluations in all PMI countries. The timeline for these evaluations is determined by the availability of two all-cause mortality data points in children under five. In most cases, these data points come from Demographic and Health Surveys, which are usually conducted three to five years apart. The evaluation will be implemented under the RBM MERG in partnership with NMCPs, local stakeholders, and international technical and funding agencies. Tanzania has already started its impact evaluation and will have results in the first quarter of 2011.

For more in-depth information about PMI's monitoring and evaluation efforts, including the complete PMI monitoring and evaluation strategy document, please visit the monitoring and evaluation section of the PMI website: http://www.pmi.gov/technical/mne/index.html.

CHAPTER 8

Jessica Butts/PMI

This survey team conducted house-to-house visits to collect data on insecticide-treated net ownership and use following a universal coverage campaign in **Madagascar**. The team used hand-held computers to facilitate data collection and to map households using global positioning systems.

U.S. Government Malaria Research and Other Malaria Programs

USG Malaria Research

The USG is committed to reducing the global burden of malaria by supporting research through a coordinated and collaborative approach among governmental agencies and research partners around the globe. The USG malaria research portfolio involves the 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 Department of Defense, and USAID. The CDC advises the USG Global Malaria Coordinator on priorities for operations and implementation research.

USG agencies work with a wide range of partners including NMCPs, universities, research institutes, private companies, and NGOs. USG-supported malaria research has made contributions in the following areas:

- Conducting operations research to improve project implementation and impact;
- Developing vaccines and conducting efficacy trials;
- Developing novel drugs to address resistance;
- Defining basic malaria biology and pathogenesis to design new interventions;
- Evaluating and setting standards for diagnostic tests; and
- Improving treatment strategies for severe malaria.

These partnerships strengthen local capacity and contribute to the sustainability of national malaria control efforts. The USG provides direction and momentum toward reaching the ambitious goal of worldwide malaria control by ensuring that basic research and product development are effectively translated into field-applicable interventions that help reduce the burden of malaria.

PMI Operations Research Activities

PMI supports operations research projects that are designed to inform and improve program implementation while contributing to global malaria control efforts. Research topics are identified in collaboration with NMCPs, and to avoid duplication, are coordinated with other organizations that fund research. These studies are implemented with local universities and research institutions to foster the development of in-country research capacity.

To date, PMI has approved 40 operations research studies, including:

- An evaluation of the durability and insecticidal longevity of commercially available ITNs in eight PMI countries.
- A study of community health workers in **Zambia** who were trained to use RDTs. These health workers were provided with ACTs for patients who tested positive for malaria and with an antibiotic for patients who had pneumonia. This program led to a reduction in the overuse of ACTs and a higher rate of early and appropriate treatment of children with non-severe pneumonia.
- A study assessing factors associated with adherence to antimalarial treatment in **Malawi**. This study concluded that observing the first dose of treatment in the health facility, using the medication package to provide instructions to the caregivers, and addressing medication preference led to better treatment adherence. Efforts to improve adherence should focus on children under the age of five because this group is vulnerable to malaria and is least likely to comply with treatment guidelines.
- A study in **Tanzania** to determine whether—in areas where IRS has brought down levels of transmission, and high ITN ownership and use has been achieved—IRS can be withdrawn without a rebound in malaria transmission.

Vaccine Development

The USG supports the development of safe and effective malaria vaccines to add to the arsenal of malaria control interventions. USAID, NIH, CDC, and the Military Malaria Vaccine Program all contribute to this effort,

Gabriel Ponce de León/CDC

A surveyor examines the size and number of holes in a long-lasting ITN in Nampula Province, **Mozambique**, as part of a PMI-funded study on the durability of ITNs. The study will help determine the quality of the nets after two years' use in the field and will inform future policy questions such as when to replace the nets.

through activities in USG laboratories, clinical research centers, and field sites as well as through partnerships with industry and academia. These programs collaborate broadly, taking advantage of the strengths of each agency.

The USG supports a robust pipeline of vaccine candidates at various stages of development. During 2010, steady progress has been made in the following areas:

- CDC and WRAIR continued field evaluation of the most advanced malaria vaccine, known as RTS, S, which was developed by GlaxoSmithKline Biologicals and WRAIR.

- After 2009 results showed that a vaccine mediated by immune cells was feasible, NMRC, with USAID support, performed the first of many planned trials to determine how to capitalize on these results.

- WRAIR performed the first clinical efficacy trial of a vaccine against *P. vivax* to be conducted in the United States.

- The National Institute of Allergy and Infectious Diseases initiated a program to develop a next generation candidate vaccine based on the circumsporozoite protein of *P. falciparum*.

Drug Development

The USG supports research on antimalarial drug development through various channels.

Medicines for Malaria Venture (MMV): MMV is a nonprofit, public-private partnership created in 1999 by WHO, the World Bank, and bilateral donor governments to replenish, and then sustain, the global pipeline of antimalarial drugs. Its goal is to register at least one new antimalarial drug every five years. Although partnered with industry, MMV's focus is on the discovery and development of drugs that will be affordable to populations living in malaria-endemic areas. The research and development activities are carried out at a broad variety of institutions, comprising more than 40 academic and pharmaceutical organizations located in 10 countries, including the United States. In 2009, the first drug whose development was supported by MMV, dispersible artemether-lumefantrine, received approval from the Swiss regulatory authority. In 2011, MMV expects approval by European Union regulatory authorities of two new malaria treatments, dihydroartemisinin-piperaquine and pyronaridine-artesunate. USAID has provided funding to MMV since 2006.

Walter Reed Army Institute of Research (WRAIR) Drug Development Program: The primary mission of WRAIR's antimalarial drug development program is to develop new drugs to prevent malaria, as well as drugs that can eliminate the latent liver stages of *P. vivax*. In 2010, WRAIR's drug tafenoquine was selected by MMV and GlaxoSmithKline for late-stage clinical trials to eliminate the latent liver stages of *P. vivax* malaria. WRAIR is concurrently developing field sites to test this drug, which may prove important for malaria elimination efforts. In addition, WRAIR has developed animal models with the glucose-6-phosphate-deficiency mutation, which will determine if the 8-aminoquinolines class of drugs can be used more safely in patients with this genetic mutation. Investigators from the Armed Forces Research Institute of Medical Sciences (a WRAIR laboratory in Thailand) continue to examine drug resistance to artemisinin derivatives and combination

partner drugs. Investigators from WRAIR have also re-examined the institute's database of more than 300,000 compounds, identifying several promising new leads to overcome multidrug resistant malaria.

For severe malaria, WRAIR developed intravenous artesunate for approval by the U.S. Food and Drug Administration (FDA). Intravenous artesunate is now available in the United States and Canada as an Investigational New Drug, sponsored by the CDC. In the past two years, 70 persons with severe malaria have been successfully treated with this drug in the United States. The U.S. Army is partnering with the pharmaceutical company Sigma-Tau to take the drug to full FDA approval.

USG Malaria Research Agencies

Centers for Disease Control and Prevention (CDC): In addition to applied research within PMI, CDC investigators are engaged in a broad range of research activities with the objectives of:

- Identifying new antimalarial drug compounds and vaccine candidates, and evaluating their potential efficacy in nonhuman primates;
- Evaluating and ensuring the quality of new tools for malaria diagnosis, treatment, and prevention;
- Establishing the optimal mix of malaria control interventions in different malaria transmission settings; and
- Exploring opportunities to integrate malaria interventions and their monitoring into other health and development initiatives in endemic countries.

CDC investigators provide expertise to global malaria research consortia, including those focusing on ACTs, health systems, malaria elimination/eradication, malaria in pregnancy, malaria transmission, and malaria vaccines. CDC scientists have played leading roles in:

- Studying the burden and treatment options for malaria in pregnancy;
- Evaluating the efficacy of a promising malaria vaccine candidate;
- Assessing the efficacy of new insecticide-treated materials;
- Assessing insecticide-resistance in malaria vectors;
- Monitoring the quality of commercially available diagnostic tests and treatments for malaria; and
- Monitoring the effectiveness and cost-effectiveness of strategies to enhance the availability of malaria treatment.

National Institutes of Health (NIH):

Fogarty International Center: In November 2010, NIH hosted a scientific conference, "Artemisinin-Resistant Malaria: Addressing Research Challenges and Opportunities, and Public Health Implications," which facilitated the sharing of the most up-to-date, unpublished research and clinical findings among more than 40 preeminent malaria researchers from around the world who are actively studying *Plasmodium* resistance to artemisinin drugs. Participants reviewed the implications of the findings for large-scale control efforts, such as those conducted by PMI and other multilateral and nationally supported programs.

The participants agreed that understanding artemisinin resistance should be a global priority. Toward this end, the NIH will be: 1) developing a "Call to Action" perspectives/opinion editorial, which will be submitted to a leading medical journal in early 2011; 2) publishing a conference "Proceedings" document that will highlight state-of-the-art understanding of how artemisinin resistance is defined, geno- and phenotyped, spread, and controlled; and 3) developing a framework for international collaborations on artemisinin resistance, including a follow-up meeting in 2011 or 2012, which would focus on pharmacokinetics, mechanisms of action, and biomarkers of parasite resistance, and other tools for diagnosis and treatment of malaria.

National Institute of Allergy and Infectious Diseases (NIAID): NIAID research covers a broad range of topics:

- **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 infection results in disease. Understanding these mechanisms should yield new approaches to prevention and treatment.
- **Genomics:** Supplying scientists with the complete genetic sequences of the mosquito vector *Anopheles gambiae* and the parasites *P. 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 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 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.

Highlights of recent NIAID malaria research activities include:

- Demonstration that malaria-transmitting mosquitoes can survive over the dry season in the region south of the Sahara desert. This finding has important implications for understanding the dynamics of mosquito population resurgence in this region during the wet season when malaria transmission occurs.

- In Cambodia, identification of resistance to artemisinins in a province farther south than two other provinces where artemisinin resistance has already been reported. These results will inform future approaches to the treatment, containment, and elimination of malaria in Cambodia and the surrounding countries.

- In July 2010, in an effort to accelerate the control of malaria and help eliminate it worldwide, NIAID established the International Centers of Excellence for Malaria Research program with 10 sites in regions where malaria is endemic, including parts of Africa, Asia, the Pacific Islands, and Latin America. These regions include several PMI focus countries. The goal of this network of multidisciplinary research centers is to generate critical knowledge, tools, and evidence-based strategies to support intervention and control programs by government organizations and health care institutions.

In addition to encouraging global cooperation in malaria research, NIAID also invests heavily in developing and strengthening sustainable local research capacity in disease-endemic countries (see http://www.niaid.nih.gov/about/organization/dir/Pages/internationalCenters.aspx). Working with the Fogarty International Center at NIH, NIAID helps train and educate new investigators in the field.

Other USG Malaria Programs

Although this report focuses primarily on malaria prevention and treatment activities funded through PMI in the focus countries in sub-Saharan Africa, the USG malaria portfolio includes investments in malaria beyond PMI. The USG supports malaria prevention and control in humanitarian emergencies and other high-burden countries in Africa (in addition to the 17 PMI focus countries), and regional initiatives in Latin America and Southeast Asia.

Malaria Activities in Non-PMI Countries

During 2010, USAID provided significant support for malaria control beyond the 17 PMI focus countries in Africa, including:

- Providing $6 million for malaria activities to **Burkina Faso**. USAID's implementing partners developed an integrated malaria training package and trained 165 district- and regional-level trainers, who in turn trained 390 health care providers in 2010. This training covered IPTp, malaria laboratory diagnosis, and case management. With USAID support, IRS was conducted in Diebougou District, protecting more than 118,000 people. USAID also contributed technical assistance and 150,000 ITNs to a mass distribution campaign, which began in September and aims for universal coverage of the population.

- Helping the NMCP in **Burundi** to train 394 community health workers in malaria prevention techniques and proper ITN hang-up and use. In addition, the USG procured 480,000 ITNs and supported the routine distribution of more than 643,000 ITNs to health clinics (covering approximately 94 percent of the country's annual ITN need for routine distribution to vulnerable populations). USAID's FY 2010 budget for Burundi was $6 million.

- Providing **Pakistan**, where malaria cases increased as a result of the devastating floods of 2010, with $5 million in emergency assistance through the USAID/Office of Foreign Disaster Assistance. WHO used these funds to purchase 245,000 ITNs, 56 solar-operated microscopes, and 2 million RDTs, and to train 300 health workers in laboratory diagnosis of malaria. In addition, 120 doctors were trained in malaria case management, and 51,000 ACT treatments were procured and distributed.

Soy Ty Kheang/URC

A billboard in **Cambodia** encourages people to always use an insecticide-treated mosquito net at home (left) and to take a net with them when they leave to work in the forest (right).

Regional Initiatives

USAID supports two regional malaria programs: one in Latin America through the **Amazon Malaria Initiative (AMI)** and one in the Greater Mekong Sub-region of Southeast Asia through the **Mekong Malaria Programme**.

AMI assists ministries of health and national malaria control programs in countries of the Amazon Basin of South America—where multidrug resistance is a major problem—to strengthen their malaria prevention and treatment measures. AMI is implemented through the Pan American Health Organization with technical assistance from CDC and others. The seven countries participating in the initiative are Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, and Suriname; in FY 2010, USAID malaria support to these seven countries totaled $5 million. Between 2000 and 2007, AMI helped these countries change their national malaria treatment policies to ACTs and implement those new policies. During the past year, work has focused on helping all seven countries adopt national standard operating procedures and build in-country capacity for quality control of antimalarial drugs. This work has entailed establishing standard operating procedures for pharmaceutical management—including strengthening the pharmaceutical management information system—assisting countries with monitoring insecticide resistance and antimalarial drug resistance, and helping to develop and implement vector control plans tailored to malaria transmission levels in the region.

USAID support for the **Mekong Malaria Programme** in the Greater Mekong Sub-region, which includes

Burma, Cambodia, Laos, Thailand, Vietnam, and Yunnan Province, China, totaled $6.5 million in FY 2010. The strategic objective of the program is to prevent the development and spread of drug-resistant malaria. With confirmation of artemisinin-resistant *P. falciparum* malaria at the Thai-Cambodian border and evidence of decreased sensitivity to artemisinins at several other sites in the region, malaria control and elimination in the region has become a global priority. Working with WHO, the Global Fund, the Bill & Melinda Gates Foundation, national malaria control programs, NGOs, the private sector, and with technical assistance from the CDC, the program has maintained a network of drug resistance and drug quality monitoring sites and provided support for pharmaceutical management. At the regional level, USAID seeks to improve access to strategic information and improve use of best practices in malaria surveillance, prevention, and treatment. Several regional activities in 2010 have supported these objectives. For example:

- A common monitoring and evaluation framework for the Mekong is being finalized and will be adopted by countries within WHO's Southeast Asian and Western Pacific regions.

- A regional operations research symposium was held to bring together malaria control programs from the six countries to identify operations research priorities and gaps and develop a cohesive regional framework.

- Twenty-three staff from nine national malaria country programs participated in a course on management for malaria field operations hosted by Thailand's National Malaria Program with teaching support from many USAID-supported partners.

USAID also directly supports malaria control and elimination activities within the Greater Mekong Sub-region with the goal of improving access to prevention measures and case management. For example, USAID directly assisted the Cambodian malaria program in Western Cambodia, where there is resistance to artemisinin. This support included: 1) distributing long-lasting ITNs to migrants; 2) ensuring adequate stocks of RDTs and ACTs for village malaria workers and health facilities; 3) ensuring high-quality RDTs; 4) providing training and supervision for data collection; and 5) supporting innovative behavior change communication activities targeting taxi drivers and community leaders. Direct support has also been provided to develop a model for malaria elimination in Thailand with assistance for surveillance, case investigation, and response activities, which have included mass blood surveys and long-lasting ITN distribution.

Appendix 1
PMI Funding FY 2006–2010

PMI Funding[1]								
	Country	FY 2005 Jump-Start Funding	FY 2006	FY 2007[2]	FY 2008[3]	FY 2009	FY 2010[4]	Total
Round 1	Angola	1,740,000	7,500,000	18,500,000	18,846,000	18,700,000	35,500,000	
	Tanzania	2,000,000	11,500,000	31,000,000	33,725,000	35,000,000	52,000,000	
	Uganda	510,775	9,500,000	21,500,000	21,822,000	21,600,000	35,000,000	
Round 2	Malawi		2,045,000	18,500,000	17,854,000	17,700,000	27,000,000	
	Mozambique		6,259,000	18,000,000	19,838,000	19,700,000	38,000,000	
	Rwanda		1,479,000	20,000,000	16,862,000	16,300,000	18,000,000	
	Senegal		2,168,000	16,700,000	15,870,000	15,700,000	27,000,000	
Round 3	Benin		1,774,000	3,600,000	13,887,000	13,800,000	21,000,000	
	Ethiopia		2,563,000	6,700,000	19,838,000	19,700,000	31,000,000	
	Ghana		1,478,000	5,000,000	16,862,000	17,300,000	34,000,000	
	Kenya		5,470,000	6,050,000	19,838,000	19,700,000	40,000,000	
	Liberia			2,500,000	12,399,000	11,800,000	18,000,000	
	Madagascar		2,169,000	5,000,000	16,862,000	16,700,000	33,900,000	
	Mali		2,490,000	4,500,000	14,879,000	15,400,000	28,000,000	
	Zambia		7,659,000	9,470,000	14,879,000	14,700,000	25,600,000	
Round 4	DRC						18,000,000	
	Nigeria						18,000,000	
	Headquarters		1,500,000	10,000,000	21,596,500	26,100,000	36,000,000	
	PMI Total		30,000,000	154,200,000	295,857,500	299,900,000	500,000,000	1,279,957,500
	Jump-Start Total	4,250,775	35,554,000	42,820,000			36,000,000	118,624,775
	Total Overall	4,250,775	65,554,000	197,020,000	295,857,500	299,900,000	536,000,000	1,398,582,275

1 This table does not include other USG funding for malaria activities from USAID, CDC, or the National Institutes of Health.
2 $25 million plus-up funds include $22 million allocated to 15 PMI 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, the USG also provided funding for malaria activities in Burkina Faso ($6 million), Burundi ($6 million), Pakistan ($5 million), Southern Sudan ($4.5 million), the Amazon Malaria Initiative ($5 million), and the Mekong Malaria Programme ($6 million).

Appendix 2
PMI Contribution Summary

1. Indoor Residual Spraying

Residents Protected by PMI-Supported Indoor Residual Spraying[1,2]						
	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)
Round 1	Angola	590,398	612,776	992,856	485,974	650,782
	Tanzania	1,018,156	1,279,960	1,569,071	2,087,062	4,861,179
	Uganda	488,502	1,865,956	2,211,388	2,262,578	2,794,839
Round 2	Malawi		126,126	106,450	299,744	364,349
	Mozambique		2,593,949	1,457,142	2,263,409	2,945,721
	Rwanda		720,764	885,957	1,329,340	1,365,949
	Senegal		678,971	645,346	661,814	959,727
Round 3	Benin			521,738	512,491	636,448
	Ethiopia		3,890,000	5,921,906	6,484,297	2,064,389
	Ghana			601,973	708,103	849,620
	Kenya		3,459,207	3,061,967	1,435,272	1,892,725
	Liberia				163,149	420,532
	Madagascar			2,561,034	1,274,809	2,895,058
	Mali			420,580	497,122	440,815
	Zambia		3,600,000	4,200,000	6,500,000	4,056,930
	Total	2,097,056	18,827,709	25,157,408	26,965,164	27,199,063

1 Data reported in this table are up to date as of January 1, 2011, and include 15 PMI focus countries (PMI did not fund IRS in DRC and Nigeria). During 2010, the USG also provided support for an IRS campaign in Burkina Faso, which protected 118,691 people.
2 A cumulative count of the number of people protected is not provided because some areas have been sprayed on more than one occasion.

Houses Sprayed with PMI Support[1,2]						
	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)
Round 1	Angola	107,373	110,826	189,259	102,731	135,856
	Tanzania	203,754	247,712	308,058	422,749	889,981
	Uganda	103,329	446,117	575,903	567,035	878,875
Round 2	Malawi		26,950	24,764	74,772	97,329
	Mozambique		586,568	412,923	571,194	618,290
	Rwanda		159,063	189,756	295,174	303,659
	Senegal		169,743	153,942	176,279	254,559
Round 3	Benin			142,814	156,223	166,910
	Ethiopia		778,000	1,793,248	1,935,402	646,870
	Ghana			254,305	284,856	342,876
	Kenya		1,171,073	764,050	517,051	503,707
	Liberia				20,400	48,375
	Madagascar			422,132	216,060	576,320
	Mali			107,638	126,922	127,273
	Zambia		657,695	762,479	1,189,676	1,102,338
	Total	414,456	4,353,747	6,101,271	6,656,524	6,693,218

1 Data reported in this table are up to date as of January 1, 2011, and include 15 PMI focus countries (PMI did not fund IRS in DRC and Nigeria). During 2010, the USG also provided support to spray 33,897 houses in an IRS campaign in Burkina Faso.
2 A cumulative count of the number of houses sprayed is not provided because some areas have been sprayed on more than one occasion.

Spray Personnel Trained with PMI Support[1,2]						
	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)
Round 1	Angola	350	582	2,104	585	834
	Tanzania	536	734	688	2,806	5,890
	Uganda	450	4,062	4,945	4,412	5,171
Round 2	Malawi		300	309	462	929
	Mozambique		1,190	1,282	1,343	1,996
	Rwanda		655	2,091	2,276	2,088
	Senegal		275	706	570	1,024
Round 3	Benin			335	347	459
	Ethiopia			1,198	3,017	4,049
	Ghana			468	577	572
	Kenya		4,697	1,452	1,719	2,496
	Liberia				340	480
	Madagascar			1,673	851	1,612
	Mali			413	424	549
	Zambia		1,300	1,413	1,935	2,396
	Total	1,336	13,795	19,077	21,664	30,545

1 Data reported in this table are up to date as of January 1, 2011, and include 15 PMI focus countries (PMI did not fund IRS in DRC and Nigeria). During 2010, the USG also provided support for an IRS campaign in Burkina Faso, which trained 574 people.

2 A cumulative count of the number of spray personnel trained is not provided because some personnel have been trained on more than one occasion. Spray personnel are defined as spray operators, supervisors, and ancillary personnel. These totals do not include many people trained to conduct information and community mobilization programs surrounding IRS campaigns.

2. Insecticide-Treated Nets

Insecticide-Treated Nets Procured and Distributed with PMI Support[1]							
	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Cumulative
Round 1	Angola	540,949	294,200	734,198	395,748	1,353,298	3,318,393
		540,949		339,440	446,348	294,169	1,620,906
	Tanzania	130,000		143,560	1,468,966	623,441	2,365,967
		130,000		113,560	1,498,966	1,495,121	3,237,647
	Uganda	376,444	1,132,532	480,000	765,940	300,000	3,054,916
		305,305	683,777	999,894	651,203	294,139	2,934,318
Round 2	Malawi		1,039,400	849,578	1,791,506	850,000	4,530,484
			211,995	849,578	851,436	457,822	2,370,831
	Mozambique		786,000	720,000	1,450,000	500,000	3,456,000
			565,000	842,802	930,000	500,000	2,837,802
	Rwanda			550,000	912,400	100,000	1,562,400
					500,000	962,400	1,462,400
	Senegal		200,000	790,000	408,000	1,025,000	2,423,000
			196,872	792,951	380,000	28,000	1,397,823
Round 3	Benin		221,000	385,697	875,000	634,000	2,115,697
			215,627	45,840	879,415	315,799	1,456,681
	Ethiopia		102,145	22,284	1,559,500	1,845,000	3,528,929
			102,145	22,284	559,500	1,000,000	1,683,929
	Ghana		60,023	350,000	955,000	2,304,000	3,669,023
			60,023		350,000	955,000	1,365,023
	Kenya			60,000	1,240,000	455,000	1,755,000
				60,000	550,000	690,000	1,300,000
	Liberia		197,000		430,000	480,000	1,107,000
				184,000	430,000	480,000	1,094,000
	Madagascar			351,900	1,875,007	1,715,000	3,941,907
				351,900	1,005,007	2,579,720	3,936,627
	Mali		369,800	858,060	600,000	2,110,000	3,937,860
			369,800	258,060	600,000		1,227,860
	Zambia		808,332	186,550	433,235	1,800,000	3,228,117
			550,017	444,865	433,235	400,000	1,828,117

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Insecticide-Treated Nets Procured and Distributed with PMI Support[1]

	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Cumulative
Round 4	DRC					824,100	824,100
						589,553	589,553
	Nigeria					614,000	614,000
	Total	1,047,393	5,210,432	6,481,827	15,160,302	17,532,839	45,432,793
		976,254	2,955,256	5,305,174	10,065,110	11,041,723	30,343,517

ITNs Procured ITNs Distributed

1 Data reported in this table are up to date as of January 1, 2011, and include 15 PMI focus countries, plus jump-start activities in DRC and Nigeria. During 2010, the USG also provided support for ITN activities in Burkina Faso, Burundi, and Pakistan; 1,110,000 ITNs were procured and 625,000 were distributed.

Insecticide-Treated Nets Procured by Other Donors and Distributed with PMI Support[1]

	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Cumulative
Round 1	Angola			109,624	17,089	540,851	667,564
	Tanzania			350,000	117,400		467,400
	Uganda		369,900			2,431,815	2,801,715
Round 2	Malawi				10,700	9,600	20,300
	Mozambique			78,000	179,730		257,730
	Senegal				1,875,456	621,481	2,496,937
Round 3	Ethiopia				475,000		475,000
	Ghana			750,000		82,600	832,600
	Madagascar				290,636	3,204,647	3,495,283
Round 4	DRC					3,966,000	3,966,000
	Total		369,900	1,287,624	2,966,011	10,856,994	15,480,529

1 Data reported in this table are up to date as of January 1, 2011, and include only those PMI focus countries that have data to report for this indicator, plus jump-start activities in DRC. During 2010, the USG also provided support for the distribution of 6,493,359 ITNs procured by other donors in Burkina Faso and South Sudan.

Insecticide-Treated Nets Sold with PMI Marketing Support[1]							
	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Cumulative
Round 1	Uganda	586,284	932,033	1,115,074	281,955		2,915,346
Round 2	Senegal		158,060	57,832	57,929		273,821
Round 3	Ghana		612,000	1,234,159	347,520		2,193,679
	Total	586,284	1,702,093	2,407,065	687,404		5,382,846

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

Insecticide-Treated Nets Redeemed through Voucher Programs with PMI Support[1]							
	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Cumulative
Round 1	Tanzania		362,194	1,034,711	596,275	623,441	2,616,621
Round 2	Senegal		134,413	168,206	72,234		374,853
Round 3	Ghana			236,789	102,833	86,579	426,201
	Total		496,607	1,439,706	771,342	710,020	3,417,675

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

3. Malaria in Pregnancy

Sulfadoxine-Pyrimethamine (SP) Treatments Procured and Distributed with PMI Support[1]							
	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Cumulative
Round 1	Uganda			18,333	72,666	39,367	130,366
				2,556	45,780	40,063	88,399
Round 2	Mozambique					3,645,052[2]	3,645,052
	Rwanda		583,333				583,333
			583,333				583,333
Round 3	Benin			766,666			766,666
					307,121	150,000	457,121
	Ghana					25,000	25,000
	Kenya				840,000		840,000
					840,000		840,000
	Liberia				78,666	85,333	163,999
					78,666		78,666
	Mali			1,000,000			1,000,000
					1,000,000		1,000,000
	Zambia				666,666		666,666
						666,666	666,666
Round 4	DRC					2,470,000[3]	2,470,000
						1,370,000	1,370,000
	Total		583,333	1,784,999	1,657,998	6,264,752	10,291,082
			583,333	2,556	2,271,567	2,226,729	5,084,185

SP Treatments Procured SP Treatments Distributed

1 Data reported in this table are up to date as of January 1, 2011, and include only those PMI focus countries that have data to report for this indicator, plus jump-start activities in DRC. During 2010, the USG also provided support for malaria in pregnancy activities in Burkina Faso; 1,100,000 SP treatments were procured and distributed.
2 All treatments were procured with non-malaria USG funds.
3 Of this total, 1,370,000 treatments were procured with non-malaria USG funds.

Health Workers Trained in IPTp Use with PMI Support[1, 2]						
	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)
Round 1	Angola	1,450	290	1,481	2,554	2,695
	Tanzania	376	1,158	2,532	2,288	2,157
	Uganda	168	807	649	724	870
Round 2	Malawi			2,747	348	181
	Rwanda		250	436		964[3]
	Senegal		43	2,422	865	1,025
Round 3	Benin		605	1,267	146	80
	Ghana			464	1,170	2,797
	Kenya				5,107	93
	Liberia			417	750	535
	Madagascar					1,576
	Mali			142		1,173
	Zambia				63	
	Total	1,994	3,153	12,557	14,015	14,146

1 Data reported in this table are up to date as of January 1, 2011, and include only those PMI focus countries that have data to report for this indicator. During 2010, the USG also provided support for malaria in pregnancy activities in Burkina Faso and South Sudan; 947 health workers were trained in IPTp.

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 These 964 health workers were trained in focused antenatal care because IPTp is not national policy in Rwanda.

4. Case Management

Artemisinin-Based Combination Treatments Procured and Distributed with PMI Support[1]							
	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Cumulative
Round 1	Angola	587,520	2,033,200	3,035,520	5,572,860	3,767,040	14,996,140
			1,689,321	3,109,089	1,947,188	3,567,360	10,312,958
	Tanzania	380,160	694,050	146,730	4,001,760	8,751,150	13,973,850
		380,160	494,050	346,730	544,017	4,873,207	6,638,164
	Uganda	261,870		1,140,480		2,085,120	3,487,470
		227,827			1,140,480		1,368,307
Round 2	Malawi		4,695,450	8,449,920	1,169,280	1,634,520	15,949,170
			4,694,013	3,579,278	3,693,510	2,198,460	14,165,261
	Mozambique		218,880	4,988,160		5,331,840	10,538,880
			218,880	1,440,000	2,210,320	1,553,430	5,422,630
	Rwanda		714,240				714,240
				714,240			714,240
	Senegal				443,520	670,080	1,113,600
						443,520	443,520
Round 3	Benin			1,073,490	215,040	1,002,240	2,290,770
				326,544	812,232	1,002,600	2,141,376
	Ethiopia			600,000	1,081,000	2,268,000	3,949,000
					1,681,000	648,000	2,329,000
	Ghana			1,142,759			1,142,759
					1,028,000	114,759	1,142,759
	Kenya			1,281,720	7,804,800	6,997,080	16,083,600
				1,281,720	6,015,360	7,667,310	14,964,390
	Liberia		496,000		1,303,175	1,631,625	3,430,800
				496,000	1,303,175	1,631,625	3,430,800
	Madagascar						
	Mali				241,720	739,200	980,920
					241,720		241,720
	Zambia			495,360		2,390,400[2]	2,885,760
				80,640	173,160	2,257,920	2,511,720

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Artemisinin-Based Combination Treatments Procured and Distributed with PMI Support[1]

	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Cumulative
Round 4	DRC					3,780,000	3,780,000
						639,075	639,075
	Nigeria						
						1,043,352[3]	1,043,352
	Total	1,229,550	8,851,820	22,354,139	21,833,155	41,048,295	95,316,959
		607,987	7,096,264	11,374,241	20,790,162	27,640,618	67,509,272

ACTs Procured ACTs Distributed

1 Data reported in this table are up to date as of January 1, 2011, and include 15 PMI focus countries, plus jump-start activities in DRC and Nigeria. During 2010, the USG also provided support for case management activities in Burundi, Pakistan, and South Sudan; 1,293,000 ACTs were procured and 1,193,000 were distributed.
2 In addition to these ACTs procured with USG funds, 1,599,360 ACTs were procured in 2010 with a donation from DfID.
3 These ACTs were procured with USG funds before Nigeria became a PMI focus country.

ACTs Procured by Other Donors and Distributed with PMI Support[1]

	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Cumulative
Round 1	Uganda		8,709,140	112,330	4,459,918		13,281,388
Round 2	Malawi				2,056,170		2,056,170
	Mozambique				1,423,350	2,857,590	4,280,940
	Rwanda				396,625	282,494	679,119
Round 3	Madagascar				519,338	396,470	915,808
	Total		8,709,140	112,330	8,855,401	3,536,554	21,213,425

1 Data reported in this table are up to date as of January 1, 2011, and include only those PMI focus countries that have data to report for this indicator. During 2010, the USG also provided support for the distribution of 529,280 ACTs procured by other donors in South Sudan.

Health Workers Trained in ACT Use with PMI Support[1,2]						
	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)
Round 1	Angola	1,283	290	1 ,357	2,784	2,868
	Tanzania	4,217	1,011	1,767	1,018	1,162
	Uganda	2,844	12,637	9,159	1,356	
Round 2	Malawi			5,315	809	1,813
	Mozambique		174	422	16,768	219
	Rwanda		5,127	8,565	7,672	7,180
	Senegal		1,020	4,776	1,162	4,158
Round 3	Benin		605		762	1,178
	Ethiopia			2,786		1,740
	Ghana			368	1,144	2,952
	Kenya				4,747	390
	Liberia			595	746	1,008
	Madagascar				1,696	4,575
	Mali			101	412	1,283
	Zambia			186	197	
Round 4	DRC					874
	Nigeria					5,058
	Total	8,344	20,864	35,397	41,273	36,458

1 Data reported in this table are up to date as of January 1, 2011, and include 15 PMI focus countries, plus jump-start activities in DRC and Nigeria. During 2010, the USG also provided support for case management activities in Burkina Faso, Pakistan, and South Sudan; 1,067 health workers were trained in ACT use.

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

Rapid Diagnostic Tests Procured and Distributed with PMI Support[1]							
	Country	Year 1 (2006)	Year 2 (2007)	Year 3 (2008)	Year 4 (2009)	Year 5 (2010)	Cumulative
Round 1	Angola	129,875	375,000	375,000	600,000	832,000	2,311,875
			101,000	380,875	975,000	282,000	1,738,875
	Tanzania	875,000	550,200	1,075,000	950,000	292,000	3,742,200
		250,000	1,025,200	425,000	989,500	661,900	3,351,600
	Uganda					1,309,000	1,309,000
						34,000	34,000
Round 2	Rwanda					200,010	200,010
Round 3	Benin		178,400			600,000	778,400
			73,815	104,585			178,400
	Ethiopia				1,680,000	1,560,000	3,240,000
					820,000	2,420,000	3,240,000
	Ghana				74,000	725,600	799,600
	Kenya					547,000	547,000
	Liberia				850,000	1,200,000	2,050,000
					850,000	1,200,000	2,050,000
	Madagascar					270,000	270,000
						202,031	202,031
	Mali				30,000	500,000	530,000
						530,000	530,000
	Zambia		979,000	1,639,000	2,070,000	4,804,500	9,492,500
				979,000	1,250,000	2,550,400	4,779,400
Round 4	DRC					500,000	500,000
	Total	1,004,875	2,082,600	2,429,000	6,254,000	13,340,110	25,110,585
		250,000	1,200,015	1,889,460	4,884,500	7,880,331	16,104,306

RDTs Procured RDTs Distributed

1 Data reported in this table are up to date as of January 1, 2011, and include only those PMI focus countries that have data to report for this indicator, plus jump-start activities in DRC. During 2010, the USG also provided support for case management activities in Burkina Faso, Pakistan, and South Sudan; 3,068,000 RDTs were procured and 2,500,000 were distributed.

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)
Round 1	Angola		374	1,356	691	1,022
	Tanzania				247	388
	Uganda			100	1,115	941
Round 2	Malawi					307
	Mozambique		391		136	
	Rwanda					29
	Senegal			90	19	4,158
Round 3	Benin		605		24	583
	Ghana				46	4,511
	Kenya			77		485
	Liberia				22	906
	Madagascar				108	2,701
	Mali			40	412	1,276
	Zambia				36	
Round 4	DRC					28
	Total		1,370	1,663	2,856	17,335

1 Data reported in this table are up to date as of January 1, 2011, and include only those PMI focus countries that have data to report for this indicator, plus jump-start activities in DRC. During 2010, the USG also provided support for case management activities in Burkina Faso, Pakistan, and South Sudan; 961 health workers were trained in malaria diagnosis.

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

Appendix 3
PMI Country-Level Targets

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 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.

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