

EXTERNAL EVALUATION OF THE PRESIDENT'S MALARIA INITIATIVE FINAL REPORT



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PRESIDENT'S MALARIA INITIATIVE



DECEMBER 2011

This publication was produced for review by the United States Agency for International Development. It was prepared by Jonathon Simon, Kojo Yeboah-Antwi, Allan Schapira, Mohammadou Kabir Cham, Rosemary Barber-Madden, and Mohamad Ibrahim Brooks through the Global Health Technical Assistance Project.

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CONTENTS

ACRONYMS AND ABBREVIATIONS	v
EXECUTIVE SUMMARY	vii
Summary for Objective 1: Leadership, Management, and Resources	viii
Summary for Objective 2: Putting Its Core Operating Principles into Practice ..	viii
Summary for Objective 3: Wider Partnership Environment.....	ix
Summary for Objective 4: Assess Program Outcomes and Impacts.....	ix
Summary for Objective 5: Assess Operational Research Activities	x
Summary for Objective 6: Make Actionable Recommendations.....	x
PREFACE	xi
PMI Overview	xii
Scope of Work	xiii
Key Evaluation Questions	xiv
Team Membership	xv
Evaluation Methodology	xvi
Report Structure	xvii
Acknowledgements.....	xviii
I. LEADERSHIP	I
Introduction.....	I
Overall Assessment.....	I
Specific Questions.....	2
Management Issues	4
Resource Allocation Issues	6
Conclusions	8
II. APPLICATION OF OPERATING PRINCIPLES	II
Introduction.....	II
Assessment of Principle 1: Use of a Comprehensive, Integrated Package of Proven Prevention and Treatment Interventions	12
Conclusions	13
Assessment of Principle 2: Strengthening of Health Systems and Integrated Maternal and Child Health Program	23
Assessment of Principle 3: NMCP Strengthening and Country Ownership.....	27
Overall Conclusions	29

III. PMI'S COORDINATION AND OPERATION WITHIN THE WIDER GLOBAL AND COUNTRY PARTNERSHIP	31
Introduction.....	31
PMI within the Wider Global Partnership.....	32
PMI and National Partners.....	35
PMI Coordination and Partnership Environment	39
Conclusions	40
IV. MONITORING AND EVALUATION	43
Introduction.....	43
PMI's Goals, Objectives, Targets, and Indicators.....	44
PMI's M&E Work with a Focus on Outcomes and Impact.....	46
V. OPERATIONS RESEARCH ACTIVITIES	59
Introduction: The Role of Research in PMI and the Global Malaria Response....	59
Clarity of Research Content in PMI.....	61
Conclusions	64
Recommendations	65
VI. CONCLUSIONS AND RECOMMENDATIONS	67
Policy Recommendations	67
Technical Recommendations.....	69

ANNEXES

Annex 1: Evaluation Team Scope of Work (SOW)	71
Annex 2: Interview List.....	81
Annex 3: Email and Telephone Questionnaires	83
Annex 4: PMI Operations Research Proposal Summary.....	93
Annex 5: Impact Evaluation Based on Data and Information for the 15 PMI Countries Available by Mid-2011	101
Annex. 6: References	179

TABLES

Table 1. PMI Countries by Round	xii
Table 2. Characteristics of PMI Resident Advisors	7
Table 3. Costs and Coverage Rates of LLIN According to PMI Country Profile and MOPs for 2008-2010	16
Table 4. Costs and Coverage Rates of IRS According to PMI Country Profile and MOPs (2006-2010).....	18

Table 5. Number and Percent of Health Workers Trained by Type of Training*	24
Table 6. Targets and Indicators for President’s Malaria Initiative Countries by End of FY 2010	44
Table 7. PMI Operations Research Proposal Summary	60

FIGURES

Figure 1. PMI Evaluation Framework.....	xiv
Figure 2. Malaria Monitoring and Evaluation Framework.....	47

ACRONYMS AND ABBREVIATIONS

ACCM	All-cause child mortality
ACT	Artemisinin-based combination therapy
AL	Artemether-lumefantrine
ALMA	African Leaders Malaria Alliance
AMFm	Affordable Medicines Facility—malaria
ANC	Antenatal care
BCC	Behavior change communication
CBO	Community-based organization
CCM	Community case management
CDC	Centers for Disease Control and Prevention
CGHD	Boston University Center for Global Health and Development
CHW	Community health worker
CMWG	Roll Back Malaria Partnership Case Management Working Group
DFID	Department for International Development (U.K.)
DHS	Demographic health survey
DOD	Department of Defense
EPI	Expanded program on immunization
FANC	Focused antenatal care
FBO	Faith-based organization
FSN	Foreign service national
FY	Fiscal year
GHI	Global Health Initiative
Global Fund	Global Fund to Fight AIDS, Tuberculosis and Malaria
GMP	Global Malaria Program
HHS	Department of Health and Human Services
HMIS	Health management information system
HWG	Harmonization Working Group
iCCM	Integrated community case management
IEC	Information, education, and communication
IPTp	Intermittent preventive treatment for pregnant women
IRS	Indoor residual spraying
ITN	Insecticide-treated mosquito net
LiST	Lives Saved Tool

LLIN	Long-lasting insecticide net
KII	Key informant interview
MCH	Maternal and child health
M&E	Monitoring and evaluation
MERG	Roll Back Malaria Partnership Monitoring and Evaluation Reference Working Group
MICS	Multiple indicator cluster survey
MIP	Malaria in pregnancy
MIS	Malaria indicator survey
MOH	Ministry of Health
MOP	Malaria Operation Plan
NGO	Non-governmental organization
NIH	National Institutes of Health
NMCP	National Malaria Control Program
OR	Operations research
PCR	Polymerase chain reaction
PEPFAR	President's Emergency Plan for AIDS Relief
PLWHA	People living with HIV/AIDS
PMI	President's Malaria Initiative
PMTCT	Prevention of mother-to-child transmission of HIV
PSMWG	Roll Back Malaria Partnership Procurement and Supply Chain Management Working Group
RA	Resident advisor
RBM	Roll Back Malaria
RDT	Rapid diagnostic test
SP	Sulfadoxine-pyrimethamine
TRP	Technical Review Panel
UNICEF	United Nations Children's Fund
USAID	U.S. Agency for International Development
USG	U.S. Government
VCWG	Roll Back Malaria Partnership Vector Control Working Group
WHO	World Health Organization
WHO/AFRO	WHO Regional Office for Africa
WHO/TDR	WHO Special Program for Research and Training in Tropical Diseases

EXECUTIVE SUMMARY

The President's Malaria Initiative (PMI) is an interagency initiative led by USAID and implemented together with CDC. It is overseen by a U.S. Global Malaria Coordinator and an Interagency Steering Group made up of representatives from USAID, CDC/HHS, the Department of State, the Department of Defense, the National Security Council, and the Office of Management and Budget.

The goal of PMI is to reduce malaria-related deaths by 50% in 15 countries that have a high burden of malaria through proven curative and preventive interventions, including insecticide-treated nets (ITNs), indoor residual spraying (IRS), intermittent preventive treatment for pregnant women (IPTp), and artemisinin-based combination therapies (ACTs).

In late May 2011, PMI commissioned an external evaluation team to review the first five years (FY06-FY10) of PMI's activities. Over the course of seven months, the evaluation team reviewed extensive documentation; interviewed key personnel in Washington, Atlanta, and Geneva; conducted five country site visits (Angola, Malawi, Rwanda, Senegal, and Zambia); and conducted e-mail and telephone interviews with malaria program personnel from the other 10 PMI focus countries.

The external evaluation was organized around six core objectives:

- Objective 1: Evaluate how PMI leadership, management, and resources have advanced the initiative's goals and provide recommendations for improved performance
- Objective 2: Evaluate the performance of PMI in terms of putting its four core operating principles into practice
 - Use of a comprehensive, integrated package of proven prevention and treatment interventions
 - Strengthening of health systems and integrated maternal and child health programs
 - Commitment to strengthening national malaria control programs (NMCPs) and building capacity for country ownership of national malaria control efforts
 - Close coordination with international and in-country partners
- Objective 3: Evaluate the wider partnership environment in which PMI operates at both the global and country level
- Objective 4: Assess progress toward program outcomes and impact, with a focus on assessing the quality of the evaluation and methods used to generate the outputs and outcomes data
- Objective 5: Assess operations research activities (added by the evaluation team as a separate piece from its reference in Objective 2)
- Objective 6: Use evidence as generated from the evaluation to make actionable recommendations for improvement of PMI and for U.S. Government (USG) involvement in global health initiatives

Overall Assessment: PMI is, by and large, a very successful, well-led component of the USG Global Health Initiative. Through its major contributions to the global malaria response via its collaborations with multilateral and bilateral partners, effective relationship with the Global Fund, and contributions to reinvigorating national malaria control programs, PMI has made substantial progress toward meeting its goal of reducing under-5 child mortality in most of the 15 focus countries. Though major biologic, political, and financial challenges exist that could

seriously erode the accomplishments made to date, PMI, through its first five years of activities, has earned and deserves the task of sustaining and expanding the U.S. Government's response to global malaria control efforts and should be given the responsibility to steward additional USG financial and human resources to accomplish this task.

SUMMARY FOR OBJECTIVE 1: LEADERSHIP, MANAGEMENT, AND RESOURCES

Leadership: The strong but discreet leadership of PMI has contributed to its overall success. PMI leadership successfully engaged key USG actors and sustained bipartisan political support for the initiative amidst a change of U.S. presidential administrations and the emergence of the Global Health Initiative. The initiative also collaborated effectively with the Global Fund, Roll Back Malaria (RBM) Partnership, and other global partners, and sustained financial support during a period of increasing pressure on USG development assistance resources. The Global Coordinator and his leadership group were especially effective in establishing a highly motivated, hard-working PMI team within the headquarters unit.

Management: Rapid and efficient start-up of PMI activities was facilitated by excellent and creative program management by senior USAID personnel. An inclusive project activity planning system was established through the Malaria Operation Plan (MOP) process, with the active participation of partners and stakeholders. PMI's willingness to be flexible according to country-specific needs and other organizations' activities was recognized and appreciated by partners.

Resources: The key to PMI's success can be attributed to the strategic use and alignment of the initiative's resources, with a focus on life-saving commodities as needed. The selected human resource model (expatriate resident advisors (RAs) from each agency and extensive use of U.S. contractors and grantees), while considered by many to be expensive, appears to have contributed to PMI's success. A full analysis of PMI's cost structure and the cost-effectiveness of the PMI approach was beyond the scope of this external evaluation.

SUMMARY FOR OBJECTIVE 2: PUTTING ITS CORE OPERATING PRINCIPLES INTO PRACTICE

It is widely believed that PMI performed well in putting its operating principles into practice. The use of an effective integrated package of malaria control interventions clearly contributed to the observed reduction of under-5 mortality. PMI successfully developed and implemented a participatory, country-driven planning process, based on MOPs to guide PMI-supported malaria control program activities. The initiative made some headway in integrating with maternal and child health (MCH) services and in extending community-based approaches to managing malaria; however, community case management is still problematic in some countries. PMI was able to effectively use the Central Emergency Procurement Fund to overcome supply chain implementation issues and assist the Global Fund as required. The effort's multi-pronged health systems strengthening strategy had variable success in enhancing individual and institutional capacity. Some NMCPs are still weak and dependent on external input, while others are clearly stronger as a result of their interaction with PMI personnel. Nonetheless, NMCPs serve as clear anchors for all national malaria control programs, creating the platform for increased country ownership of malaria control efforts. As previously noted, collaboration with partners at both the global and national level was highlighted as excellent by most respondents.

SUMMARY FOR OBJECTIVE 3: WIDER PARTNERSHIP ENVIRONMENT

Recognizing the NMCP's role as the lead agency in malaria control, PMI developed strong partnerships with almost all NMCPs in the 15 focus countries. PMI is viewed as one of the key partners at the country level, with its contribution well appreciated by most multilateral and bilateral partners. Some described PMI as "flexible," "more transparent," "inclusive in designing its approaches," and "receptive to ideas and suggestions." Most partners consider PMI to be an exemplary partner, as it refrains from using its large and broad presence and substantial financial support to gain undue influence within the partnership. PMI has played a worthwhile role in the global partnership, especially in its relationship with the Global Fund and the Roll Back Malaria (RBM) Partnership. This has contributed in a major way to the attainment of PMI's objectives and goals.

SUMMARY FOR OBJECTIVE 4: ASSESS PROGRAM OUTCOMES AND IMPACTS

Outcomes: PMI, together with national programs and partners, has been largely successful in increasing coverage levels by scaling up the distribution and increasing the use of insecticide-treated nets (ITNs), mainly in the form of long-lasting insecticide nets (LLINs). In a few countries, coverage rates are surprisingly low, given the background of repeated mass distributions of nets; in others, there is still a need for filling gaps or replacing old LLINs. The target of 85% coverage has not been reached in any country, and it may now be time to reconsider whether this high level is a realistic standard. In contrast, the coverage rates for intermittent preventive treatment for pregnant women (IPTp) are disappointingly low. The monitoring of indoor residual spraying (IRS) has generally been easy and straightforward, although there is some room for improvement in the operational details.

Impact: In 8 of 15 PMI countries, there are signs that the malaria disease burden has been reduced and/or that all cause child mortality (ACCM) has declined since malaria control interventions began to be systematically scaled up around 2003-2004. In the other seven countries, such progress was not apparent from the data available to the team at the time of the evaluation. The fact that the impact surveys have not yet been conducted make it impossible to evaluate whether progress has occurred.

The recent Tanzania report is the first of the planned series of country-specific in-depth impact surveys. It provides solid evidence that scale-up of malaria control has led to a major reduction of ACCM by approximately 10 deaths per 1,000 live births. Tanzania's operational achievements appear, in the team's opinion, to be attainable by other PMI focus countries. If operational targets are met, it is likely that similar results will be found in the other countries.

Strategies for Impact Evaluation: PMI's strategy for impact evaluation has been centered on the measurement of changes in ACCM and examination of the plausibility of attributing observed ACCM reductions to the implementation of malaria control interventions. It is the opinion of the evaluation team that impact evaluation should no longer be centered on ACCM, but should instead make use of a range of data sources, including ACCM, to assess trends in malaria incidence and mortality. Such an approach is consistent with the change in PMI's objectives, which now include reduction of malaria morbidity, not only mortality. This means that one major priority of PMI should be to improve malaria surveillance and involve scientists in modeling work to better use surveillance data on prevalence, incidence, and mortality to model disease burden. In addition, economic evaluation is an area that so far has been neglected by PMI and therefore was hardly addressed by the evaluation team.

SUMMARY FOR OBJECTIVE 5: ASSESS OPERATIONAL RESEARCH ACTIVITIES

The research component of PMI appears to have lagged compared to other components. A fundamental lack of clarity on the research program's technical scope, combined with a lack of clear leadership on the issue among the agencies, differing institutional perspectives and cultures around research, and the relative dysfunctionality of the Operations Research Committee, have all contributed to the problem. There is a high-priority need to clarify inter-agency leadership roles, revitalize the inter-agency structure under this more clearly defined leadership, and finalize strategy and guidance for research activities that have been long in development. The evaluation team believes PMI in its first five years could have better served the global malaria control community as a "programmatic learning laboratory." PMI has extraordinary resources at hand to contribute high-quality information in support of the global malaria response. With access to so much technical talent at CDC, USAID, and national partner research institutions, RAs on the ground in the focus countries, and access to data from the best-financed and largest malaria intervention in history, the opportunity to contribute program-linked information was—and remains—tremendous.

SUMMARY FOR OBJECTIVE 6: MAKE ACTIONABLE RECOMMENDATIONS

The evaluation team makes five policy and five technical recommendations:

- Policy recommendations:
 - Expand PMI's financial resources and geographic reach
 - Improve PMI organizational clarity on key programmatic issues to improve decision-making, efficiency, and effectiveness
 - Apply the country ownership principle thoughtfully to improve program effectiveness
 - Expand the use of well-trained and effective foreign service nationals as PMI resident staff
 - Adapt or fail: acknowledge the successes to date and initiate change as appropriate, based on the local context
- Technical recommendations:
 - Reevaluate the indoor residual spraying strategy
 - Improve resistance monitoring for both insecticides and antimalarial (artemisinin) drugs
 - Strengthen national surveillance and health management information systems
 - Expand PMI's operations research component and advocate for an expanded global malaria research agenda
 - Accelerate impact evaluation activities at appropriate levels of scientific rigor

PREFACE

“Evaluation in USAID has two primary purposes: accountability to stakeholders and learning to improve effectiveness.” USAID Bureau for Policy, Planning and Learning (2011), Evaluation Policy.

Contents

1. PMI Overview
2. Scope of Work
3. Team Membership
4. Evaluation Methodology
5. Report Structure
6. Acknowledgements

The goal of the President’s Malaria Initiative (PMI) is to reduce malaria-related deaths by 50% in 15 countries that have a high burden of malaria through proven curative and preventive interventions, including insecticide-treated nets (ITNs), indoor residual spraying (IRS), intermittent preventive treatment for pregnant women (IPTp), and artemisinin-based combination therapies (ACTs). In this context, malaria prevention and treatment interventions were planned to be scaled up in 15 countries in sub-Saharan Africa, eventually covering more than 175 million residents at the end of the five-year program. In each of the targeted countries, PMI closely collaborated with the host governments and national and international partners, including the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund), Roll Back Malaria Partnership (RBM), the World Bank Malaria Booster Program, non-governmental organizations (NGOs), and the private sector.

In late May 2011, PMI commissioned an external evaluation team to review the first five years’ (FY06-FY10) activities. Over the course of seven months, the evaluation team reviewed extensive documentation; interviewed key personnel in Washington, Atlanta, and Geneva; conducted five country site visits (Angola, Malawi, Rwanda, Senegal, and Zambia); and conducted e-mail and telephone interviews with malaria program personnel from the other 10 PMI focus countries.

The overall purpose of the PMI external evaluation was to:

- Identify lessons learned across countries
- Garner input from a variety of points of view
- Identify areas for performance improvement
- Assess evidence of impact after five years of implementation in PMI countries
- Identify lessons and share experiences with other United States Government (USG) global health initiatives and engagements

The evaluation team is pleased to submit the PMI External Evaluation Report. The team hopes this report will be of interest to PMI and Global Health Initiative (GHI) staff members, senior management in the United States Agency for International Development (USAID) and Centers for Disease Control and Prevention (CDC), National Malaria Control Program (NMCP)

personnel, PMI implementing partners, RBM partners, institutions involved in malaria research and control, and public health practitioners interested in international health and development.

PMI OVERVIEW

Launched in 2005, the President's Malaria Initiative is a five-year, \$1.2 billion expansion of U.S. Government (USG) resources to reduce the burden of malaria and help relieve poverty on the African continent.¹ The goal of PMI is to reduce malaria-related deaths by 50% in 15 focus countries with a high burden of malaria by expanding coverage of highly effective malaria prevention and treatment measures to the most vulnerable populations: pregnant women and children under 5 years of age (Table 1). The 2008 Lantos-Hyde Act authorized an expanded PMI program for 2009-2013. PMI is a key component of the GHI, which was announced by President Obama in May 2009. As a result, the PMI strategy was revised to achieve Africa-wide impact by halving the burden of malaria in 70% of at-risk populations in sub-Saharan Africa, or approximately 450 million people.

Table 1. PMI Countries by Round

Round 1: Fiscal Year (FY) 2006	Round 2: FY 2007	Round 3: FY 2008
	All Round 1 countries	All Round 1 & 2 countries
Angola Tanzania Uganda	Malawi Mozambique Rwanda Senegal	Benin Ethiopia (Oromia Region) Ghana Kenya Liberia Madagascar Mali Zambia

PMI is an interagency initiative led by USAID and implemented together with CDC of the U.S. Department of Health and Human Services (HHS). It is overseen by a U.S. Global Malaria Coordinator and an Interagency Steering Group made up of representatives from USAID, CDC/HHS, the Department of State, the Department of Defense (DOD), the National Security Council, and the Office of Management and Budget. PMI supports four proven, cost-effective prevention and treatment interventions and helps countries scale up access to these interventions nationwide:

- Insecticide-treated mosquito nets
- Indoor residual spraying with insecticides
- Intermittent preventive treatment for pregnant women
- Prompt use of artemisinin-based combination therapies for those who have been diagnosed with malaria

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

¹President's Malaria Initiative (PMI). (2008). Retrieved October 20, 2011, from <http://www.pmi.gov>.

- High malaria disease burden
- National malaria control policies consistent with the internationally accepted standards of the World Health Organization (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

PMI is organized around four operational principles based on lessons learned from more than 50 years of U.S. Government efforts in fighting malaria, together with experience gained from implementation of the U.S. President's Emergency Plan for AIDS Relief (PEPFAR), which began in 2003. The PMI approach involves:

- Use of a comprehensive, integrated package of proven prevention and treatment interventions
- Strengthening of health systems and integrated maternal and child health services
- Commitment to strengthen national malaria control programs and to build capacity for country ownership of malaria control efforts
- Close coordination with international and in-country partners

PMI works within the overall strategy and plan of the host country's national malaria control programs, with planning and implementation of PMI activities coordinated closely with each Ministry of Health (MOH).

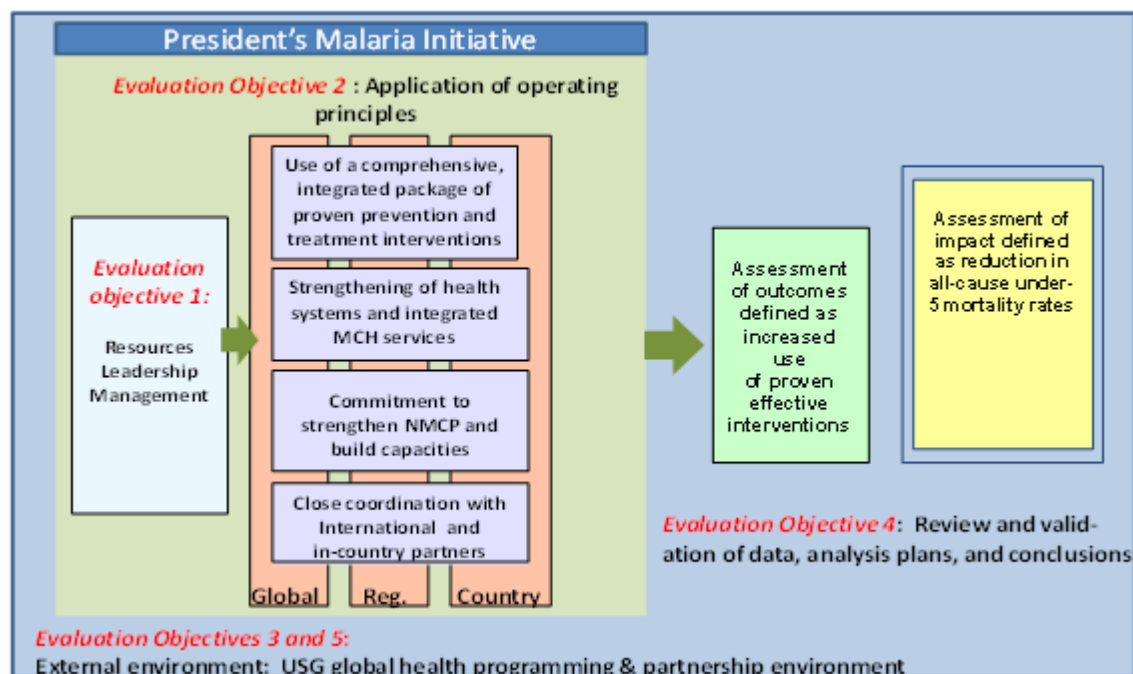
SCOPE OF WORK

The evaluation of the PMI has two major elements:

- A focus on proximal factors and issues, including the application of PMI operating principles and the partnership environment in which PMI operates
- An examination of population-based outcomes and impact

The evaluation report focuses on PMI activities accomplished with funding between FY 2006-2010. As the 15 focus countries initiated activities at different times (see Table I), not all countries had five years of operations for review. The evaluation framework (Figure I) shows the five objectives of the evaluation along with the associated components of program performance and population-based outcomes and impact. Objectives 1 through 5 are addressed in this report by the evaluation team through the key evaluation questions presented below. The team has focused its efforts on prioritized evaluation questions (highlighted in the full scope of work in Annex A), which were selected by PMI in spring 2011.

Figure 1. PMI Evaluation Framework



KEY EVALUATION QUESTIONS

Objective 1: Evaluate how PMI resources, leadership, and management have advanced the initiative's goals and provide recommendations for improved performance

Objective 2: Evaluate the performance of the PMI in terms of putting its operating principles into practice

- **Principle 1:** Use of a comprehensive, integrated package of proven prevention and treatment interventions
- **Principle 2:** Strengthening of health systems and integrated maternal and child health programs
- **Principle 3:** Commitment to strengthen NMCPs and build capacity for country ownership of national malaria control efforts
- **Principle 4:** Close coordination with international and in-country partners

Objective 3: Evaluate the wider partnership environment in which PMI operates at both global and country levels

Objective 4: Assess progress toward program outcomes and impact (with a focus on assessing the quality of the evaluation and methods used to generate outputs and outcomes data)

Objective 5: Use evidence as generated from the evaluation to make actionable recommendations for improvement of PMI and for U.S. Government involvement in global health initiatives

TEAM MEMBERSHIP

The evaluation team consists of members with broad public health experience, malaria expertise, extensive experience in the use of both quantitative and qualitative methods, and proven experience in complex multi-country evaluations involving international and national partners. The team's members include:

Jonathon Simon, D.Sc., MPH (Team Leader)

Dr. Simon is Director of Boston University's Center for Global Health and Development (CGHD) and serves as Chair of the International Health Department at Boston University's School of Public Health. He has been involved in applied child health research activities for 25 years, working in more than 20 developing countries. Dr. Simon has had extensive experience working in Africa and South Asia, particularly on issues involving child survival, infectious diseases, and capacity strengthening. For the past seven years, he has been part of a core research team at the CGHD evaluating the social and economic impact of the HIV/AIDS epidemic, with a particular focus on scientifically valid evaluations of PEPFAR OVC programming, while maintaining an active role in the CGHD's ongoing child survival research work.

Rosemary Barber-Madden, Ed.D., MPH (Team Member)

Dr. Barber-Madden has extensive experience in global HIV/AIDS, maternal and child health (MCH), reproductive health, and development in more than 35 countries. She has a proven record in design and evaluation of large-scale international health programs for multilateral and bilateral donors. Dr. Barber-Madden served as UNFPA representative for several years in Africa and Latin America, and currently consults extensively with Global Fund, USAID, World Bank, and other bilateral donors.

Mohammadou Kabir Cham, MD, MCommH, FWACP (Team Member)

Dr. Cham has more than 30 years of experience in leadership and management of health services, both at the national and international level. He has extensive experience in communicable disease prevention and control, especially in malaria control, and has been involved in planning, implementing, monitoring, and evaluating insecticide-treated material and other malaria vector control interventions at national and international levels. Dr. Cham has experience as a senior WHO advisor and was involved in the development of the RBM concept and its approach and implementation. He has numerous peer-reviewed journal publications in malaria research, control, and policy.

Allan Schapira, MD, D.Sc. (Team Member)

Dr. Schapira has more than 25 years of experience in malaria control. He has worked on malaria and other vector-borne disease as a WHO staff member for 17 years, with a particular focus on Africa, Southeast Asia, and the Southwest Pacific. After retiring from WHO in 2007, he has undertaken a number of consultancies for the World Bank, WHO, and other organizations on malaria control planning and evaluation, containment of antimalarial drug resistance, and malaria elimination. He has published over 30 articles in peer-reviewed journals and several book chapters on a broad range of topics related to malaria and its control.

Kojo Yeboah-Antwi, MB ChB, MPH (Team Member)

Dr. Yeboah-Antwi is a public health specialist and researcher with over 20 years of experience in managing health systems, program and project implementation, policy and strategy development, and research for development and implementation research. He has provided technical support and carried out consultancies to develop and review numerous public health

programs and projects; he has also participated in RBM implementation review, strengthening of monitoring and evaluation systems, and drug policy reviews. He was a member of the WHO Special Program for Research and Training in Tropical Diseases (WH/TDR) Task Force on Home Management of Malaria. He has been involved in two large-scale malaria evaluations: United Kingdom's Department for International Development (DFID)-funded FUTURES ITN project in Nigeria and USAID-funded NetMark project.

Mohamad Ibrahim (Bram) Brooks, MPH (Team Member)

Mr. Brooks has over five years of technical, management, and field experience in implementing applied research projects in several countries in Asia, Africa, and Eastern Europe. Some of the projects that Mr. Brooks has worked on include infectious disease research, cost-effectiveness studies, and program evaluations with donors including USAID, CDC, National Institutes of Health (NIH), and DFID.

EVALUATION METHODOLOGY

The PMI evaluation team's report is based on an extensive set of materials and experiences. The team's methodology consisted of data collection and synthesis using four major sources:

1. Document review
2. Interviews with PMI-associated personnel and key informants in Washington, Atlanta, and Geneva
3. Field visits with extensive interviewing and service delivery site evaluations in five PMI focus countries
4. E-mail and telephone interviews with selected PMI-associated personnel in the other 10 focus countries

Document Review

The evaluation team was provided an extensive set of PMI documentation. U.S. Government documents such as the 2005-2009 PMI Strategic Plan, the Lantos-Hyde Reauthorization, program guidance, and annual reports to Congress were read and reviewed. Country-specific documentation (annual plans, national strategic plans, Global Fund applications and awards, policy documents and technical papers, etc.) were also reviewed. Key documents from global and bilateral partners (RBM Global Malaria Action Plans, WHO World Malaria Report, Global Fund Annual Plans and special reports) were referenced as appropriate. National malaria control program (strategic plans and annual work plans) and focus country government documents were also made available for the five focus countries visited. Selected papers from the vast scientific literature on malaria were read depending on the issue under consideration and the country being reviewed.

Interviews with PMI-associated Personnel and Key Informants in Washington, Atlanta, and Geneva

Key informant interviews (KII) were conducted in either individual or group settings and focused on key actors, both internal and external to PMI. Face-to-face and telephone interviews were conducted in order to interview key informants in the PMI countries the team did not visit. The interviews followed semi-structured interview guidelines that employed both closed- and open-ended questions as appropriate. Question guides were designed to parallel the key questions identified for the evaluation. Individuals and groups that were interviewed in Washington, Atlanta, and Geneva, included the following:

- PMI staff (PMI Coordinator and Deputy Coordinator, USAID and CDC)

- Partner organizations, including the Global Fund, World Bank, United Nations Children’s Fund (UNICEF), WHO, RBM and others
- Key researchers, policy analysts, critics, and advocates

The complete list of individuals interviewed by the evaluation team is found in Annex B.

Field Visits with Extensive Interviewing and Service Delivery Site Evaluations in Five PMI Focus Countries

The evaluation team performed site visits to five PMI countries. The countries were selected to represent different periods of initiation, and more importantly, the availability of outcome and impact data from at least two points in time. The travel schedule was as follows:

- Angola (July 12–22): Dr. Rosemary Barber-Madden and Dr. Kojo Yeboah-Antwi
- Zambia (August 4–13): Dr. Jonathon Simon and Dr. Kojo Yeboah-Antwi
- Malawi (August 14–24): Dr. Jonathon Simon and Dr. Kojo Yeboah-Antwi
- Senegal (September 11–23): Dr. Allan Schapira and Dr. M. Kabir Cham
- Rwanda (September 17–27): Dr. Jonathon Simon and Dr. Rosemary Barber-Madden

Country visits included the following activities:

- Interviews with in-country PMI staff, USAID/HPN, and CDC country office head
- Interviews with key staff in NMCP
- Interviews with key staff in other departments or programs in MOH, especially those concerned with: maternal and child health, expanded program on immunization (EPI), health management information system (HMIS), community health, pharmaceuticals (regulation and storage), procurement of health commodities, and health financing
- Collection and review of in-country documents
- Province or district health office visits to assess situation in the field
- Preparation of preliminary conclusions
- Debriefing by USAID Mission (HPN)

E-mail and Telephone Interviews with Selected PMI-associated Personnel in the Other 10 Focus Countries

To capture the field experience of PMI countries not visited by the evaluation team, modified questionnaires were created to capture PMI experiences from the field. An electronic questionnaire was sent via e-mail to HPN officers, USAID PMI resident advisors (RAs), CDC resident advisors, and NMCP managers in each of the 10 non-visited countries. In addition, telephone interviews were scheduled with NMCP managers to discuss key evaluation questions of interest. Questionnaires used for e-mail and telephone interviews are found in Annex C.

REPORT STRUCTURE

To respond to the various evaluation questions, the PMI external evaluation report is structured in the following manner:

- Preface
- Executive Summary
- Section I. Leadership, Management, and Resource Alignment (Objective 1)
- Section II. Application of Operating Principles (Objective 2)

- Section III. Coordination and Operation within the Wider Global and Country Partnership (Objective 3)
- Section IV: Monitoring and Evaluation (Objective 4)
- Section V: Operation Research Activities (Part of Objective 2)
- Section VI: Recommendations (Objective 5)
- Annexes

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- Malaria research and program personnel
- Ms. Prateeksha Alsi—GH Tech Project
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- Dr. Barry Silverman—GH Tech Project

I. LEADERSHIP

Contents

1. Introduction
2. Overall Assessment
3. Review of Key Evaluation Questions
 - a. Donor Coordination
 - b. Inter-agency Coordination
 - c. Accountability and Transparency
 - d. PMI Start-up and Program Management
 - e. Resource Allocation Process
 - f. Commodity Procurement Systems
 - g. Strategic Resource Allocation
 - h. Human Resources Issues
4. Conclusions
 - a. Leadership
 - b. Management
 - c. Resource Allocation

INTRODUCTION

The evaluation team was tasked with evaluating how internal factors, including PMI’s leadership, management, and resources, advanced the initiative’s goals. These factors are most directly under the control of PMI personnel, both at headquarters and field-based. How human and financial resources were allocated to attain the program’s goals is essential to understanding the program’s outcomes and impact. The choices made by PMI leadership in how these resource allocations were applied and whether the initiative’s management was in accordance with its operating principles was also evaluated. The evaluation of PMI’s ability to plan and implement in accordance with the four core organizational principles is the focus of Section II. Section I focuses on leadership and management issues such as navigating domestic political requirements, global coordination, human resource planning, and fostering accountability and transparency, which are not explicitly described in the core operating principles. The report discusses the eight prioritized questions identified in the scope of work in Annex A as the organizing structure for this section. This section concludes with a summary evaluation of the extent to which the agencies and organizational units encompassed by PMI are operating as envisioned; the report also identifies areas for improvement.

OVERALL ASSESSMENT

The evaluation team found that the PMI is a well-led initiative. The Global Coordinator’s Office appears to have successfully engaged key U.S. Government actors, sustained bipartisan political support for PMI amidst a change of U.S. administrations and the emergence of the Global Health Initiative, operated effectively with the Global Fund, RBM Partnership, and other global partners, and sustained financial support during a period of increasing pressure on U.S. Government development assistance resources.

Overall, PMI is considered generally well-managed (with some notable exceptions, which are discussed below) and is perceived as a transparent initiative, especially in relation to other U.S. Government development assistance activities. The team found most PMI-associated technical personnel from both line agencies to be highly motivated in terms of accomplishing the mission of PMI, committed to success, and open to ideas that might improve the efficiency and effectiveness of the initiative.

SPECIFIC QUESTIONS

Leadership Issues

Donor Coordination

PMI was established to complement the malaria control programs of host countries, the Global Fund, and the other multilateral and bilateral institutions and donors within the broader RBM Partnership. PMI was never intended to “lead” the global malaria response, and prioritized donor coordination as a key principle for PMI from its inception. The U.S. Government Malaria Strategy 2009-2014 requires PMI to “coordinate closely with other multilateral and bilateral institutions and donors and their associated working groups and task forces within the broader RBM Partnership, such as the Global Fund, World Bank, WHO, and UNICEF, to ensure that investments are complementary and to “maintain close working relationships with major multilateral partners, such as WHO, UNICEF, the World Bank, and the Global Fund, as well as private sector groups involved in malaria control.” Extensive efforts are invested in meeting this goal by the Coordinator, his deputy, and the technical staff of both agencies operating through the various technical working groups (TWGs), task forces, and work streams.

Global Fund personnel expressed particular appreciation for PMI’s willingness and flexibility to assist them in maintaining country program efforts amid challenges faced by the Global Fund, including administrative difficulties and concerns over financial irregularities in some country programs. Officials at the RBM Partnership, World Bank, WHO, and UNICEF all appreciated PMI’s efforts in communicating strategic and operational plans and often commented on how different it was from other U.S. Government initiatives and USAID historic practices.

The success of donor coordination at the global level should not be minimized. It does not often happen that visible success appears to occur in five years, as it apparently has in the past five years of malaria activities. PMI’s initial country selection criteria explicitly prioritized countries with functioning Global Fund grants and/or World Bank Booster Program for Malaria Control support. This would appear to contradict a basic principle in coordination among development or donor agencies — namely, to fill in existing gaps and avoid overlaps to maximize resource use and avoid potential conflict. In the team’s view, the tendency to join forces was motivated by the political need to maximize chances of demonstrating early success to generate on-going support for the effort. When PMI started this was justifiable, considering the dearth of inspiring success stories in malaria control in Africa, and the political attacks on USAID’s previous malaria activities. In PMI’s second phase, governed by the Lantos-Hyde Act, successes are being documented and bipartisan political support is more secure; as a result, there is more of a willingness to take up the most daunting challenges, by working in big, difficult countries like Democratic Republic of Congo and Nigeria. This reflects strong leadership, and will require careful coordination. PMI deserves to be acknowledged for stepping up to the plate to take on these new and difficult challenges.

Overall the PMI is seen as providing a successful model of partnership between the U.S. Government and countries. Interviews with key informants at the national level as well as observations at the field level during the country site visits form the basis for the team’s conclusion that PMI has been largely successful in strengthening the NMCPs and has helped

strengthen countries' health systems response to national malaria burdens. The collaborations between PMI and the various ministries of health have been largely productive, collegial, and successful.

Section II reviews and evaluates the key operating principles of PMI and discusses the issue of national coordination in greater depth.

Inter-agency Coordination

PMI, under the leadership of the Malaria Coordinator Admiral Tim Ziemer, has been effective in building and sustaining political and inter-agency support at the highest levels of the U.S. Government. At the same time, the effectiveness of leadership at the level of technical coordination between the two line agencies responsible for implementing the program (USAID and CDC) is more problematic.

Leadership appears to have effectively used the PMI oversight body, the Interagency Steering Group—made up of representatives of USAID, CDC/HHS, the Department of State, the DOD, the National Security Council, and the Office of Management and Budget—to secure widespread support for the initiative. Strategic directions appear to be well articulated and documented. PMI has sustained relatively broad bipartisan political support during a change in presidential administrations and political parties. The team heard little about coordination with the PEPFAR Global AIDS Coordinator at either the headquarters or the country level. USAID Mission personnel were generally favorable toward the effort and appreciative of its central leadership, both within the Office of the Coordinator and within USAID/Washington. For CDC Mission-based leadership personnel, the bulk of the management and technical focus appears to be on PEPFAR rather than PMI, commensurate with the different scales of the program at the country level.

PMI leadership has been less effective in coordinating and managing the inter-agency relations between USAID as the PMI lead agency and CDC. There are significant differences of opinion between the agencies over the appropriateness and effectiveness of the PMI model. In general, USAID personnel preferred the PMI model over the PEPFAR approach. CDC personnel were more varied in their opinions. The more senior CDC personnel expressed preferences for PEPFAR's operating principles, which offer greater institutional autonomy; meanwhile, field and operational personnel were more mixed in their assessments of the strengths and weaknesses of each approach.

As the leading U.S. international development agency, USAID takes seriously its responsibilities to manage PMI as the initiative's lead agency. CDC personnel, especially at the headquarters level, desire more autonomy over the technical activities they believe they have a comparative advantage in, and would also like more independently controlled financial resources. They expressed some concern and frustration over being "managed" by USAID personnel. It is important to recognize that although this issue was raised extensively throughout the evaluation process by headquarters and Mission personnel from both agencies, the strongly held differences of opinion usually did not affect the effectiveness of implementation activities. The team credits this to the professionalism of the USAID and CDC personnel in-country, who usually put inter-agency debates aside and got on with the tasks of improving malaria control programs to meet the shared goal of reducing under-5 mortality.

Coordination between headquarters and Missions varies broadly by specific country and seems related to the Mission-specific history of, and preference for, engagement with centrally funded initiatives, the size of PMI activities as a proportion of the overall U.S. Government development assistance program (especially relative to PEPFAR activities), the quality of the country teams, and the expected variability in interpersonal relationships and pre-existing professional networks between headquarters staff and country-based personnel.

Accountability and Transparency

PMI was regarded as an open and transparent initiative by most respondents. This transparency fostered accountability and allowed detailed tracking of how PMI resources were used. The inclusive nature of the Malaria Operational Plan (MOP) process, described below, allowed for transparency in the way priorities were set and decisions made at the country level. The MOP process also facilitated the involvement of other stakeholders as well as the achievement and documentation of results. Each country program developed a multi-year strategy that laid out expected inputs and planned accomplishments, overall budgets, and a monitoring and evaluation plan, as well as detailed annual implementation plans describing planned activities, expected results, and required budgets. In addition, each country program submitted an annual operational and financial report describing actions taken and progress to date, together with accounting of initiative inputs and outputs,² while progress to date is reviewed as part of MOP. The PMI Web site was judged to be informative and allows easy access to action plans, budget breakdowns, obligated funds, and contracts and grants by countries.

Amid generally favorable comments on transparency, some respondents (Kenya, Liberia, Ghana, and Rwanda) expressed concerns that the full costs associated with the use of U.S. implementing partners and NGOs were not disclosed with and within the partnership. Some national partners were keen to know full and detailed program costs and the proportionate shares that went to implementing partners. At the global level, there were comments about difficulties accessing PMI expenditure data. Though not an uncommon issue—and acknowledging that some USAID data may actually be more accessible than other bilateral aid agencies—the level of transparency was perceived to be less than that of the Global Fund.

MANAGEMENT ISSUES

PMI Start-up and Program Management

Rapid, efficient start-up of PMI activities was facilitated by the excellent and creative program management provided by senior USAID personnel. PMI was fortunate that the initial USAID PMI Team Leader Richard Greene, a senior and deeply experienced USAID technocrat (Director of the Health, Infectious Diseases, and Nutrition Office of USAID), assumed direct leadership responsibilities rather than delegating these duties to more junior members of the organization. Mr. Greene was awarded the prestigious Federal Employee of the Year in 2008 largely for his efforts in support of PMI. Rapid start-up was facilitated by multiple factors:

- Efficient fielding of interagency teams in all the three initial focus countries
- Mobilization and use of “jump-start funds” strategically used to initiate implementation activities before annual central funding was available
- Production of comprehensive needs assessments within a relatively short period of time, in part through the use of existing CDC and USAID staff
- Rapid launching of curative and preventive activities to show early progress and motivate national counterparts
- Accelerated program planning and budgeting
- Use of creative mechanisms to make funding available in advance of fiscal year allocations
- Potentially the most important factor: a well-led, highly motivated technical and administrative workforce willing to work long hours to get PMI moving

² PMI Strategic Plan, USAID-CDC Interagency Working Group, July 25, 2005.

All these actions are a reflection of the PMI's strategic leadership, vision, and commitment at both the level of the Coordinator's Office and the line agencies (USAID and CDC). The appropriateness of the staffing pattern is discussed later in this report.

Resource Allocation Process

Between 2004 and 2006, U.S. development assistance for malaria programs, notably those of USAID, came under scrutiny from external critics³ and eventually was the subject of congressional hearings. As a consequence of congressional scrutiny, coupled with other critical reports,^{4,5} USAID revised its approach to malaria programming in 2006. These changes included a commitment to allocate a significant proportion of its budget to buying commodities, such as insecticide-treated mosquito nets, insecticides for indoor residual spraying, and effective antimalarials. In addition, malaria data handling was improved to track and report on budget and other program information. Finally, there was a commitment to substantially expand the use of indoor residual spraying, including spraying with the insecticide DDT where appropriate.

Under PMI, a more open mechanism for allocating resources was established through the MOP process. Country-specific MOPs are prepared for each year of funding. These plans are reviewed and approved by the PMI Interagency Technical Working Group, the PMI Coordinator, and the PMI Interagency Steering Group. The MOP is a detailed one-year plan of inputs and activities for a country. It describes how funding from PMI will complement that provided by other donors to support and strengthen the national malaria control program strategy and plan in reaching targets related to malaria prevention and control. The MOP also includes estimates of coverage and budget breakdowns for country-level management use.

Each MOP covers all evidence-based interventions, including prompt effective treatment with artemisinin-based combination therapies, prevention through IRS and the use of ITNs, and IPTp. The balance of support for these four key interventions is largely determined by the local epidemiology of malaria, national strategy, roles and actions of other donors, and political issues.

A MOP writing team consists of staff from USAID/Washington and CDC/Atlanta, as well as the in-country PMI advisers and other staff from the U.S. Government Mission. The in-country PMI advisers play leading roles in writing and editing the MOP. NMCP and other major partners such as UNICEF, WHO, Global Fund principal recipients, and others are consulted during preparation of the MOPs. The outcome of the MOP process impressed the former critics of U.S. Government/USAID malaria programming to commend the changes brought about in aligning malaria control financing and reporting with principles of good management.⁵ Once the MOP was approved, PMI was usually able to move resources efficiently to the implementation level through various implementation partners at the country level. However this mechanism also posed challenges related to the capacity of NMCPs coordinating multiple implementing partners.

Another characteristic of the PMI management approach that facilitated effective resource allocation was its flexibility. In addition to the creation of the Central Commodity Emergency Fund, PMI facilitated the reprogramming of activities and budgets to respond to changing needs and circumstances over the timeframe of countries' operational plans. For instance, PMI facilitated reprogramming as follows: change of implementing partners for the same activity; change in budgets for activities; removing or adding activities; and rapidly identifying

³ Bate, R. USAID's Health Challenge: Improving US Foreign Assistance. *J R Soc Med* 2007; 100: 11-15.1-5.

⁴ Bate, R., Schwab B. The Blind Hydra: USAID Policy Falls to Control Malaria. AEI Working Paper May 2005.

⁵ Bate, R., Tren, R., Coticell, P. Moving Mountains: The Evolution of USAID's Malaria Control Program. Africa Fighting Malaria. Occasional Paper, December 12, 2006.

implementing partners for activities whose implementers were previously not identified. Country teams were able to submit requests to reprogram their PMI country budgets and these requests were handled expeditiously. This management flexibility compared quite favorably to Global Fund processes.

Commodity Procurement Systems

The PMI model is focused on achieving direct results, with almost 50% of its funds directed toward the purchase of commodities. These malaria commodities are procured based on national needs, taking into consideration the contribution of other partners. The NMCP and partners are responsible for ensuring that there is no duplication of efforts. However, in some countries, PMI was challenged by weak logistic systems and compromised absorptive capacity to receive, manage, and distribute commodities for malaria control.

Thus weak procurement and supply chain management systems, particularly for artemisinin-combination therapies (ACTs) and other essential drugs, are a major impediment to scaling up critical malaria interventions in a timely manner. In many countries, NMCP managers are further confronted with internal and external challenges relative to the procurement of malaria commodities. PMI procurements of ITNs, because they often went through other procurement and distribution channels, were less of an issue in many countries. Global Fund and UNICEF had more difficulty at times with their ITN procurement and distribution.

Consequently, in terms of supply chain management, delays in procurements can and do lead to stock-outs of critical commodities, such as antimalarial medications and sometimes ITNs. In this context, PMI established the 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, including more than 1 million long-lasting insecticidal nets (LLINs) and 5.3 million ACT treatments. PMI's responsiveness and flexibility in its commodity procurement and management systems through the USAID/DELIVER Project (PMI implementing partner for supply chain management) minimized or prevented serious stock-outs, probably saving many lives.

Notwithstanding such success, in two of the countries visited by the team, a parallel supply chain had been established solely for malaria commodities; this as done as a result of supply chain management issues related to repeated thefts of PMI commodities. This option may be appropriate in the interim until fundamental health systems issues are addressed. Given the high levels of stock-outs of sulfadoxine-pyrimethamine (SP), a relatively inexpensive, widely available antimalarial used in IPTp, the ability of some governments to supply essential medicines for the full range of primary care activities is questionable. How to support the creation of an effective supply system for essential medicines is one of the most difficult strategic decisions PMI may need to address.

RESOURCE ALLOCATION ISSUES

Strategic Resource Allocation

The key to PMI's success can be attributed to the strategic use and alignment of its resources. The evaluation revealed that PMI allocated resources according to the priorities outlined in its strategy, specifically in the four priority areas, namely: a) prompt effective treatment with ACTs; b) prevention through IRS; c) the use of ITNs; and d) IPTp.

However, there is also evidence of disproportionate use of resources for IRS in some countries to protect a relatively small number of their populations. For example, over the period 2006-2010, Rwanda spent one-third of its PMI budget on IRS to protect only 10% of the at-risk population (more examples are provided in Table 4 in Section II of this report). PMI was under a political imperative to apply IRS on a large scale in Africa during the first years of implementation, and this was probably the main reason for the imbalance.

The importance of attention to costs is evident from tables 3 and 4 in Section II of this report. Across PMI countries, there is a high variation in costs per person protected by LLINs or IRS. A recent report on costing of IRS services in five countries during the 2008 spray year suggests similar high variability.⁶ Such variations may be justified, but a simple comparison, as presented in this report, can be a first step in an initial exercise to learn across countries to improve efficiency

Human Resource Issues

The USAID health officers serve as the PMI country team leaders at the country level and provide consultation for and support to PMI staff. The current PMI basic staff model (one RA/USAID and one RA/CDC) works well in most cases, as each individual RA often provides a different technical background. In most countries these positions are filled by expatriates. In some countries, foreign service nationals (FSNs) were hired to fill the RA roles; in many countries FSNs supplement and complement the two RA positions.

Both USAID and CDC offer expertise in the area of planning and implementation of malaria control efforts. USAID personnel often have experience and expertise in working at a national level with host country governments on large-scale, multi-donor initiatives as well as in procuring and implementing projects. CDC personnel's typical strengths in surveillance and research are a good complement to USAID's strength in program design and management. Though the evaluation team found these divisions to be generally accurate, there are USAID personnel with research expertise and CDC personnel with excellent program management skills. We briefly describe the RA population (Table 2) and observe that both USAID and CDC personnel are well trained. In many countries, the RAs allocate responsibilities in accordance with their expertise and professional preferences. It was noticed that the USAID RA often had significantly more management tasks than the CDC RA. A rigid separation of tasks would unnecessarily limit human resource flexibility at the country level.

Table 2. Characteristics of PMI Resident Advisors

	USAID RA (n=9)	CDC RA (n=10)
Avg. length of current RA position (years)	3	3
Avg. malaria control or research experience (years)	9	7
Avg. international public health experience (years)	19	11
Proportion of respondents who are African nationals	78%	30%
Proportion of respondents w/medical degree	56%	90%
Proportion of respondents w/Ph.D. degree	33%	20%
Proportion of respondents w/masters degree	100%	60%

The FSNs with their local knowledge and know-how assist the RAs in both program management and technical responsibilities. They are used as technical advisors, program managers, contract officers, financial officers, or administrative assistants. USAID Mission

⁶ RTI International (2010). Indoor Residual Spraying (IRS) for Malaria Control Indefinite Quantity Contract (IQC) Task Order 1 (TO1)—Analysis of 2008 Expenditure in Five IRS TO1 Countries.

personnel testified to the important role the FSNs play in the implementation of PMI activities at the country level and how they provide effective links with national malaria programs. There is a trend toward increasing the use of FSNs, both as a way to respond to the country ownership principle of GHI and because FSNs are usually less expensive to place. Several Missions spoke of their intent to increase their use of FSNs.

The USAID and CDC RAs have different reporting lines and supervisors. For instance, the USAID RA in Angola reports to the HPN/USAID, the direct supervisor, while the CDC RA reports to the local health officer but also directly to CDC Atlanta. Under recently announced changes, CDC country personnel will now report directly to the CDC Country Director (when CDC has a country presence) rather than to Atlanta. In the countries where CDC has a large PEPFAR-supported program, there may be 50-100 CDC personnel working on HIV, compared to the 1 or 2 CDC persons assigned to PMI. This raises some concerns over the ability of the CDC Country Director to provide the management oversight, technical guidance on malaria-specific issues, and mentoring that the CDC RA might require and benefit from.

Overall, it was observed that the RAs have extensive administrative and technical responsibilities, and play a significant technical and leadership role. Their performance and contributions were recognized and appreciated by partners as well as by the NMCPs, especially in terms of their contributions and support to Global Fund proposal development. When the RAs have the professionalism and commitment to working together as a team (which occurs in many countries reviewed), the PMI staffing pattern seems to work well. The first priority needs to be to foster the success of PMI by improving the national malaria control program. If the RAs' skill sets are too similar, or if they felt that it was their responsibility to make sure CDC or USAID is promoted in a given country rather than primarily working to support the NMCPs, personnel problems tend to emerge. The skills found to be "in most critical demand" when the evaluation team queried Mission and NMCP personnel on the subject were in the following areas: operations research (in the true sense of the word), economic evaluation, and impact evaluation. One thing that became apparent is that, although impact evaluation requires the assessment of epidemiological data, the research and data skills required go far beyond those of a good quantitative epidemiologist.

CONCLUSIONS

Leadership

PMI's strong but discreet leadership contributed to its overall success. The PMI leadership successfully engaged key U.S. Government actors and sustained bipartisan political support for the initiative amid a change of administration and the emergence of the Global Health Initiative. The initiative also collaborated effectively with the Global Fund, RBM Partnership, and other global partners, and sustained financial support during a period of increasing pressure on U.S. Government development assistance resources.

Management

Rapid and efficient start-up of PMI activities was facilitated by excellent and creative program management by senior USAID personnel. An inclusive project activity planning system was established through the MOP process with the active participation of partners and stakeholders. The flexibility in the PMI approach was recognized and appreciated by partners.

Resources

The key to PMI's success can be attributed to the strategic use and alignment of its resources, with a focus on life-saving commodities as needed. The selected human resource model (expatriate RAs from each agency and extensive use of U.S. contractors and grantees) is

considered by many to be expensive but appears to have contributed to the success achieved. Many U.S. Government personnel consider PMI to be a lean project while others, particularly host country nationals working in the country programs, consider PMI to be a financially bloated development project with too many expatriates and too many U.S. implementing partners. The different approaches taken by PMI and the Global Fund contribute to the differing perspectives.

A full analysis of the cost structure of PMI was beyond the scope of this evaluation. Both USAID and CDC are contributing resources from other parts of their organizations that are not directly billed to the PMI accounts. The evaluation team found no empirical estimates of such “in-kind” contributions but were led to believe they are substantial. More importantly, there is no counter-factual approach to which the evaluation team could compare the PMI approach. Whether PMI’s approach to resource allocations, particularly human resources, is efficient, structured for ongoing success, sustainable in its current approach, able to respond to larger and more country programs, or able to respond to the changing environment in malaria control, were questions that were unanswerable within the scope and scale of the external evaluation.

II. APPLICATION OF OPERATING PRINCIPLES

Contents

1. Introduction
2. Principle 1: Use of Comprehensive, Integrated Package of Interventions
 - a. Malaria Operation Plans Planning Process
 - b. Mix of Interventions
 - c. Community-based Approaches
 - d. Response to Implementation Bottlenecks
3. Principle 2: Health Systems Strengthening and Integration
 - a. Health Systems Strengthening
 - b. Integration with Maternal and Child Health Programs
4. Principle 3: NMCP Strengthening and Country Ownership
5. Conclusions

INTRODUCTION

To accomplish its goals and objectives, PMI is organized around four operational principles based on lessons learned from prior U.S. Government efforts to fight malaria, together with the experiences gained from PEPFAR, which began in 2003. These principles were emphasized in the U.S. Government Malaria Strategy for 2009–2014. The four operational principles are:

- **Principle 1:** Use of a comprehensive, integrated package of proven prevention and treatment interventions
- **Principle 2:** Strengthening of health systems and integrated maternal and child health programs
- **Principle 3:** Commitment to strengthen NMCPs and to build capacity for country ownership of national malaria control efforts
- **Principle 4:** Close coordination with international and in-country partners

This section examines how PMI has adhered to these operational principles in achieving its goals and meeting its targets. The evaluation team strategically removed specific questions on operations research under Principle 1 and addressed them in detail in Section V. Again, issues related to Principle 3 (close coordination with international and in-country partners) have also been addressed as part of Section III, which focuses on evaluating the wider partnership environment in which PMI operates on the global and country levels.

The first part of this section will focus on Principle 1: the use of comprehensive and integrated package of interventions. It will address the process through which the mix of interventions was determined, the appropriateness of the mix of intervention to the country setting, the community approaches employed and how effective they were, and how PMI responded to implementation. The second part focuses on Principle 2 and examines how PMI strengthened the health systems in the focus countries and integrated malaria activities into maternal and child health programs. This part of the report specifically addresses whether PMI investments did strengthen health systems beyond malaria-specific components and how PMI malaria activities were integrated into antenatal services and integrated management of childhood illnesses. The

third part of this section looks at Principle 3: PMI's commitment to strengthening NMCPs and enhancing their capacity for country ownership of national malaria control efforts. Under this subsection, the team reviews how effective PMI was in building and strengthening human resources and other institutions within the NMCP. The extent to which PMI demonstrated flexibility in aligning with and adapting to country systems, which is a question under Principle 3, is addressed under the MOP process in Section I. This section ends with a description of the team's conclusions and recommendations.

ASSESSMENT OF PRINCIPLE 1: USE OF A COMPREHENSIVE, INTEGRATED PACKAGE OF PROVEN PREVENTION AND TREATMENT INTERVENTIONS

Malaria Operation Plans Planning Process

The development and negotiation of the annual MOP is the key process by which country-specific implementation of priority malaria interventions is determined. During the three-month MOP process each year, the status of malaria control and prevention policies and interventions in each country is reviewed; challenges and unmet needs identified; and progress toward meeting PMI goals assessed. The MOP document describes planned activities under the PMI and funding allocations are laid out in Table 3 of the document for the fiscal year. MOPs are developed in close collaboration with NMCPs and its in-country partners and stakeholders to ensure that the PMI annual plan supports and aligns with country plans, supports the national strategy, and supports and complements planned investments by other donors. Stakeholder involvement has evolved, bringing together a broad range of national and international partners and stakeholders in all PMI countries into an extensive, inclusive consultative process. The MOP process engages multinational partners such as WHO, UNICEF, World Bank, and RBM, as well as a wide range of partners at the country level, including faith-based organizations (FBOs), national research institutes, national and international NGOs that may or may not be USAID implementing partners, military, and private sector partners.

The MOP process is designed to ensure that PMI country staff and the PMI headquarters teams from Washington and Atlanta engage with the NMCPs and their partners in an annual gap analysis process. During the MOP process, the NMCPs and their partners “put on the table their areas of support and jointly identify gaps and mechanisms to address them.” PMI is seen as attempting to fill most, but not all, gaps in countries, whether they result from lapses in funding principally from the Global Fund, or from when other donors and host governments encounter difficulties in honoring their pledges. The annual MOP gap analysis exercise also provides an opportunity for NMCPs and their partners to update the gap analysis presented in Global Fund proposals and make adjustments as needed.

Some NMCP managers reported PMI's responsiveness to NMCP special requests for support—for example, paying for a WHO focal point when WHO lacked funds—was extremely helpful. In sum, PMI support is valued as “predictable, reliable, flexible and responsible.” (Zambia)

The NMCP managers interviewed had a clear understanding of the MOP and value this process, reporting that it fosters solid national priority setting (Malawi, Senegal, Benin, Ghana, Angola, Liberia) and annual program adjustments (Kenya, Mali, Tanzania). They pointed to the usefulness of the annual MOP process and document that assists with NMCP planning. The NMCP managers in several countries agree that the MOP interventions are based on, and aligned with the National Strategic Plan for Malaria Control and Prevention, and attributed this to the MOPs' inclusive consultation process. It is “*an organic document aligned with national malaria policy and plans, assisting NMCPs with national planning processes in addition to the value in the resources provided for malaria control and prevention.*”

The MOP process is considered to be an “excellent” process by nearly all NMCP managers. One indicated that the PMI approach has been “*very different from that of other donors (WHO and UNICEF). It is not a burden and very flexible.*” Another indicated that while there were some difficulties in “*getting integrated at country level in the beginning,*” and “*a nightmare*” in the early years, the MOP process has “*turned into a learning exercise, with a problem solving orientation... we solve it and we move on.*” The NMCPs also noted that in addition to galvanizing engagement among multiple actors, the MOP process has promoted advocacy enabling NMCPs to promote malaria control and prevention, both with government and with other partners. As one NMCP manager noted “*We need them for continued advocacy.*” However, one noted that the timing of MOP planning is “*not flexible, as the gap analysis is done on an annual basis, and therefore it is insecure funding.*” She compared the one-year MOP process with the NMCP five-year gap analysis conducted for Global Fund grants and concluded that “*It would be better to have a longer planning period.*”

Most PMI resident advisors agree that, “the annual MOP process is very useful, provides a strategic document in which PMI can operate,” and “is important especially where there is staff turnover at national level,” “but at some level too much emphasis is placed on the MOP process, some of which is academic.” Some PMI resident advisors suggested that the guidelines be revised and the format simplified to take less time and limit repetition in the document from year to year, or “explore a multiyear MOP process.” (Ghana, Kenya, Liberia, Mali). They also reiterated that the MOP interventions are usually based on, and aligned with, the National Strategic Plan for Malaria Control and Prevention.

The NMCP managers and PMI resident advisors generally were of the view that the MOP development and program implementation process were transparent. They indicated that the amount allocated to the country was openly discussed during the MOP process, NMCPs and partners input into what was to go into each intervention as presented in Table 4. The NMCP managers signed off the MOPs before they are submitted to PMI headquarters for approval. They cited the easy availability of MOPs, PMI reports, and country-related information on the PMI Web site, which the public has access to. The NMCPs, however, indicated they were not privy to the process by which the overall financial allocation to individual country is decided. However, they were of the opinion that “*resources are allocated based on what other partners are supporting.*”

A few of the PMI RAs were of the opinion that “*ultimately, PMI will fund or not fund what it wants to, using the implementing mechanisms available.*” Several NMCP managers raised concerns about PMI working with U.S Government implementing partners with statements like “*invariably increases administrative costs,*” “*the expenditures by implementing partners are not transparent,*” “*multiple implementing partners lead to difficulty with coordination,*” and “*no money was given to NMCP*” (Liberia, Rwanda, Tanzania). Some, on the other hand, held the opinion that using implementing partners was “*a necessity, because we know if the NGOs are not there, there will be no coverage, given the fact that national health systems are not able to provide total population coverage nationwide*” (Rwanda, Angola). Under current U.S. development assistance regulations, granting foreign assistance funds directly to host governments require them to pass risk assessments and pre-award audits that have been challenging for a number of African countries. CDC, when working through HHS regulations, is more readily able to make direct transfers to local institutions.

CONCLUSIONS

NMCP managers and PMI resident advisors reported that, on the whole, PMI has been responsive to country requests, addressing gaps as they occur with flexibility and quickly adjusting to changing situations on the ground. The MOP process clearly assists countries in

developing annual plans of action that allow a systematic and thoughtful set of malaria control activities to occur. The evaluation team found that the MOP process provides a firm foundation for planning and implementing the PMI model at the country level; the team also found that the process of MOP development and implementation process to be flexible, transparent, and inclusive, although the process could be somewhat streamlined to decrease demands on NMCPs, country PMI advisors, and partners. The MOP process may benefit from some tinkering (more consideration of multi-year planning, possibly less rigid adherence to using all four major interventions in all PMI countries as the epidemiology of malaria changes, etc.) in order to improve it.

Mix of Interventions

In almost every African PMI country, PMI has supported a comprehensive malaria control package applied with uniform coverage in all malaria risk areas, consisting of the following:

- Insecticide-treated nets, mostly LLINs, and exclusively so since 2007, were distributed to cover approximately two persons per family-size nets, generally with initial priority to protecting all under 5 children and pregnant women nationwide, and subsequently aiming for coverage of all people at risk of malaria. In some countries, with unstable epidemic-prone malaria in highland areas, IRS has been deployed, mostly instead of ITNs, sometimes in combination with the latter. In nearly all countries, IRS has also been applied in selected areas of stable (highly endemic) malaria, generally, together with ITNs.
- IPTp with sulfadoxine-pyrimethamine for pregnant women delivered through antenatal care (ANC) as part of a focused-ANC package (FANC).
- Curative care through general public health services based on specific diagnosis, generally with *Plasmodium falciparum*-specific rapid diagnostic test (RDT) and treatment with nationally selected ACT (in most cases artemether-lumefantrine). Initially, the treatment for children under 5 was in most countries according to WHO norms, given on clinical grounds. From about 2008, the standard has been changed to treatment based on testing for all age groups; this predates WHO guidance to the same effect issued in 2010.

This is a fairly standardized malaria control package for Africa and other parts of the world dominated by stable *falciparum* malaria. There are, however, major uncertainties in policy pertaining to the role of IRS in Africa and the combination of IRS and ITNs. In the following, we review these three types of intervention.

Use of ITNs and IRS

Based on a series of rigorous controlled studies in various settings in Africa in the 1990s, ITNs has become established as a major tool for reducing the mortality of malaria in high-burden areas, especially in children. Development and research later established long-lasting insecticidal nets as the most cost-effective form of ITNs. The evaluation team noted that in all countries, national programs, PMI, and other partners have given high priority to scaling up LLINs, initially with priority to children less than 5 years old and pregnant women, later to all population groups. An overview of delivery, costs, and expected coverage rates based on delivery over 2008-2010 for each country is provided in Table 3. It is seen that LLINs occupied 22 to 41% of the PMI budget, but it should be taken into consideration that in many countries, larger volumes of LLINs were procured from other sources. Assuming that one delivered LLIN protects two persons for three years (which is a simplification), and that the budget costs are equal to expenditures (also a simplification), the team finds that the estimated cost per person-year protected ranges from \$1.20 to \$2.26 (mean: \$1.45; median: \$1.36). If it is assumed that each net has an average effective life of only two years, the corresponding cost per person-year protected is 50% higher, ranging from \$1.80 to \$3.39 (mean: \$2.18; median: \$2.04). The median

costs correspond to published norms.⁷ The variation is not wider than could be expected, except that costs seem high in the case of Tanzania, possibly because of a different data source (footnote 3 to Table 3). It is recommended to assess the costs per projected person-year protected and per LLIN distributed with greater precision, using expenditure data, taking care to include all costs, for example post-campaign household visits, ITN disposal, etc. Not all distributed nets are used by two persons through the transmission season, so the real number of person-years protected is bound to be somewhat lower than estimated here.

At its start in 2005, PMI was under a political imperative to apply IRS on a large scale in Africa. An important part of the IRS imperative included the desire to use DDT, an insecticide, which can only be applied through wall-spraying. This was based on a perception that for various reasons this effective intervention had been withheld, leading to the death of large numbers of African children every year. In the advocacy for IRS it was, however, neglected that an alternative method of malaria control with a similar mechanism of action, ITN, had been developed and validated since the 1980s. The position of WHO around 2005-2006 was that both methods were highly effective in preventing malaria and that both had an important role in malaria control globally and in Africa. However, there was no WHO recommendation at the time supporting the simultaneous use of these two interventions in the same communities. It should be recognized that as ITN coverage was scaled up in Africa through public and private mechanisms, any use of IRS would, in many settings, lead to unintended dual protection.

IRS to Control Unstable Malaria without Combination with ITNs

In some of the countries where PMI was implemented, there was already an established practice of using IRS to control unstable (epidemic-prone) malaria in highlands and other fringe areas of malaria transmission. The effectiveness of IRS was well known in these countries, mainly in Southern Africa and the Horn, but in many cases it had been constrained by insufficient funding and other operational factors. In Ethiopia, Kenya, and Madagascar, PMI has strengthened these program components by establishing a more secure financial platform and by improving operations, for example, by assisting Ethiopia in assessment of insecticide resistance, leading to an evidence-based policy change in the insecticide used. According to information from the MOPs, transmission is in fact now almost interrupted (again) in much of the highland areas of such countries. Similar schemes have been set up in countries with highland-fringe malaria, which did not have much IRS in the past: Angola, Rwanda, and Uganda. It will be noted from Table 4 that in most, but not all, of these countries, the estimated cost of IRS per round per person protected has been modest (around or below \$2 per person), comparing well with the cost of protection by LLINs. Given the good results, the reasonable cost and the widespread experience of low motivation for use of nets in highland areas, which typically have little mosquito nuisance, it is possible that IRS alone should be considered best practice in highlands with unstable malaria; more generally, in areas with unstable malaria, there is still a scope for studies comparing IRS and ITNs, for example, as operational research under PMI, addressing the critical entomological and human ecology determinants.

⁷White, M., et al. (2011). Costs and cost-effectiveness of malaria control interventions—a systematic review. *Malaria Journal*, 10:337.

Table 3. Costs and Coverage Rates of LLIN According to PMI Country Profile and MOPs for 2008-2010

Country	PMI LLIN budget ¹	% of budget spent on LLINs ²	Total number of LLINs procured ³	Total number of LLINs distributed ⁴	Number of person-years of net protection ⁵	Population at risk ⁶	Proportion of population protected by LLINs in 2010 ⁷	Cost per person-year of net protection ⁸	% of LLINs distributed ⁹	Cost per LLIN distributed ¹⁰
Angola	19,900,000	27.2%	1,877,000	1,079,957	11,262,000	19,100,000	11.3%	\$1.77	57.5%	\$10.60
Benin	18,030,000	37.0%	2,168,000	1,241,054	13,008,000	8,850,000	28.0%	\$1.39	57.2%	\$8.32
Ethiopia (Oromia)	25,650,000	36.4%	3,100,000	1,581,784	18,600,000	17,000,000	18.6%	\$1.38	51.0%	\$8.27
Ghana	27,730,000	40.6%	3,534,000	1,305,000	21,204,000	24,390,000	10.7%	\$1.31	36.9%	\$7.85
Kenya	27,240,000	34.2%	3,770,000	1,300,000	22,620,000	27,141,700	9.6%	\$1.20	34.5%	\$7.23
Liberia	10,880,000	25.8%	1,256,429	1,094,000	7,538,574	3,990,000	54.8%	\$1.44	87.1%	\$8.66
Madagascar	27,510,000	40.8%	3,740,000	3,936,627	22,440,000	20,710,000	38.0%	\$1.23	105.3%	\$7.36
Malawi	23,940,000	38.3%	3,160,000	2,158,836	18,960,000	14,900,000	29.0%	\$1.26	68.3%	\$7.58
Mali	22,120,000	38.0%	2,710,000	858,060	16,260,000	15,370,000	11.2%	\$1.36	31.7%	\$8.16
Mozambique	26,910,000	34.7%	3,450,000	2,272,802	20,700,000	23,390,000	19.4%	\$1.30	65.9%	\$7.80
Rwanda	13,680,000	26.7%	1,188,000	1,462,400	7,128,000	10,620,000	27.5%	\$1.92	123.1%	\$11.52
Senegal	23,720,000	39.8%	3,035,571	1,200,951	18,213,426	12,430,000	19.3%	\$1.30	39.6%	\$7.81
Tanzania*	30,350,000	25.1%	2,235,967	3,107,647	13,415,802	42,149,600	14.7%	\$2.26	139.0%	\$13.57
Uganda	17,380,000	22.2%	1,975,000	1,945,236	11,850,000	33,430,000	11.6%	\$1.47	98.5%	\$8.80
Zambia	15,990,000	29.0%	2,216,885	1,278,100	13,301,310	12,930,000	19.8%	\$1.20	57.7%	\$7.21

¹ Total LLIN budget from 2008-2010. Includes procurement and distribution of LLINs in addition to national and community IEC/BCC for net usage.

² Total LLIN budget from 2008-2010 / total PMI budget from 2008-2010. Note: Budget and expenditure data may be different for any program component.

³ Total LLIN procured from 2008-2010 (obtained from MOPs). Note: Tanzania MOPs do not provide LLIN procurement targets, numbers obtained from Country Profile.

⁴ Total LLIN distributed from 2008-2010 (obtained from PMI Country Profile).

⁵ Total number of LLINs procured x 6. Assuming that 2 LLIN protects 2 persons for 3 years, one LLIN gives 6 person-years of protection, based on the assumption that all procured nets are distributed and that each delivered net protects an average of two persons through the transmission season for 3 years.

⁶ 2010 country population x proportion of population at risk.

⁷ Total LLIN distributed over 2008-2010 x 2 / total population at risk. Assuming that each net protects on average 2 persons and that nets have an effective life of 3 years.

⁸ Total LLIN budget / number of person-years of net protection.

⁹ Total LLINs distributed / total LLINs procured. The ratio may be greater than 1, because nets procured before 2008, may have been distributed during the three-year period, 2008-10.

¹⁰ Total LLIN budget / total number of LLINs procured. We are assuming that all procured nets will be distributed.

IRS Used in Combination with ITNs in Areas of Stable Malaria

As generalized IRS was apparently considered unaffordable in areas of stable malaria, which were also targeted for ITN implementation, PMI has supported selective IRS in areas with stable malaria, almost always in combination with ITNs. The use of IRS + ITN combination has been addressed in a recent WHO report, which notes:

“Although it could be expected that the two vector control methods used together would have an additive (or multiplicative) protective efficacy and that combined coverage will exceed that of one method alone, existing data lead to inconsistent conclusions. In order to justify the considerable additional resources that dual protection would require, it is essential to carry out more rigorous prospective studies.”⁸

PMI would have been in an ideal position to study effectiveness, cost-effectiveness, and impact sustainability of such combination schemes across several transmission and operational settings through experimental or quasi-experimental designs. This is only happening now as PMI is funding a major study with the London School of Hygiene and Tropical Medicine in Tanzania and a small-scale study in northern Ghana. In the meantime, the offer of selective IRS by PMI has stimulated the definition of national policies for IRS. Based on the 2011 MOPs, they can be summarized as follows:

- IRS should be applied to rapidly reduce transmission and maintained, while ITN is gradually fully scaled up; thereafter IRS should be withdrawn, and the transmission reduction maintained by ITN (most countries, but not all).
- High childhood mortality/high burden should be the main criterion for IRS: Benin, Ghana.
- Low ITN coverage should be the main criterion: Zambia.
- In peri-urban areas with high population density, IRS is more cost-effective: Zambia.
- IRS should be used in areas with a single seasonal peak of transmission: Benin, Ghana.
- Regional cross-border elimination schemes should be supported by IRS: Angola.
- Spraying should be prioritized in areas of pyrethroid resistance: Madagascar.
- Absence of pyrethroid resistance is a factor favoring IRS: Benin.

The fact that these policies are so diverse is additional evidence of the need for field research in this area, with particular attention to cost-effectiveness. In most of the PMI countries, there has been some monitoring through the use of epidemiological data, indicating good impact, but it has not been systematic.

The importance of attention to costs is evident from Table 4. Across PMI countries, the variation in estimated costs of IRS per person protected is very high, and with a few exceptions, they are several times higher in the countries without an IRS tradition than in those, which have sprayed for many years. Such differences would be expected in the first few years because of capacity building, but the team did not find a declining tendency in these costs over the years in countries without an IRS tradition, and the differences are also not explained by choice of insecticide. At a cost above \$5 per person per spray-round in most of these countries, IRS would have to be much more effective than ITNs to be a cost-effective alternative, and the incremental benefit from combination would have to be even greater, considering the much lower financial costs for a year's protection with LLINs (Table 3). In two countries, Ethiopia and Zambia, the costs of IRS appear to be extremely low; PMI staff has explained that IRS activities

⁸WHO (2010). WHO technical consultation on combining indoor residual spraying and long-lasting insecticidal net interventions, WHO Headquarters, Geneva, February 4-6, 2009. WHO, Geneva.

in these two countries also had support from other sources, meaning that the real budget costs per person protected are higher than shown in Table 4. A recent literature review estimated costs of ITNs/LLINs and of IRS; these estimates generally closely match the costs in PMI.⁹ While the external evaluation took place, RTI (the organization, which was responsible for implementing most of the PMI- supported IRS) has undertaken an analysis of the costs of IRS across 12 PMI countries from 2008 to 2010 based on expenditure data. This report includes valuable operational data on surface areas sprayed and volumes of insecticide used. The results are similar to the findings reported here, but it is also noted that program size was an important determinant of efficiency, with the cost-per-person protected generally being lower in programs where more than around 150,000 structures are sprayed per year.¹⁰

Table 4. Costs and Coverage Rates of IRS According to PMI Country Profile and MOPs (2006-2010)

Country	PMI IRS budget ¹	% of total PMI budget spent on IRS ²	% of population protected by IRS ³	IRS budget cost per protected person ⁴
Angola	13,250,000	13.8%	3.7%	\$3.98
Benin	11,300,000	23.3%	6.5%	\$6.76
Ethiopia (Oromia)	15,430,000	21.9%	16.3%	\$1.07
Ghana	12,500,000	18.3%	3.0%	\$5.79
Kenya	15,740,000	19.8%	5.4%	\$2.46
Liberia	5,770,000	13.7%	7.4%	\$9.88
Madagascar	22,200,000	32.9%	11.1%	\$3.30
Malawi	8,200,000	10.6%	1.6%	\$9.14
Mali	13,000,000	22.3%	15.0%	\$1.93
Mozambique	20,020,000	21.0%	10.2%	\$2.16
Rwanda*	22,610,000	33.1%	10.5%	\$5.26
Senegal	14,390,000	19.3%	6.1%	\$4.88
Tanzania	40,570,000	25.4%	5.0%	\$3.75
Uganda	39,480,000	36.1%	6.0%	\$4.10
Zambia	16,250,000	29.4%	38.8%	\$1.10

¹ Total IRS budget from 2006-2010. Includes procurement, operations, environmental safeguards, technical assistance, but not entomological monitoring.

² Total IRS budget from 2006-2010 / total PMI budget from 2006–2010. Note: IRS cost data is from MOP budget and does not reflect actual IRS expenditure.

³ The number of residents protected by IRS in a specified year / total population within year of interest. Total average is conducted over the time period of 2006-2010 for each country.

⁴ Total IRS budget from 2006-2010 / total number of residents protected each year from 2006-2010.

* Rwanda is the only country with two spray rounds per year.

⁹ White, M.T., et al. (2011). Costs and cost-effectiveness of malaria control interventions—a systematic review. *Malaria Journal*, 10, 337.

¹⁰ Sine J., et al., RTI International (2011). An economic analysis of the costs of indoor residual spraying in 12 PMI countries, 2008–2010. Unpublished document prepared for PMI. Accessed from <http://www.fightingmalaria.gov/H> on December 20, 2011.

Entomological Monitoring and Insecticide Resistance

One of the valuable side-effects of IRS in PMI has been the strengthening of entomological monitoring, especially for insecticide resistance. The entomological work has strengthened capacities and provided results of direct importance for policy. Initially there was much attention to entomological monitoring related to IRS. It is now known from PMI-supported research and other studies that pyrethroid resistance is becoming more and more widespread, threatening to compromise the effectiveness of ITNs over large areas.¹¹ PMI guidelines recommend resistance monitoring in one site per million people, including areas without IRS.

There is an urgent need for exploring the potential of insecticide management schemes to delay pyrethroid resistance; with current technologies, this means that IRS with non-pyrethroid insecticides may have an important role. Identifying cost-effective, feasible strategies will require a major, coordinated effort in applied field research, including observational studies linked to implementation.

Conclusions

Based on the data presented in this evaluation, the costs of protecting a population with LLINs is in general considerably lower than applying IRS; this result has also been found in previous studies. Of course, this comparison does not imply that LLINs are more cost-effective than IRS, as there is no assessment of effect. There is currently considerable discussion of the cost-effectiveness of the combination of IRS and LLINs; however, given that international financing of malaria control is unlikely to significantly increase in the near future, it may be a higher priority to compare LLINs and IRS. A particular priority may be to assess the impact of each in all age groups, which has been done only in two small trials, one in Kenya and one in India. Until this is done, given that PMI is active mainly in high-burden countries, it seems reasonable (except in areas of unstable highland fringe malaria) to choose the less costly option, LLINs, which in one rigorous review was found to be more cost-effective in reducing mortality in young children.¹² That said, in areas of manifest pyrethroid resistance (and perhaps even in areas with signs of reduced pyrethroid susceptibility) the situation may be different, and the best option in those cases may be to spray with an insecticide to which the local vectors are fully sensitive.

In contrast, the role of IRS in areas of unstable malaria has been confirmed, especially in highlands, where good quality spraying can sometimes interrupt malaria transmission.

Finally, it should be noted that pyrethroid resistance is a looming major threat to the effectiveness of ITNs. With current technologies, this problem can only be mitigated or potentially controlled by somehow applying alternative insecticides from a compression sprayer. Given the limited resources, the clarification of this “somehow” will require a major coordinated effort in basic and applied research.

Recommendations

- PMI should work with WHO to prepare an evidence-based framework for decision-making related to ITNs and IRS in Africa.
- Until such a framework is available, IRS should not be expanded in areas of stable malaria, unless there is a specific emergency situation where IRS is clearly appropriate—for example,

¹¹Trape, J.F., et al. (2011). Malaria morbidity and pyrethroid resistance after the introduction of insecticide-treated bed nets and artemisinin-based combination therapies: a longitudinal study. *The Lancet Infectious Diseases*. Published online August 18, 2011 DOI:10.1016/S1473-3099(11)70194-3.

¹²Yukich, J., et al. (2008). Costs and consequences of large-scale vector control for malaria. *Malaria Journal*, 7:258.

an area where the epidemiological effect of ITNs is compromised by pyrethroid resistance (which is likely to be a growing problem in the coming years).

- In areas of stable malaria without evidence of pyrethroid resistance, the general strategy should be to maximize coverage of ITNs. Any IRS schemes in such areas should, as a general rule, be phased out, while assessing whether any incremental reduction of transmission afforded by the addition of IRS to ITNs is maintained after IRS withdrawal.
- Maintain existing IRS schemes in areas of unstable malaria that are on track to interruption of transmission, so that IRS can be suspended within a few years and replaced with surveillance and preparedness.
- Conduct further operational research (including desk studies) on IRS to identify the reasons for persistently high costs in certain countries and ways these costs can be addressed.
- Study and model the malaria burden before, under, and after IRS, making best use of surveillance and other data.
- Apply spatial statistics, population genetics, and inter-sectoral data in reviewing the density and frequency needed for longitudinal studies of insecticide resistance and other entomological determinants, considering the need for early detection of resistance in all areas under insecticidal pressure. PMI is in a good position to plan, coordinate, and implement such applied field research studies.
- Work with WHO and other partners and scientists to develop appropriate strategies for insecticide resistance management.

The Role of IPTp

IPTp is possibly the most cost-effective of all malaria control interventions, but the number of deaths prevented by it is in a narrow age range and less than with IRS or ITNs. Its use should be simple in areas with high levels of use of ANC services, which in fact are found in most African countries. Even so, the coverage rates achieved for IPTp have been disappointingly low in most PMI countries, well below 50%. It appears that the operational issues are somewhat more complex than would have been expected. Also, in many areas, women present quite late to ANC services. This inexpensive and apparently simple intervention would benefit from more operational research and managerial attention.

There is concern in PMI that Rwanda has excluded IPTp from the country's standard intervention package. The national program cites low parasite rates and SP resistance as justification for this policy. In relation to the latter issue, there is evidence that moderate levels of SP resistance are still compatible with good IPTp effectiveness with SP. As for the former issue, the international consensus is that IPTp is a cost-effective intervention in areas of moderate to intense transmission; the problem is that there is no definitive threshold. It seems immediately plausible that the highlands in Rwanda do not need IPT. The situation is less clear in the lowlands.

Under all circumstances, it would seem that as long as there is good quality implementation of other interventions, there should be openness to this variation from standard policy in a country with Rwanda's operational characteristics. This may also pose an opportunity for a controlled trial to assess the effect of IPTp—that is, the prevention of severe malaria—in pregnant women in low transmission settings. In Ethiopia, IPTp is also not part of the standard intervention package according to national policy. The arguments for and against are similar to those in Rwanda, except that there are probably stronger arguments for IPTp in Ethiopian lowland areas with stable malaria, where there is little information on SP resistance and where malaria is probably less controlled than in Rwanda. However, this point seems not have led to much debate in Ethiopia.

Case Management with RDTs and ACTs

One major difficulty in implementing good case management in malaria control is the horizontal nature of this intervention. The health workers providing the service are not part of a “malaria army”—and even if they were, effective case management depends on patients’ initiating appropriate health-seeking behavior. The evaluation team observed that in all countries, PMI has invested considerably in improving supply systems and quality assurance for RDTs and ACTs, as well as in training and supervision of health workers. The main problem is now ensuring monitoring of clinical services (see Section IV), given that it is no longer recommended that all children with a fever should receive ACT. With the proportion of fever cases due to malaria apparently decreasing, it is now generally accepted policy that antimalarial treatment should be based on a specific diagnosis, usually based on RDT results.

Other issues related to case management concerns the role of community-based services, which the team discusses elsewhere in this section. Furthermore, it is still the case in many countries that most people with fever first seek treatment in the private sector. In some countries, PMI has attempted to strengthen curative care delivered through the private sector, but so far with limited results,

Community-based Approaches

In an effort to achieve the desired results, PMI has collaborated with NMCPs and other MOH units to employ community-based approaches to deliver interventions, especially in rural areas and hard-to-reach villages. The main approaches are community case management (CCM) of malaria, community distribution of LLINs, and community-based BCC and IEC activities. PMI supports community distribution of LLINs in all 15 countries, CCM of malaria implementation in 9 of the 15 countries, and community-based IEC and BCC in all 15 countries.

The scope and scale of CCM of malaria implementation is variable, ranging from countrywide implementation in two countries to implementation in a few districts in others. CCM of malaria activities is based on the needs and gaps identified in the MOP process with NMCPs and stakeholders at the country level. PMI support to countries includes procurement and distribution of ACTs and RDTs and training and supervision of community health workers. In six of the nine countries implementing CCM of malaria, treatment is guided by RDTs. The team visited two countries with CCM of malaria and the quality of care delivered at the sites was highly variable: one was excellent and the other was suboptimal. The supply of ACTs to the sites was quite regular. In a number of countries, PMI is collaborating with the NMCP and other stakeholders in developing or updating policies for home management of malaria and in developing guidelines and training manuals. In one country, Ghana, PMI also leveraged Global Fund support by providing targeted technical assistance and logistical support to address bottlenecks and fill gaps in home-based management programs, funded in part by the Global Fund.

Working through sub-grants to CBOs, FBOs, and NGOs, PMI supports community distribution of LLINs in all 15 countries. These organizations engage community volunteers to distribute nets during mass campaigns or through door-to-door distribution. In some countries, the volunteers not only distribute nets but are also responsible for hanging them. In one of the countries implementing CCM, LLINs are distributed to children under 5 who are seen at clinics. PMI has made a significant investment in community-based BCC/IEC activities across the 15 focus countries to increase understanding and demand for malaria prevention and treatment interventions. PMI estimates that these activities have reached millions of people in urban, peripheral, rural, and isolated villages across the focus countries since PMI’s inception, although it is difficult to precisely quantify utilization.

PMI uses CBOs, FBOs, NGOs, and a wide range of community-based organizations—including women’s groups, churches, and other civil society networks—to carry out IEC/BCC activities. These activities cover a wide range of topics, including proper ITN care and use; improving prevention, treatment-seeking behaviors, and malaria case management; IPTp; and community sensitization and mobilization for IRS. Specific activities have included:

- Use of community health workers (CHWs) and volunteers to conduct group discussions and interpersonal communication visits on net use, IPTp, and appropriate care-seeking for fever
- Volunteer door-to-door visits to explain the importance of IRS and improve compliance with instructions on preparing houses for spraying and reducing refusal rates; community outreach to encourage early and frequent ANC visits, and efforts to encourage pregnant women to sleep under LLINs
- Use of traditional opinion leaders to accelerate uptake of IPTp and help encourage pregnant women to seek ANC services early in their pregnancies
- Sensitization of communities and caretakers on changes that affect care-seeking and malaria prevention, and the need for prompt follow-up with a referral for a child with severe malaria or a non-malaria related fever
- PMI has used various channels to support its community approaches. Local NGOs were awarded sub-contracts through a lead implementing partner, which was responsible for building their capacity and managing their activities. One such channel was the Malaria Communities Program, which awarded 19 grants in 13 countries. PMI also collaborated with Peace Corps volunteers in a joint effort to carry out malaria education and prevention community-based activities in some countries.

Response to Implementation Bottlenecks

Having committed to allocating a significant proportion of its budget to buying such commodities as ITNs, insecticides for IRS, and effective drugs, PMI designed the initiative to address commodity procurement and distribution challenges and to prevent stock-outs. PMI also recognized that many of the focus countries lacked sufficient human resource capacity to manage the expansion and massive scale-up needed for effective malaria prevention, diagnosis, and treatment. PMI made adequate provisions in its programming to resolve this acute human resource gap. These challenges and bottlenecks were addressed via three main approaches, as detailed below: 1) the Central Emergency Procurement Fund; 2) re-programming flexibility; and 3) management of the human resource crisis and provision of essential and critical technical staff.

The Central Emergency Procurement Fund

PMI set up the Central Emergency Procurement Fund in the early days of the initiative. From the beginning, this mechanism allowed PMI to procure commodities to solve problems with commodity shortages/stock-outs at short intervals. In some countries, PMI was called upon to fill gaps to avoid stock-outs when Global Fund funding was suspended or delayed. The use of this fund at these critical periods was appreciated by both MOH officials and partners. NMCP managers and PMI resident advisors agree that PMI’s malaria success story could not be written without note of the role the Central Emergency Procurement Fund played in ensuring the availability of malaria commodities. However, a few partners indicated that as much as they agreed with PMI’s humanitarian mandate to provide essential medicines and supplies to prevent children from dying, this approach potentially undermined making countries accountable for their actions, especially when Global Fund resources were suspended due to countries’ inability to meet demands and control corruption.

Re-programming Flexibility

PMI allowed re-programming flexibility so that countries could re-direct funds to meet emergency and unanticipated occurring. This flexibility allowed PMI countries to meet emerging demands from NMCPs. This facility was used mostly when PMI had to address Global Fund financing gaps and/or procurement delays or when there was problem with quantification of commodities. The use of this facility contributed to the description of PMI as “very flexible” by many partners.

Managing the Human Resource Crisis at the Country Level

PMI supported countries in managing the human resource crisis through a number of ways. The most significant approach was seconding critical technical personnel to NMCPs through PMI implementing partners. Some of the critical personnel seconded included monitoring and evaluation officers, logistics officers, and IRS officers. PMI resident advisors and senior technical officers from some of the PMI implementing partners have desks at the NMCP and work there with the NMCP on occasion, some even on a daily basis. In several countries PMI provided funding to WHO to recruit and/or maintain national and international professional officers. These efforts were highly appreciated by the NMCPs and partners.

ASSESSMENT OF PRINCIPLE 2: STRENGTHENING OF HEALTH SYSTEMS AND INTEGRATED MATERNAL AND CHILD HEALTH PROGRAM

Health Systems Strengthening

It is increasingly recognized that poorly functioning health systems are a major obstacle to scaling up interventions aimed at improving health outcomes.¹³ The need to address weak health systems has become critically important and PMI investments must be seen as strengthening broader health systems by improving the accessibility and quality of primary health care, diagnosis, and treatment in addition to malaria-specific services. PMI designed its health systems strengthening approach to upgrade the capacity of national-level systems for malaria prevention and control, while extending activities out to provincial, district, and community levels. PMI investment has been directed to strengthening pharmaceutical supply chain management, health worker capacity and supervisory system, laboratory/diagnostic systems, and monitoring and evaluation systems.

Pharmaceutical and Supply Chain Management

A significant proportion of PMI’s budget was allocated to improving the pharmaceutical and supply chain management to ensure appropriate procurement and distribution of malaria commodities. PMI’s pharmaceutical and supply chain strengthening activities in many countries was focused at the central, district, and facility levels. Assistance at the central level included support for drug quantification and forecasting, reinforcing quality control, storage and inventory management, and improving warehouse conditions; all these efforts were designed to ensure availability and the appropriate use of malaria commodities, including ACTs and RDTs. At the district and facility level, personnel were supported in stock control and management. These efforts were reinforced with support to end-use verification surveys, monitoring the availability of key antimalarial commodities at regional and district stores as well as health facilities to detect and respond to critical issues such as stock-outs and expired drugs. Strengthening the

¹³Travis, P., Bennett, S., Haines, A., Pang, T., Bhutta, Z., Hyder, A.A., Pielemeier, N.R., Mills, A., and Evans, T. 2004. Overcoming health-systems constraints to achieve the Millennium Development Goals. *Lancet*; 364: 900–06.

supply chain management system from the central through the provincial to district and facility level is considered by most NMCP managers as an important contribution in their countries.

In some countries, to ensure a reliable supply of life-saving commodities and fulfill the responsibility to provide appropriate stewardship over U.S. Government development assistance dollars in the face of large-scale theft and corruption, PMI decided to temporarily stop using national procurement, storage, and distribution systems and created a “parallel” system for malaria commodities. The NMCPs in these countries quietly endorsed this approach and indicated that under those circumstances, PMI has no other option but to create the parallel system. Some partners, however, were of the view that supporting parallel supply chain systems undermines capacity strengthening and country ownership. The evaluation team (as do many of the PMI personnel) believes that operating a parallel supply chain in an emergency mode and solely for malaria commodities only makes sense in the short term. Developing an approach to ensure honest and effective national supply systems for essential drugs is one of the most difficult technical issues PMI will have to face as it moves forward into its second major phase.

Health Worker Training and Supervision

Broad categories of health workers in public and private sectors and NGOs were trained in malaria case management, pharmaceutical management, laboratory and diagnostics, M&E and data reporting systems, IRS, and supervision. PMI has supported the training of nearly 300,000 health workers since PMI Year 1.

PMI also provided support for strengthening supervision at both the district and facility level. PMI worked through its contracting mechanism with implementing partners to provide health worker training and supervision. In most cases these trainings and supervision were done in collaboration with the MOH. This approach, however, was not without criticism. There were reports from NMCP managers that the implementing partners “acted on their own,” “did not coordinate with NMCP and local officials,” “not all performed at optimal levels,” or “did not have the same capacity level as public health staff.”

Table 5. Number and Percent of Health Workers Trained by Type of Training*

Health Worker Training by Type	No. Trained
IRS spray personnel	86,417
Health workers/ IPTp use	45,865
Health workers/ACT use	136,404
Health workers/malaria diagnosis	23,196

*Source: PMI Annual Report, April 2011.

There were no indications that the knowledge and performance of the health workers that were trained had been improved. For example, there were widespread reports of clinicians and clinical officers after training continuing to prescribe anti-malarial drugs even when they are provided with RDT-negative results. The evaluation team did not find specific information about how PMI tracks and assesses quality improvements in service delivery and how the competence and performance of health workers that have been trained had improved. Certainly, training, technical assistance, and measures to improve supportive supervision (an activity that PMI has funded in many countries) in management and technical areas are key elements of capacity building; as PMI moves into its next phase, measures should be put in place to rigorously assess the effect of these approaches. Methodological sound, scientifically valid assessments of the outcomes and impacts of training investments would be consistent with the principles of GHI and the recent Evaluation Policy guidance issued by USAID in January 2011.

Monitoring and Evaluation

The PMI monitoring framework aims to complement and support the existing NMCP monitoring and evaluation efforts. Working in close coordination with NMCPs and national and international partners, PMI has invested in supporting national efforts to develop costed national malaria monitoring and evaluation plans in all focus countries; PMI has also supported local efforts to build and strengthen national and provincial/district-level capacity in monitoring and evaluation to strengthen existing routine data collection, data analysis, reporting, and use of data for decision-making and malaria surveillance. PMI has supported monitoring and evaluation (M&E) advisors, contracted consultants, or hired national specialists to assist with national strategic plan development and implementation, and to provide on-the-job training for NMCP staff on malaria M&E.

Working through specialized teams, PMI has supported the strengthening of entomological and drug resistance monitoring and epidemiologic surveillance and epidemic response in some countries; it has also supported the maintenance of sentinel sites. Some NMCPs value the support of PMI in strengthening their M&E systems, especially in the area of seconding M&E officers. The evaluation team could not ascertain how much the M&E systems in focus countries have been strengthened. However, PMI seems to be particularly successful at strengthening capacity for entomological monitoring in some countries, for example, in Ghana, Ethiopia, and Senegal.

Laboratory and Diagnostic Services

As malaria prevention and treatment activities in focus countries advanced, adjustments in the PMI approach were made to emphasize improving the quality of malaria laboratory services as a key to good case management. PMI has supported the provision of microscopes and essential reagents to allow basic laboratory functions to occur and the procurement of millions of RDTs in support of NMCP initiatives to scale up facility- and home-based management of malaria using RDTs and ACTs. PMI has also supported the training of health workers and community-based workers in the use of the malaria RDTs.

PMI is providing technical assistance to revise national malaria diagnostic policies, standard operating procedures, and job aids, as well as to strengthen quality control programs for laboratories in partnership with NMCPs and national reference laboratories in nearly all PMI countries

PMI has rightly provided strong support for making RDTs available and ensuring correct use at all health service levels. With the rapid expansion of RDTs, the evaluation team encourages using the PMI program experience to conduct a critical review of the role of microscopy in malaria case management in Africa, apart from the areas where *vivax* malaria is prevalent. While the evaluation team accepts that microscopy has an important role in monitoring the quality of the rapid diagnostics and in managing treatment failures in inpatient facilities, the widespread use of microscopy in standard malaria case management may no longer make sense, given the technological advances of RDTs.

Though PMI training efforts to improve the quality of microscopy and provision of improved equipment were widespread, the performance in the laboratories we observed was highly variable. In one hospital laboratory, which had received excellent microscopes and good quality Giemsa stain from PMI, the evaluation team observed that the water for dilution was not buffered, and the pH therefore so high that parasite nuclei were poorly differentiated from the cytoplasm. In others, quality control procedures were not well understood or well-practiced. The team does not believe these are isolated incidents and problems. Creating and maintaining high-quality microscopy continues to be a difficult health system challenge that will require

engagement from ministries and hospital facilities far beyond what PMI as a project can (or should) offer.

The evaluation team observed that in some rural health facilities, microscopists have been trained only in malaria microscopy and that microscopes provided through PMI support are used solely for malaria microscopy, a missed opportunity to integrate laboratory services—as long as these services are meant to serve routine curative services. There is, however, some effort in Ethiopia (and probably other countries) to leverage funding from HIV and tuberculosis programs to integrate malaria and other laboratory diagnostics. These efforts at integration and training efficiencies are consistent with GHI principles of integrated programming to improve health systems and should be even more widespread.

Conclusion

PMI has made significant investments in health systems strengthening activities. NMCP managers recognize the value of these investments. They commented that *“our capacity has been strengthened”* and *“we now have the capacity for procurement and distribution.”* However, some NMCPs felt that PMI’s approach of health system strengthening through funding to implementing partners to provide technical assistance instead of directly to NMCPs undermines country ownership and national capacity strengthening.

As PMI moves to its next phase of implementation, it is important to gradually hand over some training and supervision functions, managed by PMI implementing partners and NGOs, to national health systems. This will be contingent upon NMCPs’ being able to meet the financial capability requirements required under U.S. foreign assistance regulations and policies. It is also important to shift the focus of technical support from individual health worker skill building to team building that stimulates team problem solving and work standards that foster quality of service delivery.

Integration with Maternal and Child Health Programs

Advancing FANC initiatives

PMI has been supporting the expansion of focused antenatal care programs as a means of integrating malaria with maternal and child care. PMI investment is supporting the training of midwives and nurses in both public and private sectors in FANC as well as providing post-training follow-up supervision visits. PMI is procuring SP and LLINs for distribution through ANCs based on individual country needs and priorities. In all these cases the package of intervention include anemia and syphilis testing; provision of iron and folic acid; de-worming; IPTp and ITNs; prevention of mother-to-child transmission of HIV (PMTCT) services; and health education and counseling on breastfeeding, nutrition, HIV, and hygiene.

Integration with Child Care

There is fair amount of PMI support for integrating malaria into child health activities. Through PMI investment, health workers have been trained and are being provided with PMI-procured LLINs to be distributed to children under 5 at child welfare clinics and EPI sessions. These activities are being implemented in all 15 countries. In some countries, PMI uses UNICEF for the procurement and distribution of the LLINs to the facility level and CHWs; in other countries, PMI procures and delivers to the facility, either through the NMCP or an implementing partner. However, the supply of LLINs to these sessions is not regular and stock-outs of LLINs still occur.

Of the nine countries implementing malaria CCM, eight have integrated the approach within integrated community case management (iCCM) programs for child health. These programs also deliver antibiotics for pneumonia and oral rehydration packets with or without zinc supplements for diarrhea. LLINs are also sometimes distributed to children who are seen by the CHWs. PMI

is collaborating with the USAID/Maternal and Child Health Program to support a basic package of services, including malaria case management with ACTs, diarrhea case management with oral rehydration therapy, de-worming, growth monitoring and promotion, vitamin A supplementation, management of malnutrition, and a series of other health promotional services, including those for family planning and reproductive health in Senegal and Ethiopia. PMI is supporting other countries (Kenya, Mali, Angola, and Liberia) in removing policy barriers to iCCM and initiating pilot projects. Progress in some countries has been slow, particularly in Zambia, Uganda, Mozambique, Ghana, and Tanzania, largely because of a lack of MOH commitment.

PMI has also been leading efforts at the global level to scale up iCCM. PMI, working with USAID, first convened international partners to begin to address iCCM scale-up; it also developed draft iCCM benchmarks and indicators, which were then shared and adopted by major agencies, including UNICEF and WHO. PMI was influential in the formation of the iCCM Task Force and is providing 100% of the funding for the task force's secretariat.

Malaria and HIV/AIDS

The evaluation team found limited but important PMI efforts to leverage malaria in pregnancy (MIP) funds with PEPFAR. For example, in Benin there is joint effort to promote the integration of EPI, ANC, PMTCT, and malaria registers at the facility level to reduce the burden of collection and reporting of health data for vertical programs.

In Mozambique, one implementing partner is leading the technical support for malaria and HIV/AIDS laboratory activities using both PMI and PEPFAR support. PMI is collaborating with the Liberia National AIDS Control Program to ensure that more HIV-positive pregnant women receive IPTp; PMI is also working to make LLINs available to people living with HIV/AIDS (PLWHA).

Conclusion

Integrating malaria prevention and control activities in maternal and child health services presented some significant challenges. PMI has taken steps toward integration with varying degrees of success, due in part to the varying interest and commitment of MCH units in ministries of health, and to the differential capacity of public health structures, systems, and human capital. While the integration with maternal health care is far advanced, the same cannot be said about the integration with child care, especially in the case of integrated community case management. PMI is helping implement iCCM in eight countries.

Moving toward better integration with child health will require concerted efforts with ministries of health and donors. PMI should continue to engage other partners such as UNICEF and WHO.

ASSESSMENT OF PRINCIPLE 3: NMCP STRENGTHENING AND COUNTRY OWNERSHIP

From the outset, PMI made an important strategic decision to make the NMCP its central partner, recognize the NMCP's leadership role, and work within that framework. PMI carried out important activities to strengthen the NMCP's capacity to lead, advance the sense of country ownership, and encourage countries to assume the responsibility of partner and stakeholder coordination. Recognizing the human resource challenges faced by many of the NMCPs, PMI recruited two resident advisors whose job descriptions included providing technical assistance to NMCPs. They were to spend time at the NMCP and were even required to have a desk at the NMCP. Specific technical assistance provided included the following:

- Working with the NMCP manager and staff on planning, monitoring, decision-making, and problem solving
- Preparation of Global Fund grant applications and responding to comments
- Assistance with development of the national strategic plan and annual progress reviews
- Serving on national technical committees that develop and assess implementation of national policies and guidelines
- Supporting the work of the national technical working groups
- Assistance with organization/structuring and funding national malaria fora
- Assistance with targeted studies

In the process, many of the RAs “coached” some of the NMCPs and their staff.

Through its implementing partners, PMI seconded key critical technical personnel (e.g., BCC specialists, M&E officers, logisticians) to the NMCPs. Some NMCPs were provided with office equipment and furniture as well as communication equipment and services.

This assistance was highly appreciated by the NMCP, as seen in these statements: *“The RAs have been very capable and both very helpful, practically integrated into the NMCP”*; *“our human resources have been strengthened as well as our communication, M&E, and supply chain,”* and *“PMI has reinvigorated technical working groups.”* One NMCP manager remarked *“any time we receive a letter from the Global Fund, we always contact the RAs.”* This statement may express how the RAs are valued but at the same time indicates the NMCP’s total reliance on the RAs; one wonders what will happen in the absence of the RAs. It was refreshing to hear some NMCPs referring to PMI as their primary technical partner.

Alignment of PMI with National Malaria Control Strategies and Programs

There is clear evidence that PMI has aligned its strategy with national strategies and policies. NMCP managers were clear that PMI is fully aligned with their priorities and plans. PMI processes facilitated this alignment, in large part facilitated by the transparent MOP process involving all partners. This issue is discussed in more detail in Section I.

NMCP Variability

The evaluation team found that the capacity of the NMCPs varied widely. The differing levels of national capacity strongly influence the ability of PMI to support the NMCPs. Several countries began their partnership with PMI with especially weak national health systems and NMCP programs. PMI resident advisors noted that one major challenge to advancement was frequent turnover of NMCP managers and staff. A similar phenomenon is likely in cases where NMCPs have been dependent on donors, and have yet to assume a proactive position in terms of program development, implementation, monitoring, and evaluation.

Other NMCPs have been considerably strengthened through PMI support. Clearly, a well-structured NMCP with a strong human capital base at the national and district levels at the outset begins its partnership with PMI at an advantage, as do those whose governments have provided political and financial support for malaria control and prevention. NMCP manager and PMI resident advisor responses indicate that these NMCPs have advanced at a more rapid pace. In fact, two NMCP managers commented that their programs had adequate capacity to begin with, but that support for M&E planning and other specialized areas was important. (Tanzania, Rwanda)

PMI will need to develop measures of autonomy and sustainability for NMCPs and their functions, examining the above-mentioned factors and others that contribute to country-level program performance. PMI should develop a set of indicators that measure the competency of

NMCPs and their managers, as well as the initiative's success in strengthening country ownership.

Sustainability

The strengthening of NMCPs and transitioning more responsibilities to national health systems (fostering country ownership) will not guarantee continuity of interventions or continued success of systems set in place thus far. In the evaluation team's extensive document review and analysis of interviews conducted, it did not identify an explicit plan for sustaining advances achieved thus far or an exit strategy for current PMI countries. This is an issue of concern for NMCP managers, who expressed concern about plans for the longer term: *"PMI provides 80% of ACTs nationally; if PMI funding reduces, we will have a big problem," "it is great to have PMI do procurement, so we don't have that heavy work," and "if the IRS support from PMI ceases, there is no way the government can spend that much money annually on spraying."* In the words of one NMCP manager: *"Malaria cases have gone down, and NMCP is satisfied with the PMI contribution, but malaria control is long-term business and support will have to continue."* Malaria control requires a sustained commitment over time and a dynamic scientific and programmatic approach to modify strategies, as the vectors and parasites adapt to the various control strategies—and, as the threat diminishes, people may become complacent.

In a time of global economic downturn and reduction in donor support for global health, it is incumbent on PMI to conceptualize a cost-effective mix of interventions tailored to the needs of individual countries, address current and emerging vulnerabilities, gradually hand over functions as NMCPs are able to manage them, and develop a phased exit strategy with ministries of health and partners. These are difficult goals to accomplish in a time of flat or declining resources. Moving forward, it is imperative that PMI build on the initiative's successes, and deal forthrightly with efforts to ensure continuity over the longer term. This will require national governments to invest more domestic resources in malaria control, the generation of even greater political will through initiatives like African Leaders Malaria Alliance (ALMA), and renewed global support to continue funding the Global Fund

OVERALL CONCLUSIONS

The evaluation team found the NMCP managers consider themselves to be the key actors in the overall coordination of PMI programming. For the most part, they value PMI's respect for their important national role.

The team agrees with the majority of NMCP managers and partners who reported that PMI "performed well" in putting the principles in practice. PMI was able to:

- Use the largely effective integrated package of malaria control interventions to contribute to a reduction of under-5 mortality.
- Develop and implement a participatory, country-driven planning process based on the MOPs to guide PMI-supported malaria control program activities.
- Make some headway in extending community-based approaches to managing malaria. Unfortunately, community case management is still problematic in some countries.
- Use the Central Emergency Procurement Fund to overcome supply chain implementation issues and assist the Global Fund as required.
- Advance a multi-pronged health systems strengthening strategy to enhance individual and institutional capacity, jointly with NMCP and its partners. Extensive training of health workers, technical assistance and supportive supervision in health services, support for pharmaceutical and supply chain management, assistance to improve laboratory diagnostic services, and support for community-based approaches provide an improved health systems

base on which to launch the mix of interventions at the central, provincial/district, and community levels.

- Make a sustained and continuing effort to integrate malaria control activities into ongoing MCH program activities.
- The performance of individual NMCPs was highly variable. The stronger national programs, though aided by PMI personnel, did not report that their capacity had been strengthened markedly. Some NMCPs may have been strengthened due to their interaction with PMI and became more independent, while a third group are still deeply dependent on external support and have made less progress in capacity strengthening.
- Successfully anchor its country-level strategy in the NMCP as the country's principal actor and national leader for malaria prevention and treatment. PMI also aligned its strategy in all focus countries with national strategic plans, and honored its commitment to fill gaps in national plans as part of PMI's efforts to foster country ownership of the national malaria control program.

III. PMI'S COORDINATION AND OPERATION WITHIN THE WIDER GLOBAL AND COUNTRY PARTNERSHIP

Contents

1. Introduction:
2. PMI within the Wider Global Partnership
 - a. The GFATM to Fight AIDS, Tuberculosis and Malaria
 - b. Roll Back Malaria Partnership
 - c. World Health Organization/Global Malaria Program
 - d. Other Global Partners
3. PMI and National Partners
 - a. Ministry of Health/National Malaria Control Program
 - b. The GFATM to Fight AIDS, Tuberculosis and Malaria
 - c. Multilaterals
 - i. World Health Organization
 - ii. United Nations Children's Fund
 - iii. World Bank
 - d. Bilateral Aid Agencies
 - e. Private Sector
 - f. National and Academic Institutions
 - g. Non-governmental Organizations and Other Partners
 - h. Other USG In-country Programs
4. PMI Coordination and Partnership Environment
 - a. PMI's Approach to Advancing Its Goals
 - b. PMI's Mechanism for Addressing GFATM Implementation Issues
 - c. PMI's Role and Effect as a New Malaria Partner
 - d. PMI in the Eyes of Partners
5. Conclusions

INTRODUCTION

PMI was launched at a time when there was broad agreement that major global health problems could only be effectively addressed through partnerships and concerted collective action. Thus, the RBM Partnership was launched in 1998 by WHO, UNICEF, the World Bank, and the United Nations Development Program to address malaria, which had worsened in Africa through the 1980s and 1990s. In April 2000 the Abuja Declaration and Plan of Action¹⁴ on the RBM initiative was adopted at the Summit of African Heads of State and Governments. In 2001, the United Nations General Assembly proclaimed the period 2001–2010 as the Decade to Roll Back

¹⁴ The Abuja Declaration and the Plan of Action. An extract from The African Summit on Roll Back Malaria, Abuja, April 25, 2000 (WHO/CDS/RBM/2000.17). Accessed via http://www.rollbackmalaria.org/docs/abuja_declaration.pdf.

Malaria in Developing Countries, Particularly in Africa.¹⁵ The RBM Partnership was restructured in 2002 to ensure representation of malaria-endemic countries, bilateral and multilateral development partners, the private sector, non-governmental organizations, foundations, and research institutions. A secretariat led by an executive director was established and has since been hosted by WHO in Geneva. The most consequential achievement of the RBM partnership was probably the inclusion of malaria among the diseases covered by the Global Fund, which became operational in 2002.

By 2005, annual investments in malaria control were still only a fraction of the U.S. \$ 1.9 billion needed, according to WHO estimates.¹⁶ As a major and dominant financier, the Global Fund had helped establish a greater degree of coordination, at least in some countries, but malaria control in Africa was still often referred to as fragmented and insufficiently funded.¹⁷ After two years of substantive scale-up, there was little evidence that the investments had reduced the disease burden in sub-Saharan Africa except in a few atypical countries with limited malaria, including Eritrea and South Africa.

Realizing the need for achieving and documenting impact, PMI from its inception placed emphasis on the development of effective partnerships in the beneficiary countries. This emphasis was guided by a number of guiding principles, including the following:

- PMI's commitment to coordinating and organizing itself to support national malaria control programs.
- Making the presence of a Global Fund malaria grant one of the selection criteria for PMI candidate countries.
- PMI's commitment to partnering with host country governments, other U.S. Government agencies; international organizations; other bilateral, multilateral, and private donors, non-governmental organizations and faith-based organizations; and the private sector.
- PMI resources meant to fill gaps in funding from other global/national partners.

Objective 3 of this external evaluation is to “evaluate PMI's coordination with international and in-country partners and the wider partnership environment in which PMI operates at both the global and country level.” This objective focuses on how well PMI has engaged partners in advancing its goals and performed as a partner at both the global and country level.

PMI WITHIN THE WIDER GLOBAL PARTNERSHIP

The Global Fund

The Global Fund is recognized as the key global partner for PMI, with the two viewed as the largest financial supporters of Global Malaria Program implementation. From the very beginning PMI has emphasized the importance of close collaboration with the Global Fund to achieve success. This emphasis was underscored when the presence of a Global Fund malaria grant was singled out as a criterion for selection as a PMI country. PMI has worked regularly and hard to foster this relationship.

PMI's partnership with the Global Fund through complementing resources in selected countries has helped PMI attain its goal (mortality reduction) and aims (strengthen national malaria

¹⁵ 2001-2010: Decade to Roll Back Malaria in Developing Countries, Particularly in Africa UN General Assembly A/ 65/L.70. April 8, 2011.

Accessed via <http://www.rollbackmalaria.org/docs/2011/UNresNI129413-en.pdf>.

¹⁶ Roll Back Malaria, WHO, UNICEF (2005). World Malaria Report 2005. Geneva: WHO.

¹⁷ Anon. (2005). Reversing the failures of Roll Back Malaria (Editorial). *The Lancet*, 365, 1439.

program response). By focusing on working together in support of the NMCPs, the partnership has helped national malaria programs attain maximal synergies. Country coordinating activities have been functional and PMI's ability to "fill gaps" from Global Fund investments and massing of resources has set the stage for greater program impact to occur.

PMI leadership on the U.S. delegation to the Global Fund and interaction through the RBM Partnership helped ensure close coordination and collaboration between the PMI and the Global Fund at the global level. PMI leadership participated in deliberations leading to development of key position papers from the policy and strategy and portfolio and implementation committees of the Global Fund.

Probably the most important aspect of the complementarity and collaboration between the PMI and the Global Fund is in the procurement of commodities at the global level. PMI, the Global Fund, and the World Bank have held regular meetings (at 6- to 12-month intervals) under the Financiers Forum to coordinate and discuss commodity procurement activities, including quantification of commodities, capacity strengthening, and "gap filling" with emergency procurement at the country level. PMI and the Global Fund also interact through their participation in the RBM partnership working groups, especially the RBM Procurement and Supply Chain Management Working Group (PSMWG) and the RBM Monitoring and Evaluation Reference Group (MERG) (the PMI Deputy Coordinator was the former chairperson of MERG).

Regular communication between the Global Fund portfolio managers and PMI technical staff in Washington, D.C. (even though there was very little joint travel to PMI countries as team back stoppers) has also helped to cement the relationship between PMI and the Global Fund. The close communication at the global level, strengthened by the MOP gap analysis process, has allowed implementation issues of the Global Fund grants and PMI activities to be identified and addressed. The mobilization of the PMI emergency procurement fund has helped in addressing bottlenecks in Global Fund implementation.

The presence of a Global Fund grant as a criterion for country selection aimed at improving partnership is increasingly problematic. Looking forward, it could be that countries without Global Fund awards are precisely those that are in need of capacity strengthening in order to secure Global Fund awards. Looking back, the need to demonstrate impact and show results quickly has led to partnering in countries where funds had already been mobilized. This reasoning can no longer be justified, since most countries now have Global Fund grants and the strategy of joining forces at country level may conflict with the goal of reducing mortality due to malaria.

Roll Back Malaria Partnership

PMI recognizes the RBM Partnership as an important partner. The PMI Coordinator represents the U.S. Government on the RBM Board, the Executive Committee of the RBM Partnership, and the Resource Mobilization Sub-Committee of the RBM Partnership. PMI provides \$ 3 million a year to the RBM Partnership for country support, mainly through the sub-regional network, to enhance the development of Global Fund malaria grants, road maps, and strategic plans. PMI is also a major contributor to the RBM progress and impact series. Through its technical staff, PMI participates in the RBM working groups and also provides some funding for their secretariats and the work of some of the working groups.

Harmonization Working Group

The Harmonization Working Group (HWG) facilitates and harmonizes partner support in response to countries' identified needs. It mainly works on coordination to fill gaps at the country level, advises the Global Fund Technical Review Panel (TRP), and supports the preparation of Global Fund malaria applications. For the past five years, PMI has provided

funding to the working group to engage consultants to help countries with preparation of their malaria proposals. PMI investment in the HWG reportedly has contributed to the success rate of Malaria Global Fund proposals. The evaluation team was unable to ascertain the impacts of these investments.

Case Management Working Group Diagnostics Work Stream

The Case Management Working Group (CMWG) work stream, currently chaired by PMI technical staff, is responsible for scaling up malaria diagnostics. Outputs from this work stream include an operational manual for program managers on key components of a malaria diagnostics program; a guidance document to the Global Fund TRP on appropriate criteria for evaluating diagnostics components of applications for funding; and a position statement promoting the adoption by countries of the revised WHO guidelines for malaria diagnosis.

Monitoring and Evaluation Reference Group

The PMI Deputy Coordinator used to co-chair the Monitoring and Evaluation Reference Group (MERG); supported by PMI funding, the MEASURE Evaluation Project continues to serve as the secretariat that coordinates MERG activities. MERG outputs have included helping set the agenda for malaria impact evaluation; developing the malaria module that was incorporated in demographic and health surveys (DHS) and multiple indicator cluster surveys (MICS); and designing a comprehensive package of tools for providing guidance in carrying out malaria indicator surveys (MIS), which are household-level surveys relevant for assessing core malaria indicators. PMI is also involved in co-chairing various MERG task forces.

Vector Control Working Group

A PMI technical staff person serves as co-chair of the Vector Control Working Group (VCWG). This working group facilitates the alignment of partners on strategy and best practices to ensure rapid scale-up of malaria vector control interventions, particularly ITNs and IRS, in order to meet malaria control targets. The VCWG is divided into eight work streams, each focused on a particular aspect of vector control, and PMI supports a number of activities in some VCWG work streams.

Procurement and Supply Chain Management Working Group

The Procurement and Supply Chain Management Working Group (PSMWG) coordinates the efforts of RBM partners and countries to resolve challenges in procurement and along malaria commodity supply chain. It focuses on five procurement and supply challenges: technical assistance to countries; forecasting and quantification of commodities for prevention, treatment, and raw materials; implementation of quality assurance/quality control policies, in particular with regard to product selection and supply chain management; dissemination of tools, best practices, and information; and advocacy to mobilize resources for in-country operations. PMI technical staff were active in PSMWG's work during its initial stages, but have since been inactive. However, technical staff from DELIVER (the SPS Project, a PMI implementing partner) co-chair one of the work streams.

World Health Organization

The view of Global Malaria Program (GMP) staff contacted by the evaluation team is that there is little direct collaboration between GMP and PMI; as a result, they do not feel central to PMI activities. While PMI is generally seen as following published WHO guidelines, GMP leadership stated that they are surprised that PMI rarely seeks their counsel or inputs on broader strategic issues. PMI seconded a senior staff person to the GMP M&E team in 2011; the presence of this person will hopefully improve the GMP/PMI relationship.

On technical matters, the relationship seems better than on the strategic level. There is good and productive technical collaboration between PMI and GMP on issues related to the durability of LLINs, insecticide resistance monitoring, and rapid diagnostic tests. PMI and GMP collaborate through the RBM working groups, particularly the MERG, the CMWG, and the VCWG. PMI and Research Triangle International, a PMI implementing partner, serve as members of the WHO working group on integrated vector management. PMI is recognized and appreciated for its collaboration in collecting data for WHO's malaria reports. However, WHO staff criticized PMI for placing more emphasis and reliance on large-scale, cross-sectional household surveys than on strengthening health management information systems and surveillance. WHO staff contacted by team expressed the hope that, as PMI moves forward, it will put equal emphasis on these two approaches to M&E.

PMI and the WHO Regional Office for Africa (WHO/AFRO) have had some collaboration, with PMI providing about \$1 million/year in support through USAID's Africa Bureau; PMI also funds a number of international and national staff in WHO country offices. Personnel from WHO/AFRO participated in PMI's initial country planning visits, needs assessments, and follow-up visits. Since then, the collaboration has mainly occurred at the country level.

Other Global Partners

PMI's collaboration with the World Bank Booster Program is mostly at the country level; at the global level, it is mainly in the form of joint participation in the RBM working groups, particularly the MERG and the HWG, as well as the annual Malaria Financier's Forum. Among the major bilateral donors, DFID is foremost in considering a major scale-up in malaria work. In doing so, DFID is looking to PMI's example as well as exploring innovative approaches to expanding malaria partnership—for example, working with private partners in-country and with FBOs for community mobilization. As far as the private sector and foundations are concerned, PMI has regular communication and awareness-raising activities with the Bill and Melinda Gates Foundation, which has an extensive and innovative research agenda. PMI has provided technical support to the Global Business Coalition for HIV/AIDS, TB and Malaria for its activities related to best practices and efforts to advocate for the “business case” for malaria control.

PMI engages with university partners to respond to specific cross-country questions and issues. PMI is engaged with the London School of Hygiene and Tropical Medicine in a study to assess the combined use of IRS and LLINs for malaria reduction. The initiative is also working in collaboration with the Johns Hopkins University Malaria Research institution on monitoring insecticide resistance. In addition, PMI funds activities at several U.S. universities (Tulane, ICSF, University of Washington, University of Maryland, Johns Hopkins University) and has academic personnel serving as advisors and consultants.

PMI AND NATIONAL PARTNERS

PMI recognizes the MOPs as an important process for supporting and coordinating partnership at the country level. The MOP process has been used as an entry point for partnership and has been essential for bringing all partners together. Working in collaboration with the NMCP, with access to funds and an inclusive and participatory process, PMI has been able to bring together traditional and new partners into national malaria response.

Ministry of Health/National Malaria Control Program

PMI collaborated with the MOH/NMCP and operated within country-specific strategic plans. PMI recognized the leadership of the NMCPs and worked within that framework. Through the MOPs and involvement in the technical working groups of the national program, PMI was able to involve other national partners in its program and activities. Some of the national programs

indicated that the NMCPs' partnership with PMI helped bring stakeholders in malaria control together and invigorated national malaria partnerships. The technical assistance the NMCPs received from the PMI RAs and PMI contractor technical staff was helpful in developing a number of important strategic documents, including Global Fund proposals, national malaria strategic plans, and intervention-specific operational plans.

Most of the NMCPs appreciated their partnership with PMI and described PMI as a worthy financial and strategic partner. Below are quotes from some of the NMCPs on their partnerships with the PMI:

"The RAs have been very capable and both very helpful, practically integrated into the NMCP."

"Collaboration is close, we meet regularly."

"All planning and collaboration is open and transparent."

"PMI is perfectly aligned with national strategy."

"MOP is oriented to country needs and very flexible."

"In a short time, PMI has established itself as a mature initiative that has dramatically scaled up evidence-based interventions, comprehensively monitored the implementation of these interventions, which have already resulted in some dramatic achievements."

One NMCP was critical of PMI: *"Due to structures and policies of PMI Washington, the PMI program is not considered to be one of the more flexible and stable partners of the NMCP."* There were a few areas that some NMCPs thought PMI could do better. These included the complaint that many implementing partners competed for the time of the NMCP manager on the smallest issues, even if they were referred to other members of the NMCP. One NMCP member questioned the rationale for allocating funds to IRS: *"...negative experience has been the questioning of some activities (e.g. ,monitoring and evaluation) when others received a 'free pass' (e.g. IRS)."* Another NMCP member indicated that PMI *"occasionally ignored advice from MOH and collaborators."*

The Global Fund

There is good collaboration and coordination between PMI, the principal recipients and sub-recipients of the Global Fund, and the country coordinating mechanisms. PMI complements Global Fund plans and resources during gap analysis in preparation for the country MOPs. The MOPs outline the Global Fund's role, specific intersections with PMI-supported activities, and how all contribute to the NMCP.

Procurement is sometimes coordinated between PMI and Global Fund, especially in countries where there is a common distribution system to ensure that commodities arrive when they are needed to prevent stock-outs. However, this coordination has not always been effective. In some countries the Global Fund uses the DELIVER Project (PMI's implementing partner for commodity procurement) to accomplish its procurement requirements. PMI occasionally makes emergency procurements of commodities when Global Fund disbursements are delayed or disrupted. The Global Fund and PMI work together on strengthening supply chain management systems in countries where such systems are weak. PMI works through the RAs on national applications to the Global Fund, sometimes with support from PMI headquarters. PMI also provides support to national teams for Global Fund grant negotiations, especially when there is delay in disbursements.

Multilaterals

The most important multilaterals at the country level are WHO, UNICEF, and the World Bank. When the technical expertise or other resources (financial or commodities) exist, PMI finds a way to involve multilateral groups in national program efforts.

World Health Organization

PMI and WHO work together well at the national level in all 15 countries except for 1, where there is little collaboration. WHO participates fully in the MOP process, both in pre-meetings before the delegation from Washington and Atlanta arrives and during the stakeholder presentations and de-briefing exercises. PMI has been involved in the preparation of WHO biannual plans in two countries. Under NMCP leadership, PMI and WHO work together closely on the NMCP technical working groups. Areas of collaboration include resource mobilization, policy and strategy development in support of NMCP actions, support for activities to ensure better overall program quality, and advocacy for the generation and utilization of improved information and evidence for malaria program decision-making. In some countries PMI provides financial support to maintain national professional officers for malaria. In one country, PMI provides financial support for maintaining an international professional officer for malaria.

In most cases, WHO country personnel perceive they are well engaged with the PMI program and there is regular interaction between the NPOs and the PMI resident advisors. WHO believes its views are well respected and its technical expertise used by the PMI team.

WHO receives funding from PMI to undertake specific activities in some countries. For example, in one country, WHO receives PMI funding to carry out activities to strengthen national malaria epidemic preparedness and response. Research money for local research is sometimes channeled through WHO. This collaboration is seen as beneficial to both institutions, as it allows WHO to carry out its mandate and PMI to fulfill and implements its work plan.

United Nations Children's Fund

PMI engagement with UNICEF is collaborative and interactive in almost all 15 countries, with UNICEF interacting with PMI largely through the NMCP. The major points of interaction include joint work on the NMCP technical working groups and collaborative preparation of Global Fund proposals. UNICEF has been deeply involved in the MOPs process; in several countries, PMI has reciprocated this gesture by being involved in UNICEF's work plan. In one country, PMI was actively involved in the development of UNICEF strategic plan on community case management and motivation of community health workers. In another, PMI used UNICEF to procure and distribute LLINs to children under 5 and pregnant women through antenatal clinics and immunization clinics. PMI provided financial support to UNICEF in another country to conduct multiple indicator cluster surveys. In several countries UNICEF was selected as a Global Fund sub-recipient, which helped cementing PMI/UNICEF collaboration and partnership.

World Bank Malaria Booster Program

The World Bank Booster Program was implemented in seven of the PMI focus countries. While the program is currently closing down in most countries, there was good collaboration between the PMI and the World Bank at the time the programs were active. Both institutions worked together to program funds for essential malaria interventions.

Bilateral Aid Agencies

PMI's partnership and collaboration with bilateral development agencies at the country level is varied, depending on the bilateral supporting malaria activities in the country. DFID is a

significant player in several countries and in those cases there is some collaboration. In one country, DFID has developed a memorandum of understanding with PMI/USAID and provides some funding to procure LLINs for distribution through antenatal and immunization clinics. The Japan International Cooperation Agency, the Canadian International Development Agency, the Swiss Agency for Development and Cooperation, and the Netherlands Ministry of Development Cooperation are present in one or two countries, but there seems to be little collaboration between PMI and these bilaterals. The PMI collaboration with these agencies has been challenging due to their relatively small investments in malaria and their funding approaches.

Foundations and Private Sector

There is some collaboration between PMI and the private sector in a few countries. The most significant is in Angola, where Exxon Mobil has provided \$3.5 million to the U.S. Embassy to support PMI ITNs activities. There is also some collaboration between PMI and mining companies in two countries for IRS activities.

National Academic and Research Institutions

PMI has been eager to collaborate and productively engage with national academic and research institutions. The evaluation team found numerous productive relationships in this context. In Senegal, PMI collaborated with two research institutions, working with the Centre de Recherche pour le Développement Humain in conducting DHS and the Université Cheikh Anta Diop on studies on the longevity of insecticides used for IRS. In Malawi, PMI collaborated with the Malaria Alert Centre on a number of studies, including piloting interventions to improve patient adherence, efficacy of SP in preventing malaria in pregnancy, testing LLIN distribution strategies, and drug efficacy studies. In Zambia, PMI worked with the Tropical Disease Research Centre to assess the efficacy of SP in the prevention of malaria in pregnancy and insecticide resistance monitoring; it also collaborated with the Malaria Institute at Macha on insecticide resistance monitoring. In Kenya PMI is working with the Kenya Medical Research Institute to assess the longevity of insecticides used for IRS and to evaluate the use of integrated vector control in high- and low-transmission areas. Notwithstanding these important scientific collaborations, much more needs to be done with academic and research institutions.

Non-governmental Organizations and Other Partners

Collaboration with NGOs and FBOs mainly occurs through PMI's use of these groups as contractors for implementing malaria interventions. Areas of engagement include community-based distribution of ITNs and BCC. PMI also collaborates with some of the national Christian Health Associations through the technical working groups of the NMCP.

Other USG In-country Programs

PMI works to strengthen links with other USG programs. For example in some PEPFAR countries, there is collaborative distribution of LLINs to HIV/AIDS patients. PMI has also engaged the Peace Corps in malaria prevention activities in some countries, including providing malaria prevention education and ITN distribution campaigns; this collaboration is expanding with the recently announced PMI-Peace Corps Initiative. PMI also works with the DOD through the Walter Reed Army Institute of Research to strengthen malaria diagnostics capabilities in Kenya and Tanzania.

PMI COORDINATION AND PARTNERSHIP ENVIRONMENT

PMI's Approach to Advancing Its Goals

PMI has engaged a wide variety of international and in-country partners to advance its goals and objectives, including host government ministries and parastatals, multilaterals, bilaterals, private sector organizations and foundations, international and local non-governmental and faith-based organizations, academic and research institutions, and other U.S. Government agencies and programs. PMI identified the Global Fund as an important strategic partner and the two organizations have worked to complement each other's work in providing essential resources to reduce malaria-related deaths. Using the MOPs, PMI has collaborated with partners at the country level. The MOPs have been used as entry points for partnership and have been essential in bringing partners together. Working together with the NMCPs, PMI has been able to bring together traditional and new partners with access to funds to the national malaria response, using an inclusive and participatory process.

PMI recruited two resident advisors and in some countries one or two FSNs to provide technical support to the NMCPs and has worked with other national partners to help maintain and sustain NMCP technical working groups, which provide guidance for implementing malaria control activities. PMI also engaged a number of implementing partners to implement PMI-funded activities agreed upon during the MOPs process. Some of the implementing partners seconded staff to the NMCP and also participated in the work of the technical working groups.

At the global level, PMI technical staff participated in working groups and committees of global partners (especially the Global Fund and the Roll Back Malaria Partnership) to advance its goals. In some of these instances, PMI technical staff did not represent PMI but were members in their personal capacities.

PMI's Mechanism for Addressing Global Fund Implementation Issues

As noted earlier, PMI recognized the importance of Global Fund malaria grants to the achievement of its goals and objectives. The initiative aligned its funding with Global Fund malaria grants and, working through the NMCP, ensured that the two funding sources were complementary. During the MOPs process, PMI funds were preferentially obligated to fill identified resource gaps in cases where Global Fund malaria grants and other sources of funding fell short or faced implementation problems. The PMI-created Emergency Procurement Fund was frequently used to procure malaria commodities and avoid stock-outs when there was a delay in the release of funds from the Global Fund malaria grants and when such grants were suspended.

PMI's Role and Impact as a New Malaria Partner

As a new malaria partner, PMI brought considerable resources to support the NMCP and its partners in implementing key malaria control interventions. In most countries, PMI was one of the two largest funders of malaria activities. The in-country presence of the resident advisors, together with the presence of technical staff from some of the implementing partners, may have helped strengthen malaria partnership in some countries. However, some partners expressed the fear that this approach may not be sustainable, as the gains derived from the involvement of these personnel may not last when PMI funding dries up, especially given that PMI seems to have no exit strategy. Some partners, although recognizing the role of PMI implementing partners, were of the view that this approach is too costly due to the related administrative costs.

It was not clear what role PMI has played in shaping the policies and priorities of the Global Fund through its participation on the board and the board committees.

PMI in the Eyes of Partners

Both global and national partners generally had favorable comments for PMI and indicated that “PMI has learned how to be a good partner at the country level.” The Global Fund specifically mentioned the technical complementarity between the two organizations and PMI’s ability to step in and help when the Global Fund falters. However, some Global Fund staff and other partners, including local health professionals within several PMI countries, asserted that PMI had bailed out countries when the Global Fund suspended release of funding due to accountability and transparency issues. Several respondents cautioned that these actions may create a moral hazard by potentially undermining Global Fund accountability efforts to mitigate the impacts of corruption on national programs. PMI personnel are fully cognizant of the dilemma, but argue that PMI’s prioritization of the “moral imperative” to save children’s lives trumps the “development imperative” to help build functioning national health systems that have integrity. Independently and across several countries, NMCP, PMI, and Global Fund personnel all stated that efforts to strengthen the performance and accountability of the drug procurement and distribution systems is an essential, high-priority issue that needs urgent attention as the global malaria program goes forward.

Some partner representatives noted that PMI has more rigorous criteria for pharmaceutical procurement than does the Global Fund, as it requires WHO pre-qualification or stringent regulatory authority approval (preferentially from the Food and Drug Administration). Similar to WHO, the Global Fund expressed some frustration over the difficulty of getting financial data from PMI for grant performance reporting.

Overall, the RBM Partnership has a favorable view of PMI. It appreciates the funding and support it receives from PMI and emphasized that PMI, despite its importance, does not try to dominate the board. It also perceives that the cost of implementing PMI activities is likely to be high due to high contractor fees. The RBM Partnership expects PMI to participate more in the sub-regional network activities.

Several people from the Global Fund and the RBM partnership were critical of PMI’s position on the Affordable Medicines Facility—malaria (AMFm). They believe that PMI asks for a higher level of proof than other initiatives and seems antagonistic to AMFm. The perception expressed was that PMI/USAID works against AMFm approval by Global Fund Board and tends to undermine the facility. The evaluation team notes the widely divergent opinions that exist on the effectiveness and utility of this effort. The team was not asked to evaluate AMFm and offers no opinion on this issue due to its lack of investigation on this question.

CONCLUSIONS

- PMI developed strong partnership with almost all the NMCPs in the 15 focus countries and recognized the NMCP’s lead role in malaria control. The signing off of the annual MOPs by the NMCP before submission to PMI’s leadership in Washington for approval was seen as a positive step in country ownership of the plans in some countries.
- PMI is recognized as a key partner at country level and its contribution is well appreciated by most of the partners. Some described PMI as “flexible,” “more transparent,” “inclusive in designing its approaches” and “receptive to ideas and suggestions.” All partners were aware of the additional funding PMI brings for procurement of malaria commodities. Some partners gave PMI credit for introducing IRS in a number of countries, where this intervention had not been used before.
- Most partners believe that PMI has invigorated and strengthened malaria partnerships at the country level. The partners note the role PMI plays in creating efficient communication within the partnership. In conversations with the evaluation team, they acknowledged the

strategic and technical contributions of some of the RAs, along with their understanding of the specific roles of other partners and their sensitivity to the requirements of international work.

- PMI is generally viewed as an exemplary partner by partners because it does not use its large, broad presence and substantial financial support to gain undue influence within the partnership.
- PMI has had a worthwhile role in the global partnership, especially with the Global Fund and the RBM Partnership. Active and collegial engagement within the partnership appears to have contributed significantly to the attainment of PMI's goal and objectives. It is unusual that a bilateral donor initiative with so much financial and technical resource invests so much effort in collaborating with a range of partners and interested parties. Not only do partners appreciate this, but there are indications that the NMCPs see this as helpful for their engagement with partners. PMI clearly sees partner engagement as well worth the effort.
- PMI was not seen as a good partner in one specific area. PMI leadership and selected technical personnel may have their reservations about AMFm, but the evaluation team heard from multiple sources that the perception of an openly antagonistic manner in which PMI voices its concerns is unjustified and potentially inappropriate. As the AMFm is being evaluated by others, the evaluation team suggests all parties "let the data speak" to resolve questions over the benefits and impacts of the AMFm program in an empirical fashion.

IV. MONITORING AND EVALUATION

Contents

1. Introduction
2. PMI's Goals, Objectives, Targets, and Indicators
 - a. Goals and Objectives (FY2005-2010)
 - b. Targets and Indicators for PMI Countries by End of FY2010
 - c. Objectives and Targets Following the Lantos-Hyde Reauthorization
3. PMI's M&E Work with Focus on Outcomes and Impact
 - a. Strategic and Theoretical Framework
 - b. Operational Principles and M&E Implementation
 - c. Planning of Outcome and Impact Evaluation
 - d. Impact Evaluation Report on Mainland Tanzania
 - e. Assessment of Outcomes and Impact by the External Evaluation Team
 - f. Summary Findings

INTRODUCTION

This section has two distinct aims:

1. To assess the appropriateness, quality, and performance of the PMI's monitoring and evaluation work
2. To assess the program's outcomes and impact

The emphasis is on the first of these aims: Having visited five PMI countries, and having had access to substantial documentation, the evaluation team is well-positioned to assess PMI's M&E work. The team's review of PMI's efforts shows how challenging it is to evaluate the initiative's impact on the malaria burden in countries. The team agrees with PMI that impact evaluation should be done in collaboration with each national malaria control program and other partners; it also agrees with PMI that such evaluation should use modeling and control for potentially confounding factors. Given that the team's time and resources did not make it possible to meet these criteria, we limit ourselves to presenting available data and information on outputs, outcomes, impact, and selected potential confounders in each country, and assessing whether any reductions in all-cause child mortality (ACCM) or malaria indicators have a time relationship to scale-up of interventions, which makes causality plausible.

In the following section, the evaluation team first reviews PMI's objective and targets, which sets the stage for an assessment of PMI's M&E work as well as for impact evaluation. Following these elements, the team presents its conclusions, with a focus on future M&E priorities.

PMI'S GOALS, OBJECTIVES, TARGETS, AND INDICATORS

Goal and Objectives of PMI (FY 2005-10)¹⁸

The goal of PMI is to scale up malaria prevention and treatment interventions in 15 countries in sub-Saharan Africa, eventually covering more than 175 million residents at the end of the five-year program.

Building on the Abuja targets, the PMI plans to achieve 85% coverage of the most vulnerable groups—children under 5 years of age, pregnant women, and people living with HIV/AIDS—with key preventive and therapeutic measures.

This is expected to result in a 50% reduction in malaria-related deaths after three years of full implementation in each country (i.e., FY10 for the first three countries). The U.S. contribution holds the potential to save 140,000 lives/year by 2010.

Table 6. Targets and Indicators for President's Malaria Initiative Countries by End of FY 2010¹⁹

1. Proportion of households with a pregnant woman or child under 5 that own one or more ITNs	>90%
2. Proportion of children under 5 sleeping under an ITN the previous night	85%
3. Proportion of pregnant women sleeping under an ITN the previous night	85%
4. Proportion of houses sprayed in geographic areas targeted for IRS	85%
5. Proportion of pregnant women and children under 5 who have slept under an ITN the previous night or in a house that has been protected by IRS	85%
6. Proportion of women (in areas determined to be appropriate for IPTp use) completing a pregnancy in the last two years who have received two or more doses of artesunate + SP for IPTp during that pregnancy	85%
7. Proportion of government health facilities that have ACTs available for the treatment of uncomplicated malaria	85%
8. Proportion of children under 5 with suspected malaria who have received treatment with an ACT in accordance with national malaria treatment policies within 24 hours of the onset of their symptoms	85%

These objectives and targets are quantitatively as clear as is possible in a multi-country project and have well-defined time limits. The three-year timeline is reasonable for an initiative aiming to supplement existing efforts. However, the actual funding was planned over five years, with the biggest proportion (40% of the total) coming in FY10. Thus, the PMI timeframe that was agreed to and was communicated in PMI annual reports includes an additional year (through September 2011). By setting a reduction of malaria mortality (without age-group reference) as its objective, the initiative signals a laudable effort to focus malaria control on the burden of this particular disease. At the same time, it also sets up its scientists for a major challenge in estimating an

¹⁸ President's Malaria Initiative Strategic Plan. Prepared by a USAID-CDC Interagency Working Group, July 25, 2005.

¹⁹ Table 3 in President's Malaria Initiative Strategic Plan. Prepared by a USAID-CDC Interagency Working Group. July 25, 2005 (revised September 24, 2006). (Numbering has been introduced for this report.)

epidemiological effect, which cannot be directly measured in the absence of a strong disease surveillance system.

The goal of halving malaria mortality compared to the situation before the start of PMI was to be achieved in Round 1 countries in 2010, in Round 2 countries in 2011, and in Round 3 countries in 2012. This is also reflected in the individual country MOPs up to 2010. There is an inconsistency in this planning framework, as all targets are set to be met using FY10 monies, while the impact objective should be met three or four years after project start in each country.

The targets for ITN coverage (indicators 1-3) are consistent with the approximately 80% coverage in all age groups, which was targeted in the controlled trials showing a reduction of ACCM of 17%, when compared to no nets in tropical Africa.²⁰ The relationship between ACCM and malaria mortality is discussed below. The target for coverage of ITNs is focused on children and pregnant women. These are still the clear priorities, although PMI policy has changed during the period of implementation, in line with international consensus, toward coverage of all age groups with all interventions, except of course IPTp. Indicator 4, the target for IRS coverage, is close to the 80% usually assumed to be necessary for IRS to be effective. The limitation to “geographical areas targeted for IRS” means that this is more an indicator of program quality rather than of population coverage, and begs the question of what the criteria are for targeting (addressed in this report in Section II.) Indicator 5 focuses on coverage with ITN or IRS, suggesting that these interventions were seen mainly as alternatives at the outset of the initiative, although they could reach the same households. In reality, as noted in Section II, most IRS supported by PMI has been applied together with ITNs.

There is no clinical or epidemiologic rationale for the 85% coverage target (indicators 6-8) for IPTp and for therapeutic interventions. The target should, in principle, be 100%, given that any untreated malaria patient is at high risk of dying from the disease. However, lower targets are strategically and programmatically rational by setting benchmarks that are challenging, but achievable.

The targets noted above have been maintained until now (with one exception, as discussed below), but there is less and less clarity on the time-dimension.²¹ This may be rational, given the great variability between countries, but targets that are not time-bound cannot be evaluated meaningfully; as a result, it might be more sensible to consider these levels as standards, not targets, and leave country planners to identify annual and quinquennial targets with reference to those standards, along with epidemiological objectives.

In 2009, PMI issued a precise, detailed list of indicators with their definitions.²² For outcomes and objectives, this largely reiterated established and widely known RBM indicators. In addition, a complete set of epidemiological and outcome indicators were defined for sentinel sites and a complete set of output indicators were defined.

²⁰Lengeler, C. (2004). Insecticide-treated bed nets and curtains for preventing malaria (Review). Cochrane Database of Systematic Reviews, Issue 2. Art. No.: CD000363. DOI: 10.1002/14651858.CD000363.pub2.

²¹USAID & CDC (2011). The President’s Malaria Initiative. Fifth Annual Report to Congress. USAID, Washington, DC.

²²Anon. (2009). Monitoring and evaluation Indicators to be used within the President’s Malaria Initiative. Unpublished document.

Because of the change in case management policy toward a positive diagnostic test as a prerequisite for treatment,²³ a new, more appropriate indicator for case management was introduced, namely “Proportion of children under 5 years old with fever in the last two weeks who had a finger or heel stick.” Still, the main indicator for case management was “Proportion of children under 5 years old with fever in the last two weeks who received treatment with ACTs within 24 hours of onset of fever.” PMI is still awaiting the development of a new indicator for case management by the MERG.²⁴ High priority should be given to establishing an adequate set of indicators for this important, costly, and demanding project component.

Objectives and Targets Following the Lantos-Hyde Reauthorization

With the reauthorization of PMI through the Lantos-Hyde Act in 2008, the objectives were updated. The Lantos-Hyde malaria strategy issued by PMI in 2010 for the period 2010-2014 defines the following new objectives:

- By 2015, achieve a 70% reduction in malaria burden (morbidity and mortality) in the original 15 PMI focus countries when compared with the PMI baseline established in 2006/2007
- Expand malaria control efforts to reach large areas of the Democratic Republic of the Congo and Nigeria and up to seven additional high-burden countries, achieving a 50% reduction in malaria burden (morbidity and mortality) in at-risk populations when compared with a 2009-2010 baseline

The objectives, which as before have no age-reference, now refer to both malaria morbidity and mortality, with clear baseline and target years. In contrast, the operational targets are those described above and have no timeline.²⁵

PMI'S M&E WORK WITH FOCUS ON OUTCOMES AND IMPACT

Strategic and Theoretical Framework

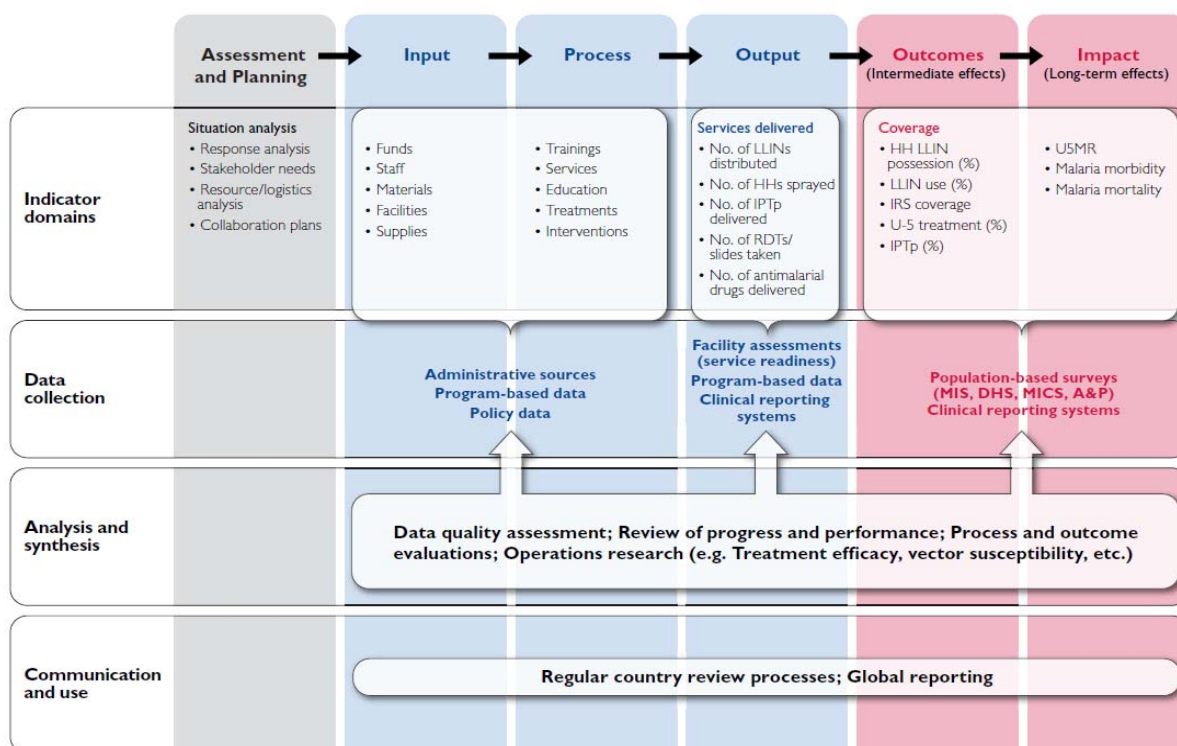
Throughout the history of PMI, all guidance documents on M&E have made reference to a classic planning, monitoring, and evaluation framework, as shown in the figure below.

²³WHO (2009). Parasitological confirmation of malaria diagnosis: WHO technical consultation, Geneva, October 6-8, 2009. WHO, Geneva.

²⁴PMI (2011). PMI Technical Guidance on M&E Activities. Unpublished document.

²⁵ USAID, CDC, PMI (2010). Lantos-Hyde United States Government Malaria Strategy 2009–2014. Unpublished document.

Figure 2. Malaria Monitoring and Evaluation Framework



Several studies and documents issued between 2000 and 2005 by RBM, WHO, and others observed that it was considered impossible to reliably measure malaria-specific mortality or morbidity in tropical Africa. In contrast, standardized demographic surveys allowed assessment of ACCM with known precision at the country level. Furthermore, it was assumed that indirect malaria mortality—which is, for example, mortality related to low birth weight due to placental malaria or mortality from other communicable diseases in young children, whose health has been degraded by malaria (i.e., mortality not presenting as directly caused by malaria and not measured as part of malaria mortality)—would account for a death rate in young children in Africa corresponding to 50% to 100% of direct malaria mortality.²⁶ This indirect malaria mortality could be reduced as a result of anti-malaria interventions and/or other health interventions (nutrition, pneumonia management, etc.).

Against this background, PMI’s need for a well-defined M&E strategy was addressed in an article on the RBM partnership prepared for MERG.²⁷ The authors recommend following trends in the coverage of malaria control interventions, other factors influencing childhood mortality, malaria-associated morbidity (especially anemia), and ACCM. The greatest emphasis was placed on the latter indicator in view of its measurability. They recommend that this indicator be measured at the outset of scale-up and every three to five years thereafter. In the final analysis, evaluation would have to be based on plausibility arguments. The approach would not quantify the impact of individual initiatives: “Our philosophy is that if mortality is significantly reduced, the country and all participating initiatives should share the credit.” This principle has been respected by PMI ever since—to its credit.

²⁶WHO, UNICEF & RBM (2005). World Malaria Report 2005. WHO, Geneva.

²⁷Rowe, A., et al. (2007). Viewpoint: Evaluating the impact of malaria control efforts on mortality in sub-Saharan Africa. *Tropical Medicine and International Health*, 12(12), 1524-1539.

A related modeling exercise estimated that if direct malaria mortality, assumed to account for about 22% of ACCM, is reduced by 50% in populations exposed to high-intensity malaria transmission, ACCM would decrease by 17% (12% to 25%).²⁸ Further models led to the assumptions used in the Lives Saved Tool (LiST) model,²⁹ employed in PMI's impact evaluation in Tanzania. The protective efficacy of ITNs in relation to direct malaria mortality in the 1-59 month age group was estimated at 55% (range 49-61%). The impact of IRS was estimated to be the same on the basis of one trial comparing the two interventions. IPTp and ITNs for pregnant women are modeled to have the same effect of reducing prevalence of low birth weight in first and second pregnancy by 35%; the best coverage indicator is considered to be the proportion of pregnant women protected by ITN and/or IPTp (suggesting, surprisingly, that there is no additive effect). The article argues that the coverage of ITNs should be assessed by the percentage of households owning at least one ITN.³⁰

More recently, case management has been reviewed for the LiST model. It was found that the effect of case management with ACT on reducing malaria mortality in young children would be 97% to 99% depending on age group. These estimates assume that the alternative to ACT is no antimalarial treatment (which seems highly theoretical); the authors note that they cannot be applied for estimating impact until standardized indicators for coverage of uncomplicated malaria episodes have been developed and applied.³¹

The earliest document prepared explicitly as guidance for PMI's M&E is not dated, but the contents suggest that it was written in 2008 or later. Contradicting the earlier official definition of objectives, which does not age-reference the mortality reduction, it states the PMI goal for countries as: "to reduce the estimated number of deaths in children less than 5 years of age caused by malaria by 50%."³² The framework for impact evaluation follows that proposed by Rowe et al. in 2007, with more detailed discussion of confounding factors.

The choice of ACCM as the main measure of impact is well justified for two reasons: (a) with very large investments, the financiers (U.S. taxpayers) have a right to know about the results measured in a way that is accurate, reliable, and applicable in all beneficiary countries; and (b) the use of a reliable measure of impact provides a good basis for applying statistical models in evaluation to arrive at a better understanding of the effectiveness of different interventions. This allows feedback to mathematical models to predict impact, carry out cost-effectiveness assessments, and ultimately, control policy. However, this exclusive focus on childhood mortality is problematic. An estimation of the age-distribution of the malaria burden in Africa based on several sources indicated that in the year 2000, 35% of malaria deaths and 49% of malaria cases occurred in persons aged 5 years or more (with a disproportionate burden in school-age children).³³ As effective control leads to a shift toward lower transmission with slower acquisition of immunity, these figures are likely to have increased since. The strategic choice of focusing impact evaluation on ACCM was correct, but the neglect of the hidden and

²⁸ Rowe, A., & Steketee, R. (2007). Predictions of the impact of malaria control efforts on all-cause child mortality in sub-Saharan Africa. *Am.J.Trop.Med.Hyg.* 77 (Suppl 6), 48–55.

²⁹ Fox, et al., eds. (2011). Application of Life Saved Model (technical inputs, enhancements and applications of the Lives Saved Tool (LiST) Reviews. *BMC I Suppl* 3.

³⁰ Eisele, T.P., et al. (2010). Protective efficacy of interventions for preventing malaria mortality in children in *Plasmodium falciparum* endemic areas. *International Journal of Epidemiology*, 39, i88-i101.

³¹ Thwing, J., et al. (2011). Protective efficacy of malaria case management for preventing malaria mortality in children: a systematic review for the Lives Saved Tool. *BMC Public Health*, 11, (Suppl 3): 5-14.

³² PMI M&E Team (undated). President's Malaria Initiative Monitoring and Evaluation Strategy 2005-2010. Unpublished document.

³³ Breman, J.G., et al. (2006). Conquering malaria. Chapter 21 in: D.T. Jamieson, et al., eds. *Disease Control Priorities in Developing Countries* 2nd ed. The World Bank and Oxford University Press, Washington, DC.

poorly estimated malaria burden in older children and adults in nearly all reports and communications from PMI conflicts with the initiative's goal and objectives as originally formulated.

The strategy does take note of the need for malaria surveillance: "with the changing epidemiologic picture in several of the focus countries, PMI M&E strategies must also be similarly adjusted. As malaria transmission is reduced, the ability for health facilities to report cases of malaria as they are diagnosed and for the NMCP to rapidly respond to outbreaks becomes critical."³⁴ It identifies sentinel surveillance as one of the main approaches to strengthening surveillance in countries and to providing useful data for PMI evaluation. However, sentinel surveillance was later considered to have not lived up to expectations, as the majority of the cases reported at those sites were not confirmed parasitologically, or the quality of diagnosis was considered uncertain. Except in Benin, Madagascar, and Uganda, where the approach had performed well,³⁵ it was decided to "transfer ownership" to the respective NMCPs. It will be interesting to see what role sentinel surveillance will play in the future, but the team agrees with PMI staff that sentinel surveillance—which is often limited to sites with atypically good standards of case management—is not the ideal long-term approach.

The strategy included the use of verbal autopsy data from demographic surveillance sites and in some cases from surveys. Caveats related to these techniques were emphasized, and based on accrued data, it was later decided not to use verbal autopsy information.³⁶

Surveillance was certainly not abandoned. The 2010 (and 2011) M&E guidance includes a useful distinction between three kinds of monitoring activities:

- Monitoring programs carried out by NMCPs, local governments, contractors, and grantees
- Monitoring the efficacy of antimalarial drugs and insecticides for vector control
- Malaria surveillance based on laboratory-confirmed malaria cases and deaths

Furthermore, these guidance documents include "stratifying malaria risk based on disease morbidity and mortality data" under capacity building and health system strengthening. The inclusion of stratification is formulated almost as a new terrain for PMI, but a reading of MOPs indicates that in reality, PMI and NMCPs have paid attention to the epidemiological variations for years (in, for example, highland areas and urban areas). It is strange that it seems to be assumed that stratification should be based only on morbidity and mortality data because (a) so many PMI documents rightly point out the inadequacy of most epidemiological information systems, and; (b) there is ample evidence that malaria control and epidemiology is strongly influenced by climate, physiography, and human ecology. For example, private health care providers tend to be more important in urban areas; it may be difficult to achieve high usage of mosquito nets where the nights are very hot or where the mosquito nuisance is minimal, as is often the case in highlands.

A draft M&E strategy document based on the Lantos-Hyde Act and Malaria Strategy was shared with the evaluation team.³⁷ It differs from previous strategy documents in its firmer commitment to malaria surveillance and the use of malaria morbidity data for decisions on where and when to target interventions. The document proposes more attention to exploring

³⁴PMI M&E Team (undated). President's Malaria Initiative Monitoring and Evaluation Strategy 2005-2010. Unpublished document.

³⁵ PMI M&E Team (2010). PMI Sentinel Site Assessment and Recommendations. Summary Document for all Countries. Unpublished document.

³⁶Anon. (2010). PMI Technical Guidance on M&E Activities. Unpublished document and similar, almost identical guidance document, issued 2011.

³⁷ PMI/CDC/ME: Draft SME 2.0 Strategy Document, 2011.

the potential of new (or less used) technologies, including polymerase chain reaction (PCR) and serology. Of these, PCR should theoretically be useful in elimination; in Cambodia, it has proven extremely expensive and the utility remains unproven (unpublished data).³⁸ Serology as an epidemiological tool has been tried out many times and has rarely proven useful.

The M&E strategy document proposes impact evaluations that are based on ACCM and occur every five to seven years. This is surprising. First, the fact that it is difficult to estimate malaria mortality in higher age groups is not a reason for pretending that it does not exist or that it is unimportant. Second, the development of good malaria surveillance is no longer an option; rather, it is an imperative if resurgences and outbreaks are to be detected early. Third, the relevance of ACCM is bound to decline; in simple terms, once malaria mortality has been halved, it will contribute only about 10% to ACCM. With so many other factors influencing it, ACCM is not a plausible cornerstone for malaria control evaluation, although it certainly must be watched closely. Finally, the long intervals between evaluations based on ACCM are unsatisfactory for the audiences and compromise the early detection of problems.

Operational Principles and M&E Implementation

The M&E Strategy 2005-2010 recommends that each PMI country team have a documented monitoring plan that details which indicators will be collected by which partners, as well as the data sources and timeframe for reporting. Scrutiny of a non-random sample of about 50% of the MOPS (those from 2006, 2009, and 2011) by the evaluation team revealed that this has been fully respected. These monitoring plans should include “a survey with biomarkers every two to three years,” and this has also been accomplished.

This strategy enunciates the following principles (abbreviated here):

- Work closely with the NMCP and within existing NMCP strategies and plans
- Work with the MOH to ensure that the NMCP M&E plan is coordinated with the overall MOH M&E plan
- Strengthen capacity of the NMCP and other national institutions and staff to address challenges related to M&E for malaria control efforts
- Coordinate closely with the NMCP, other national and international partners, and others, including NGOs and the private sector
- Support M&E related to all national malaria prevention and control measures and efforts, not just those attributable to PMI funding
- Coordinate PMI-supported M&E activities with those of other USG programs and initiatives, such as the PEPFAR, whenever possible

³⁸ Schapira (2011). The nested PCR used in Cambodia has a cost of U.S. \$20 per test, which includes the collection of samples, follow-up of positive cases, and overhead. Report on an external evaluation of the project strategy for the containment of artemisinin-tolerant malaria parasites in Southeast Asia (ARCE) 2009-2011. Unpublished document, available from WHO.

These principles demand substantial time, commitment, and good will from PMI in-country staff. As far as the evaluation team could assess, and judging from the perusal of MOPs and feedback from national program staff and partners, PMI has done its best to coordinate on these fronts in most countries. The priority has rightly been to work closely with the NMCPs; coordination with, for example, NGOs, the private sector, and other USG programs has probably not always been as developed as it could have been. That said, all such collaboration has transaction costs and it is necessary to prioritize.

It is also stipulated in the document that each country team should produce an annual report from each country, with data and analysis “that examines progress and trends, and points out areas for improvements or enhancements in the coming year.” Such reports are available only for the first couple of years. Later on it was decided to integrate such reporting in the MOPs. In fact, the MOPS usually do include a review of progress, achievements, and the current malaria situation in the country. However, these reviews are brief and tend to abstain from analysis of strategic directions. In 2008, PMI started a country results review process to monitor pipelines, key accomplishments, and challenges. Finally, the annual reports to Congress on PMI include essential output data by country.

Based on the reviews of M&E work in the MOPs, it can be seen that the activities fall into four major categories:

1. Routine monitoring of inputs and outputs, which does not seem to have posed a major problem, probably due to the strict requirements for implementing partners to report, along with effective management systems that have been trained and honed in other USAID projects. However, in some areas, there is room for improvement. IRS reports, for example, go into great detail on the number of people trained, how transport problems were addressed, and, not least, environmental safeguards. There is generally less attention to classic, simple indicators such as number of houses sprayed per worker per day, assessment of surface areas, or volume of insecticide used per household.
2. Entomological and drug resistance monitoring, which are usually well-planned activities carried out by specialized teams. There are signs that PMI has been particularly successful at strengthening capacity for entomology in several countries, for example, in Ghana, Ethiopia, and Senegal. Entomological and drug resistance monitoring could probably be further improved if handled as a research activity rather than as part of routine program monitoring. Such an approach would ensure competitive bidding, timely reporting, and a greater interest in the scientific basis of, for example, the unsolved problem of determining optimal spatial and temporal distribution for these activities. For many years, WHO has advocated that these activities be part of “routine program work.” That they are necessary on a continuous basis is incontrovertible. But the technical demands are now so high that they are practically always outsourced to scientific institutions.
3. Population and health facility surveys are in most cases outsourced to experienced implementing partners, which deliver on time. This component typically takes around 50% of the M&E budgets, but is perceived as a good investment, as the returns are predictable. However, the health facility surveys, which in contrast to household surveys are scheduled according to the need for information, have in many countries been infrequent; there is a need to re-think their planning, the timely use of the data collected for improving programs, and the possible use of LQAS and/or data collection through routine supervision.
4. Strengthening of HMIS and malaria surveillance, which is associated with health system strengthening and national-level capacity development. This is the most challenging component. In many MOPs, the title of the activity is something like “strengthening national capacity for surveillance/HMIS,” etc., in some cases repeated year after year. In this area, it is easy to agree on principles and difficult to make a lasting significant difference. Progress

requires intense focus, with attention to detailed situation analysis and quality dialogue leading to the definition of measurable, achievable targets and milestones. While external partners play a limited role in strengthening human resources in the general health system, it may be easier—though certainly not easy—to boost central specialized teams through technology, technologists, salary supplements, and trainings. Highly centralized information systems are not ideal, but may be the best option in some cases; modern technology can make it possible to receive and process large volumes of data at a central level and provide rapid feedback to the periphery on achievements and problems. In this it must be recognized that technology alone will not solve problems related to health worker adherence to norms. A system perspective is essential for situation assessment as well as for strategy development. Thus, while local and national situation analysis is paramount in this area, there is also an important scope for PMI-wide learning and development.

Planning of Outcome and Impact Evaluation

While the theoretical basis was elaborated at the start of PMI, the planning of impact evaluations has taken some time to get off the ground. The following description is based on the latest M&E guidance documents, presentations given by CDC and USAID staff, and interviews with senior CDC M&E staff.

- According to the 2010 and 2011 guidance documents, the PMI impact evaluation will be carried out after the first five years of PMI implementation (2006-2010) in each of the 15 countries.
- PMI will take the lead together with respective NMCPs and will also collaborate with MERG and RBM partners.
- An ad hoc technical advisory group will be established, and the evaluations will be reviewed by global partners.
- It is expected that an in-country technical partner will be identified to assist with the logistics of coordinating in-country activities, including meetings and data compilation. ICF MACRO or an appropriate in-country partner will take the lead in data analysis in each country. If capable, the local partner will also assist with the analysis and report writing.
- Single or combined country reports will be submitted to a scientific journal for publication.
- A summary report covering all 15 countries will be prepared in 2014.

The first report, from mainland Tanzania, is available as a draft, which has been shared with the evaluation team. It is reviewed below.

A timeline with approximate start- and end-dates is as follows:

2011	2012	2013	2014
Tanzania (Mainland) (6/10-6/11) Malawi (1/11-11/11) Zanzibar (6/11-12/11) Angola (3/11-1/12) Rwanda (5/11-3/12) Senegal (5/11-5/12)	Ethiopia (11/11-8/12) Benin (12/11-10/12) Mozambique (12/11-10/12) Uganda (2/12-12/12) Ghana (3/12-1/13) Mali (3/12-1/13) Liberia (5/12-3/13)	Zambia	Kenya Madagascar 15 country reports

The main point is to compare ACCM before and after the achievement of high coverage of main malaria control interventions. If a high level of coverage was achieved in a given year, then the demographic survey to assess ACCM should take place at least three years after that year,

because the measurement of child mortality is valid for a period of three to five years before the time of the survey. Given the timing of scale-up, the “post” surveys had to be timed to the years 2010-2013. It takes about a year to finalize the work-up of the data from these surveys. Thus, the final impact evaluations could not take place before the dates indicated above. This point was not made clear in PMI’s early M&E strategy documents. Had it been, there might have been more attention to preliminary assessments based on careful use of data from health information systems and focused studies.³⁹

Impact Evaluation Report on Mainland Tanzania

The draft report has been shared with the evaluation team. The main data are from four national population-based surveys (1999, 2004/2005, 2007/2008, 2009/2010). These are supplemented by programmatic data, small-area studies, and other survey data. The main findings are:

ITN Use

Between 1999 and 2009/2010, ITN use by children under 5 and pregnant women reached 64% and 56%, respectively. Thus, this intervention is moving toward the PMI target of 85%. This should have been achieved in 2010, but there is still some way to go.

IPTp

Since its introduction in 2001, IPTp (two doses) coverage rose from 20% of pregnant women in 2004 to 25% in 2009. This low achievement contrasts with high attendance at ANC services and is ascribed to a combination of problems with ANC supplies and inconsistencies between ANC guidelines and malaria guidelines, leading to confusion among health workers.

Case Management

Mainland Tanzania switched from a failing drug (chloroquine) to more effective therapies: SP in 2001 and artemether-lumefantrine (AL), an ACT, in 2006. Procurement delays in 2009 led to widespread stock-outs at the health facility level in late 2009 and through much of 2010. By mid-2010, most AL in the country was obtained through emergency procurements funded by PMI. In 2009/10, a survey found that 27% of children under 5 with fever were treated with ACT the same day or the day following fever onset. This data point is difficult to assess, because the policy from 2008 was that all patients with suspected malaria should receive antimalarial treatment, if a diagnostic test was found to be positive. However, RDTs had been implemented in less than a quarter of regions by the time of the 2009/2010 survey. There was an increase in percentage treated with an effective antimalarial drug, but the achievement remains far from the target.

IRS

This intervention reached over 90% of targeted households every year in the target areas. This achievement therefore satisfied the so-called PMI target for 2010. If this proportion applies approximately to each target community, it can be assumed that all the populations targeted were protected, based on the old rule of thumb that a village is protected if more than 80% of structures are properly sprayed. From the data presented in the report, the following can be inferred on the premise that the national population of Tanzania was 42.4 million in 2009: In 2008, 500,000 people (1% of national population) were protected; in 2009, protection rose to 2.2 million (10%) and in 2010, to 6 million (14%). A case study from the Kagera region in northwest Tanzania based on examination of the numbers of positive blood smears among in- and out-patients at hospitals in districts shows that the following: malaria was highly seasonal in

³⁹Rowe, A.K., et al. (2009). Caution is required when using health facility-based data to evaluate the health impact of malaria control efforts in Africa. *Malaria Journal*, 8:209.

some but not all the targeted districts; and slide positivity in absolute and relative terms decreased sharply after the initiation of IRS and remained low (from about 2% to 20%) during and after annual spray rounds. The effect was present, but not equal, in the three districts. Unfortunately, no information is given on ITN coverage in the sprayed areas, so it is difficult to draw any lesson for the program.

Parasitemia

Large-scale (but not nationally representative) surveys by the NMCP found that parasite prevalence in children under 5 declined from 19.4% in 2006 to 16.1% in 2008. In six districts of Lindi and Mtwara regions, all age malaria prevalence halved (from 50.5% to 26.5%) and prevalence in infants aged 2-11 months fell by two-thirds (from 57.3% to 19.2%) between 2004 and 2007. Repeat cross-sectional random surveys in the Ifakara DSS area found a decline in all-age malaria parasitemia from between 18% and 25% (2001-2004) to 4.6% in 2009 and 3.7% in 2010.

Anemia

The DHS surveys found that the prevalence of severe anemia (Hb<8g/dL) among children under 5 has been halved, falling from 11% in 2004/2005 to 5.5% in 2009/2010. The relative decline was greater in rural (54%) than in urban areas (24%) and was largest in the age group (6-23 months) most vulnerable to malarial anemia.

ACCM

The ACCM rate nearly halved, from 148 per 1,000 live births in 1995-1999, to 81 in 2005-2009. The decline appears to have commenced around 1999-2000. From the 2004-2005 survey to the 2009/2010 survey, the under-5 mortality decreased from 112 to 81 per 1,000 live births (28%). Significant reductions in child mortality occurred in all age categories, but the gains are greatest in the 1-11 month age group. An ecological analysis of mortality change by malaria risk (proxied by 6-59 month malaria parasite prevalence in 2007/2008) shows a larger mortality decline, from a higher baseline in areas of higher/intermediate malaria risk as compared to lower-risk areas.

Case Studies

A case study from Mtwara and Lindi regions describes a steep reduction in malaria parasitemia in children under 2 years of age associated with ITN scale-up. There are new research data showing decreases in malaria and other infection burdens, which should be incorporated into the report.⁴⁰

Potential Confounders

Mean annual rainfall showed large variations from year to year, but no systematic change over the period 2000-2009. Tanzania has experienced compound GDP growth of 42% over this period, and economic models predict that this should be associated with a 16% (13%-19%) decline in under-5 mortality (around one-third of the actual mortality decline observed). Nutritional status improved over the last 20 years, but this is difficult to disentangle from economic growth on the one hand and reduced malaria incidence on the other. According to the draft PMI report, exclusive breastfeeding and vitamin A supplementation could also have contributed to mortality reduction.

Modeling

According to the LiST model, over the period 1999-2010, scale-up of ITN ownership is estimated to have prevented approximately 68,000 (37,000-104,000) deaths in children 1-59

⁴⁰Mtove, G., et al. (2011). Decreasing incidence of severe malaria and community-acquired bacteraemia among hospitalized children in Muheza, northeastern Tanzania, 2006-2010. <http://www.malariajournal.com/content/10/1/320>.

months; ITN use by pregnant women was estimated to have saved an additional 1,500 (700-2,400) lives of children under 5 (including neonatal deaths due to low birth weight). These averted deaths represent 15% of the reduction in ACCM that occurred between 1999 and 2009.

The report concludes that there is a plausible association between the scale-up of malaria interventions, reduction in malaria morbidity, and decline in all-cause under-5 mortality during the period 1999-2009/2010. A major portion of the mortality decline observed is plausibly associated with malaria control, although economic growth, breast-feeding, and vitamin A supplementation are also thought to have contributed. The model results underestimate the impact of malaria control interventions, as it omits the gains associated with improved treatment efficacy, the impact of IRS, and the impact of reduced malaria burden on “indirect” malaria mortality.

Critical Assessment of the Report

This report is a solid piece of work, which fully implements the impact evaluation strategy adopted by PMI. It is more objective and scientific than any other comprehensive country-level evaluation published in recent years. However, it has some weaknesses.

In its language, it tries in several places—for example, in relation to IPTp and case management—to give a favorable presentation rather than bluntly pointing out failures in implementation. The evaluation team accepts that it is hard to change health service access and people’s behavior over a short time span, but is less accepting when an intervention as simple as IPTp is not scaled up despite high levels of ANC attendance.

There is no assessment of the impact of IRS and of case management. As population coverage of IRS is well known, it could have been modeled, assuming that its effect is additional to that of ITNs, which is what is suggested by trials elsewhere in Africa. Case management would be more difficult, but assumptions could be generated on the relationship between the use of ACTs and other antimalarial treatment for febrile episodes and their use for malaria.

The small reduction in infant mortality ascribed to ITNs in pregnancy should probably be considered as indirect malaria mortality. More generally, an attempt should also be made to model indirect malaria mortality. Although the uncertainties are great, this could be expressed by reporting upper and lower bounds.

Among the potential confounders, female literacy, which could reduce ACCM, and urbanization, were not analyzed.

In the conclusions, the reported mortality reduction that is being “plausibly associated with malaria control” is overly cautious language. After all, the cautionary note, “can be attributed to” would be more in line with the findings. In fact, apart from the use of household ownership of ITNs, the analysis of the ACCM reduction attributable to malaria seems to be so conservative that it may be closer to a lower bound than to a plausible midpoint estimate. The conservative nature of the estimates should be explained more fully. Also, an interpretation should be made on the proportion of malaria mortality in young children that is currently averted through malaria control interventions. This can be estimated through modeling and comes closer to the objective of PMI than the estimation of ACCM reduction, which is also based on modeling. Finally, the question of the impact on malaria mortality in older age groups should be addressed.

Evaluation Team Assessment of Outcomes and Impact

Summary of Country Assessments

Reference is made to Annex E, which provides simple assessments based on graphing of available data and, in some cases, review of relevant publications. The main conclusions from that exercise can be formulated as follows.

In the following countries, there is some evidence of impact with a plausible time relation to scale-up of interventions, also after the start of PMI: Angola, Kenya, Malawi, Rwanda, Senegal, Madagascar, Tanzania, and Zambia.

Other countries have achieved high coverage rates of one or more interventions, making it almost certain that once data has been accrued, it will be possible to document impact: Ethiopia, Uganda, and Mali.

In some countries, it is not possible to comment on impact at this stage: Benin, Ghana, Liberia, and Mozambique.

Achievement of Outcomes

The total population of all the PMI countries (Oromia alone representing Ethiopia) is 438 million. The median ITN coverage rate (percent of children under 5 sleeping under ITN night before survey) according to latest survey (2006-2011) is 49.9% (Annex E); applying this proportion to the total population yields 218 million persons protected. The real figure is likely to be higher, as some of the surveys date back to 2006 or 2007, and coverage has tended to increase from survey to survey. This is above the figure of 175 million residents foreseen in the original planning framework. However, the coverage rates are far from the 85% foreseen. In many countries, ITN coverage rates are approaching but not reaching 85%. For all other interventions, they are far from that standard; in fact, in most cases these rates are below 50%. For case management, this may be related to the difficulty of measurement; in contrast, for IPTp, which is a simple and inexpensive intervention, reasons for the low coverage rates found in most countries need to be identified. They may be related to continued lack of confidence on the part of population or providers (problems that can be addressed), late first attendance at ANC services, inadequate managerial attention, and/or continued uncertainty about policy.

Achievement of Impact

There is nothing in the epidemiological or health system situation in Tanzania that is radically different from other countries in tropical Africa. With persistence in implementation, the results obtained in Tanzania should be replicable in any of the other countries. Based on PMI's conservative Tanzania impact evaluation, the evaluation team notes that the ACCM has decreased from 148 to 81 deaths per 1,000 live births—i.e., by 67 deaths per 1,000 live births—from 1999 to 2009. According to the LiST exercise, at least 15% of the lives saved are saved because of malaria control, i.e., 10 deaths per 1,000 live births per year. With a crude birth rate of 42 per 1,000 (United Nation Population Division) and a population of 42.4 million, mainland Tanzania would have avoided 17,815 deaths in 2010 due to malaria control interventions. If this is extrapolated crudely to the total population of the 15 current PMI countries, the number of lives saved per year would be over 170,000. However, it is likely that in some countries with large populations living in areas with unstable malaria, especially Ethiopia, the number of lives saved among children will be lower, but there will be deaths averted in higher age groups. Tanzania is a Round 1 country, which was more advanced in malaria control than most other PMI countries.

The original objective of PMI—to save 140,000 lives per year by 2011—is unlikely to have been achieved. However, with continued robust scale-up and quality implementation, it is likely to be met within two to three years.

Summary Findings

Outcomes and Their Monitoring

PMI, together with national programs and partners, has been successful in scaling up ITNs (mainly in the form of LLINs), increasing coverage levels. Implementation and monitoring systems work well for this intervention. However, the achievements have been variable. In a few countries, the coverage rates are surprisingly low against a background of repeated mass distributions; in others, there is still a need for filling gaps or replacing old LLINs. The target of 85% has not been reached in any country, and it may now be time to reconsider, whether this high level is a realistic standard. In contrast, the coverage rates for IPTp are disappointingly low. The exact reasons for this probably vary from country, but it is the evaluation team's impression that in general there is a need for a stronger managerial focus in relation to this intervention. For case management, PMI has been investing considerably, but there is an urgent need for revising the monitoring framework. With its resources in clinical epidemiology and field research, PMI is in a good position to carry out operational research to address this problem. PMI has supported health facility surveys in all countries, but it is not clear how the data has been used for the improvement of day-to-day implementation or in assessing the coverage of adequate case management. There is a need for review of the approach. The monitoring of IRS has generally been easy and straightforward, although as noted above, there is some room for improvement in the operational details. More attention should be given to the indicator for population coverage with vector control (IRS or ITNs). Furthermore, the relevant indicator for population coverage with ITN and/or IRS seems to have been neglected.

Impact

In 8 of the 15 PMI countries there are signs that the malaria disease burden has been reduced and/or that ACCM has declined since malaria control interventions began to be systematically scaled up around 2003-2004. The Tanzania report provides solid evidence that scale-up of malaria control has led to a major reduction of ACCM, which has fallen by approximately 10 deaths per 1,000 live births. The team considers that the evaluation report draft is overly conservative and has identified a lower bound for the reduction in ACCM attributable to malaria control. Further analysis, it is hoped, will make it clearer whether the reduction is consistent with a halving in malaria mortality. The operational achievements in Tanzania do not look particularly outstanding compared to the other countries, most of which joined PMI later. It can therefore be predicted with confidence that similar results are likely to be found in other countries.

Strategies for Impact Evaluation

PMI's strategy for impact evaluation has been centered on the measurement of changes in ACCM and examination of the plausibility of attributing ACCM reductions observed to the implementation of malaria control interventions. The evaluation team considers this approach appropriate for the early phase of scale-up of malaria control in high-burden countries in Africa, but has a number of reservations, as follows:

Given that the objective of PMI's first phase has explicitly been to reduce malaria mortality (not malaria mortality in young children), there should have been from the outset an attempt to also assess the mortality burden in higher age groups; at the very least, it should have been acknowledged that the problem exists.

There is a contradiction between the rhetoric about involving programs and partners in impact evaluation and the rather rigorous framework based exclusively on the LiST model, which is applied in assessing number of deaths averted without any questioning of its assumptions. It is, for example, assumed that the effect of ITNs in pregnancy is such that IPTp has no additional

effect when a woman is protected with the former or vice versa.⁴¹ This is at odds with global technical recommendations and PMI policy that pregnant women in highly endemic areas should be protected by both. IRS is in practice not considered in the modeling and there has not been an attempt at setting up a pragmatic ad hoc framework for modeling the effect of case management, although there is no lack of models in the literature.

As for the future of impact evaluation—meaning a second-phase impact evaluation in countries such as Tanzania, where there is evidence for a substantial reduction of malaria mortality in young children—it is the evaluation team’s opinion that it should no longer be centered on ACCM, but rather make use of a range of data sources, including ACCM, to assess trends in malaria incidence and mortality. This is consistent with the change in PMI’s objectives, which now include reduction of malaria morbidity, not only mortality. This means that one major priority for PMI should be to improve malaria surveillance and involve scientists in modeling work to be able to better use surveillance data on prevalence, incidence, and mortality to model disease burden. The team does not consider surveillance to be synonymous with the use of data generated by health services (“passive case detection”). In accordance with Langmuir’s classic definition, surveillance includes surveys and other special studies, whenever necessary, and analysis that results in public health action. The balance between surveys and health service-generated data must be determined in each country, sometimes with intra-country differences. The more epidemic-prone the malaria situation, the more important passive case detection becomes. The weaker the health system, the more necessary it will be to rely on surveys.

Economic evaluation is an area that so far has been neglected by PMI and was hardly addressed by the evaluation team. There is a need, and there are opportunities due to the number of countries involved, to undertake various studies of cost-effectiveness and cost per defined outputs and outcomes. Such studies will have major implications for policies and the refinement of best practices.

⁴¹ Eisele, T.P., et al. (2010). Protective efficacy of interventions for preventing malaria mortality in children in *Plasmodium falciparum* endemic areas. *International Journal of Epidemiology*. 39:i88–i101
doi:10.1093/ije/dyq026.

V. OPERATIONS RESEARCH ACTIVITIES

Contents

1. Introduction: The Role of Research in PMI and the Global Malaria Response
2. Research Structure in PMI
3. Clarity of Research Agenda
4. Conclusions
5. Recommendations

INTRODUCTION: THE ROLE OF RESEARCH IN PMI AND THE GLOBAL MALARIA RESPONSE

Research activities are essential to a successful malaria response. The USG has made a commitment to reducing the global burden of malaria in part through the support of a widespread, coordinated, and collaborative approach among U.S. governmental agencies. The list of USG organizational actors (HHS through the National Institutes of Health [NIH] and CDC, DOD through the Naval Medical Research Center and the Walter Reed Army Institute of Research, State Department through USAID) contains a tremendous amount of scientific talent and significant financial resources for malaria research. These government agencies are complemented by the research institutes, universities, private companies, and NGOs, both domestic and international, which also contribute to malaria research.

Every major organization, in almost every document, stresses the importance of a high-quality, focused, and relevant research enterprise complementing the intervention activities of national malaria control programs. The RBM Partnership Global Malaria Action Plan⁴² names research as one of the three components of the global strategy. Research is part of both the control and elimination strategies and is supposed to both inform policies and improve operational implementation. It also is meant to create new tools. The USG GHI Strategy Document⁴³ calls for program-based monitoring and evaluation and the promotion of research as two of the seven pillars of GHI. These pillars are seen as central to aid effectiveness and essential for accelerating results. PMI's own original Strategic Plan (July 2005)⁴⁴ recommends "targeted studies and evaluations to improve program effectiveness" as one of the five "proven and effective approaches" to meeting the mortality reduction goal. The Lantos-Hyde Malaria Strategy 2009-2014⁴⁵ explicitly directs PMI to "conduct operational research that helps overcome implementation bottlenecks, contributes to the scale-up of malaria control activities, and identifies the most cost-effective mix of currently recommended interventions under different malaria transmission strategies." In the Hyde-Lantos Act itself, "impact evaluation research," "operations research," and "program monitoring" are defined.

Given this widespread engagement and explicit guidance from both the Global Partnership and USG legislation and strategy, one would expect PMI to have a well-defined, clearly articulated,

⁴² <http://www.rbm.who.int/gmap/gmap.pdf>.

⁴³ <http://www.pepfar.gov/documents/organization/136504.pdf>.

⁴⁴ http://www.pmi.gov/resources/reports/strategic_plan.pdf.

⁴⁵ http://www.pmi.gov/resources/reports/usg_strategy2009-2014.pdf.

robust research agenda by this point in its evolution. The PMI evaluation team acknowledges that PMI is engaged in malaria research, reporting in the Fifth Annual Report to Congress that 37 operations research (OR) studies have been approved as of April 2011 (Table 1, refer to Annex 4). At the same time, the team finds that PMI’s research enterprise lacks clear direction, a well-articulated research strategy, and inter-agency processes for decision-making around research activities that are working poorly. As PMI matures and enters its next phase, focused on maintaining and improving on the mortality-reduction successes realized to date, PMI has even more responsibility to ensure it has a robust implementation and impact evaluation research program. The evaluation team strongly encourages PMI to expand the research agenda. New operational and evaluation research that accounts for the changing epidemiologic situation that is occurring as a result of the successes to date—and acknowledges that the utility of key interventions will increasingly wane over time, due to increasing resistance—is essential new information, and PMI should prioritize generating it. PMI research needs to get out ahead of the biologic and programmatic threats to PMI’s continued effectiveness.

Table 7. PMI Operations Research Proposal Summary

Fiscal Year (FY)	Number of studies	Number of countries	Total budget (USD millions)
2006/2007	10	5	1.72
2008	15	8	2.24
2009	3	3	0.30
2010	5	3	2.78
2011	4	3	0.95

Note: Refer to Annex 4 for PMI OR proposal summary details.

This section of the report describes the team’s observations, based largely on interviews with PMI associated technical staff in Washington and Atlanta, as well as discussions with USG Missions, PMI implementers, and national malaria control personnel. This section features discussion of both the structural issues related to how PMI’s research enterprise is organized and the research content issues. Based on findings, the team offers recommendations to improve the contributions of the research effort to assist PMI in meeting its fundamental goal of reducing mortality.

PMI Research Structure

According to the Lantos-Hyde Reauthorization Act of 2008 (Stat. 2962 PL 110-293), the Global Malaria Coordinator is charged with ensuring that that operations and implementation research needed to support an effective global response to malaria and strengthen national control efforts is conducted and that this research complements the malaria-related research of the NIH. CDC is explicitly granted an advisory role on the identification of priorities and is identified as a “key implementer” of the research.

Prior to the enactment of the Lantos-Hyde Act, PMI established the CDC-USAID OR Committee, consisting of three senior scientists from each agency. The OR Committee had shared leadership and epidemiologic and entomologic research experience and expertise. The committee reports to the Coordinator. The Coordinator referred many of the research issues to the Deputy Coordinator, who served as Senior Technical Advisor and had extensive malaria research experience working on the bed net and IPTp trials in CDC’s Kenya field station. The OR Committee was charged with developing the strategy and associated technical guidance for the research program. Post Lantos-Hyde, the OR Committee continued to meet intermittently

and was responsible for incorporating Lantos-Hyde guidance into the PMI research strategy. This inter-agency working group was not considered one of the strongest or best organized by any group (PMI Coordinator's Office, USAID, CDC).

In addition to headquarters-level technical expertise, PMI sought to engage global academic communities and research institutions in the focus countries in strategic development, technical guidance, and implementation of research studies. A robust engagement with national scientific personnel was envisioned, working through pre-existing relationships with USAID and CDC personnel and new relationships stimulated by the country-specific needs determined by NMCPs and nurtured and managed by PMI resident advisors. The research component was seen as both part of program implementation and as a capacity-strengthening aspect of the effort. Country-specific research questions were to be identified through the MOP process, while identifying and addressing global questions were the responsibility of high-level technical expertise provided by CDC and USAID. As needed, U.S. and European institutions would be engaged in helping answer specific research questions in instances where they had comparative advantage and expertise.

CLARITY OF RESEARCH CONTENT IN PMI

Though Lantos-Hyde contains language defining program monitoring and research, the OR Committee seems to have struggled to clarify the technical boundaries for PMI's research program. Part of this lack of clarity may be due to unclear and diverging agency-specific definitions of program monitoring, OR, and impact evaluation research. There also appears to be differing opinions on the time frame for research questions and results, with some personnel strongly favoring short-term, implementation-based questions (largely, though not solely, USAID personnel), while others believed the research agenda should address future interventions and potential risks (largely, though not solely, CDC personnel). The lack of agreement on technical boundaries may also be due to different criteria between technical staff at USAID and CDC regarding relevance and quality, differences that are related to varying traditions within the respective agencies. The boundary between M&E and research is also unclear.

Operational definitions and time frame for PMI research activities. Given the lack of a clear PMI consensus on these issues, the evaluation team, based on its understanding of PMI's mission, review of the PMI documentation, and interviews with PMI staff and stakeholders, believes that the regulatory language of the Lantos-Hyde Act and the Lantos-Hyde USG Malaria Strategy form a suitable basis for clarifying the technical boundaries of PMI's research agenda. These core documents focus on "implementation bottlenecks," contribution to "scale-up," and identification of cost-effective approaches all within the "mix of currently [emphasis added] recommended interventions."⁴⁶ Overall, the evaluation team understands PMI to be primarily a programmatic initiative with clear, measurable outcomes. Its research activities should be focused on program needs, leaving the important, broad research questions to other institutions that are contributing to the broader malaria research agenda (non-PMI USG malaria activities through NIH, CDC, USAID, and others). The team believes that the vast majority of the PMI research program could be categorized as program-based "implementation research."

Modifying the WHO/TDR definition of implementation research, the team believes that PMI should prioritize research on the delivery of efficient, effective, and sustainable malaria control program services. The answers and approaches will be different in different nations as countries implement national malaria control programs. This expected variation reinforces the need to involve national research scientists and program personnel in local identification of research projects. At the same time, PMI has the advantage of working in a number of countries, which

⁴⁶ Lantos-Hyde USG Malaria Strategy 2009-2014 (2010).

provide ample opportunities for comparative, ecological, and multi-country research projects related to important common implementation problems.

Operations research, health systems research, and impact evaluation research are specific types of implementation research. OR should be limited to short-term studies that can rapidly generate information to improve program efficiencies within existing activities and interventions. These OR studies should have the potential to generate immediate, concrete effects on programs. They may be desk and or field studies and should normally include some modeling.⁴⁷ The studies on longevity of LLINs, which have been supported by PMI, are excellent examples of field-based operations research. Health systems research should focus on answering questions on the most appropriate structures for the malaria control components of the health systems, and on the policy processes, organization of health services, and modifications of human behaviors necessary to expand and improve existing malaria control interventions. Impact evaluation research, following Lantos-Hyde, should measure and assess the changes in population outcomes that can be attributed to the program interventions. In addition, far more systematic information on program costs needs to be collected to allow for rigorous economic evaluations of program strategies across multiple countries.

Monitoring data—defined as routinely collected program data on outputs, outcomes, and costs—should be used by implementation researchers to the greatest extent possible (particularly expenditure data, which is not currently widely available) so that research work is well grounded in actual programmatic realities whenever feasible. It should also be used for routine program monitoring and therefore should be shared among both the program personnel and research scientists/analysts.

Research that generates knowledge (whether next-generation malaria interventions or fundamental clinical, epidemiologic, entomologic, molecular mechanism, or genomic information) is essential for furthering malaria control; such research should continue to be part of the USG's malaria research investment. CDC, NIH, academic research centers, and private research institutions should all participate in this important research. At the same time, the evaluation team does not believe that PMI should be the financial mechanism supporting these types of inquiries, and encourages USAID, as the lead agency in this initiative, to work in close consultation with CDC, NIH, DOD, and academic centers to use PMI's programmatic experiences to inform the boundaries for this expanded research agenda.

PMI's research need—and potentially the area for its greatest research contribution—is program-linked implementation research, including operational and evaluation research, carried out in collaboration with national research institutions and scientists in PMI focus countries. The overall objective of this implementation research is providing support for NMCP efforts to reduce malaria mortality and morbidity. Research that tells programs how to improve access to and utilization of efficacious malaria control interventions by developing practical solutions to common, critical problems in implementation should contribute to the mortality reduction.

A number of important research question deserve immediate attention. There is an urgent need to improve measurement of effectiveness and cost-effectiveness of certain intervention combinations that are not yet standard, such as the combination of ITN and IRS in different settings. There is also a need for applied field research concerning insecticide resistance management and mitigation. This should not be considered basic research, as monitoring of insecticide resistance is recognized as an essential program component. PMI has access to a unique repository of insecticide resistance data and determinants across a number of countries and can work with other scientists on using this resource to generate new strategies. If

⁴⁷ Royston, G. (2011). Meeting global health challenges through operational research and management science. *Bull. WHO*, 89:683–688.

controlled trials of new insecticide combination strategies are warranted, PMI program activities might provide the best platform for implementing them. Unfortunately, there may also be a need in the future for research to better understand artemisinin resistance. With the probable changes in the age structure of malaria morbidity, there may be a need for a research and development component focusing on the integrated management of disease in school-age children in Africa. There is also a need for research around the control of malaria in older age groups where, according to some studies, the case fatality rate of severe malaria is higher than in young children. Some of these questions are appropriate for PMI funds while others may be more appropriately addressed using other HHS, USAID, or NIH monies. Having PMI-supported country activities serve as the research population and program base for future trials is different from actually implementing the studies.

One area of health systems research, which is urgently needed, concerns the strengthening of malaria surveillance. As much as this depends on national health services' performance and on national HMIS, there will be ample scope for learning across countries—for example, for developing and assessing new methods and using them to develop improved strategies to deliver existing interventions. The key point overall is that the PMI research agenda should be program- and policy-relevant, based on existing interventions, and conducted within relatively short time frames.

Institutional expectations for research. The evaluation team observed that the two collaborating agencies have differing *a priori* assumptions for the role of research in PMI. A portion of the failure to move the research agenda along more fully emerges from the different cultures and reward systems around research between the two institutions. The team does not claim one is right and the other wrong, or that one is better than the other, but does believe the differing beliefs create a management challenge that has yet to be overcome.

Though CDC has grown its global activities tremendously since the advent of PEPFAR and its engagement with GHI, and has personnel in 50 countries around the world, CDC is still fundamentally a domestic disease control technical and scientific agency that assists in global health and development. USAID is fundamentally an international development agency, with a focus on health that uses technical and scientific information to accomplish its health and development mission. Both have talented, well-motivated professionals committed to using their professional skills to improve the health of populations. In fact, the team noted with some surprise that the USAID PMI-RA personnel hold more academic doctoral (Ph.D.) level degrees with masters of public health (MPH) training than their CDC colleagues, who largely are trained as MDs and have widely varying levels of malaria or research experience. The team's analysis did not compare headquarter personnel assigned to PMI.

CDC technical personnel are expected to produce scientifically rigorous research that contributes to the global knowledge base. Their respect among their peers, and their progress through their agency, is in large part based on the quality and impact of the scientific work produced and presented in peer-reviewed scientific literature. USAID health personnel, in contrast, are expected to facilitate improvements in the health of populations globally; their progress through their agency is less influenced by their productivity as measured by publishing in peer-reviewed scientific literature. Because these two technical labor forces have different pathways to success and different agency-specific measurement criteria for promotion and advancement, it is not surprising they view the research component of a program intervention like PMI quite differently.

There was notable variation among CDC personnel on the appropriate role of research within PMI. While most strongly advocated for CDC to serve as the lead for this component, others, more quietly, suggested USAID was the appropriate agency to lead this component. Some CDC

personnel told us “you can’t do good research” under PMI. Others reported that working on PMI research was a “career ender” and a “dead end” within CDC. Some felt that USAID “didn’t understand good research.” On the other hand, USAID personnel were more consistent in their opinions regarding research. Many were concerned that CDC personnel lacked sufficient commitment to the research effort serving programmatic and implementation issues, and suggested that CDC personnel were more interested in “cutting edge” science that supported their own research interests and career advancement. Nearly all of them accepted the importance of rigorous evaluation to monitor and potentially improve program performance. Several health officers spoke of the importance of having a research component and engaging national scientists and institutions in the effort. Several USAID HQ staff referred to the January 2011 USAID Evaluation Framework guidance as an important improvement in USAID programming and seemed committed to an increased and improved focus on research consistent with the GHI pillars.

CONCLUSIONS

PMI’s research component appears to have lagged compared to other components. The lack of clear leadership on this issue between the agencies, the fundamental lack of clarity on the technical scope of the research program, the relatively dysfunctional nature of the OR Committee, and the differing institutional perspectives and cultures around research have all contributed to the problem. There is a fairly high level of frustration over this issue, particularly among headquarters personnel from each agency, and a sense from the field personnel that more should and could be done in this area.

There is a high priority need to clarify leadership roles, revitalize the inter-agency structure under more clearly defined leadership, and finalize the strategy and guidance for research activities, which has long been in development. The technical guidance documents are unlikely to be finalized until the underlying leadership and structural issues are addressed.

Inter-agency differences of opinion are problematic in general, but when they create a suboptimal environment and lead to low research productivity among all actors, they need to be addressed and sorted out. National programs have implementation issues that need to be investigated, national scientific organizations want to do more, and the global knowledge base regarding malaria control could benefit far more from the PMI program experience than has occurred to date. The evaluation team notes that all parties acknowledge difficulties in this area and efforts were revitalized in 2011 to address some of the issues. These very recent activities were not the focus or within the timeframe of the external evaluation.

The evaluation team believes PMI in its first five years could have better served the global malaria control community as a programmatic learning laboratory. PMI has extraordinary resources at hand to contribute high-quality information in support of the global malaria response. With the access to so much technical talent at CDC, USAID, and national partner research institutions, with resident advisors on the ground in focus countries, and with access to data from the best-financed and largest malaria intervention in history, the opportunity to contribute program-linked information was (and remains) tremendous. In almost any area, important questions are there to be answered. The extensive programmatic experience with combining ITNs with spray operations provides a unique setting for studies on effectiveness and cost-effectiveness studies of this approach. How to manage IRS operations amid increasing insecticide resistance is an important issue worth deeper investigation; initial investigations have already begun. There are numerous useful and important research questions that PMI should be addressing. PMI program experiences serve as a natural, large-scale, cross-country comparative laboratory for malaria, public health, health services, and health systems research. PMI has generated a data goldmine—and the delays in figuring out how to take advantage of this rich

opportunity and make major contribution to the global and national knowledge on malaria control are disappointing.

RECOMMENDATIONS

- PMI needs to clarify the inter-agency research advisory structure. CDC personnel believe the language of Lantos-Hyde gives it a leadership role in this area, while most USAID personnel believe that the responsibilities of being the PMI lead agency serve as a mandate for oversight over all components, including research. Clarifying this issue lies within the responsibilities of the Global Coordinator. Once this strategic issue is settled, the definition of the technical boundaries for research activities, along with articulation of the structure and technical areas, can be documented in a finalized research strategy document. It is important to create a mechanism to get greater field and external scientific inputs to the research agenda.
- Given that USAID is the PMI lead agency, the team recommends that leadership be vested in a senior, USAID professional with recognized research expertise. This person should be of sufficient scientific stature to command respect among CDC personnel and should have revitalization of the relationship with CDC as a priority action item. This person need not be a malariologist; in fact, it might be better if the person was a recognized expert in implementation and health systems research.
- The research component should be expanded to take advantage of the opportunity inherent in PMI's scope, resources, and structure, and the huge potential contribution PMI can make. The technical resources represented by PMI in collaboration with national research institutions with access to malaria program data create an institutional comparative advantage that contributes important knowledge to global and national malaria control efforts. This expansion should be based on PMI's allocating more resources directly or by advocating for an expansion of non-PMI funding for essential research.
- CDC should re-focus its effort and staff and re-commit to working enthusiastically with USAID and the national research institutions on a clearly defined and expanded research agenda. CDC needs to acknowledge that its institutional research interests, or the ongoing basic and laboratory research activities of some of its scientists from various branches, may play a relatively limited role within the PMI research agenda. These areas of interest within CDC, which are not immediately applicable to improving PMI program efforts, should be supported with other CDC Malaria Branch or global malaria research funds. As important as some of these issues may be for the global knowledge base, the evaluation team believes that the research agenda for PMI needs to be tightly focused on current operational issues that foster near-term program improvements. CDC needs to focus its resources on program-linked efforts—for example, operations, evaluation, and health systems research, including health economics. In addition, a considerable research and development effort is needed to strengthen national malaria surveillance, an area that falls squarely within CDC's area of core expertise.
- PMI should expand its use of national or international academic research centers and research institutes to accomplish its research mission. National research communities, including state sector, academic, and private sector institutions, should continue to be engaged, encouraged to generate program-linked questions, and strengthened to make contributions to the national program efforts.
- The PMI resident advisor with the appropriate skills (CDC, USAID, or FSN) should act as the focal points for research in each country, working together with national institutions, partners, and USAID personnel in-country to make sure that a PMI-specific research agenda is formulated, and that the implementation of the research is well monitored. The RAs

should also help advocate for additional, non-PM research funding to generate the resources required to address other important malaria questions.

- PMI is in an increasingly strong position to advocate for investment in basic and applied malaria research on issues that complement its internal research investments. PMI needs to carefully prepare its advocacy strategy, so that the full weight and authoritativeness can be brought into play to expand the global malaria research agenda.

VI. CONCLUSIONS AND RECOMMENDATIONS

Contents

1. Policy Recommendations
2. Technical Recommendations

Based on extensive document reviews, key informant interviews of U.S.-based and country-based personnel, field visits to five of the PMI focus countries, and extensive debate within the team, the evaluation team offers the following recommendations. The recommendations are divided into five policy recommendations and five technical recommendations.

POLICY RECOMMENDATIONS

1. Expand PMI's financial resources and geographic reach

- PMI is, by and large, a very successful component of the USG Global Health Initiative. The PMI team, including the Global Coordinator and Deputy, the technical leadership within the USG line agencies responsible (USAID and CDC), the technical and administrative personnel in Washington, Atlanta, and the Missions, and the country implementation partners (NMCP personnel, partners, and PMI contractors) have done a remarkable job using the initial PEPFAR and subsequent Lantos-Hyde Authorization to make substantive and substantial contributions to the global malaria response over the past five years. They quickly re-oriented a problematic USG malaria program, took it to a large scale quickly, efficiently and effectively complemented the larger global malaria program, and contributed to the apparent reduction in child mortality. Based on this performance, the deepening constraints upon other actors in the global malaria response, and the reality that reducing control efforts now would probably lead to resurgence in the burden of malaria around the world, the evaluation team believes that PMI should be commended for its efforts and rewarded with the privilege of receiving additional financial resources and the responsibility to refocus its programmatic agenda on low-income, high malaria burden countries.

2. Improve PMI organizational clarity on key programmatic issues to improve decision-making, efficiency, and effectiveness

- There are inter-agency organizational and programmatic issues that need to be addressed on a priority basis to improve technical and allocative efficiencies. Particularly in times when resources are unlikely to grow, efforts to improve organizational efficiencies and effectiveness are essential. Lack of clarity over responsibilities, along with interagency (mostly headquarters- level) conflicts over decision-making, has constrained PMI and led to inefficiencies, especially in the areas of research and M&E. The evaluation team strongly believes the presence of a lead agency improves the functioning of PMI relative to other USG development assistance efforts. The team encourages the Global Coordinator to clarify the roles, responsibilities, and decision-making in the research and M&E program areas.

3. Apply the country ownership principle thoughtfully to improve program effectiveness

- Following GHI core principles, PMI supports strengthening country ownership of the national malaria response. However, the high levels of variability the team observed in the

preparedness, willingness, and capabilities of countries for assuming these responsibilities leads the evaluation team to recommend a country-specific critical review of the scope and pace of transferring responsibilities to country control. Consistent with the Paris Declaration on AID Effectiveness principle of mutual accountability and PMI's fiduciary responsibility to U.S. taxpayers, the program needs to proceed cautiously in this area. In some PMI-supported countries, the human capital base and management control systems are insufficient to transfer many PMI responsibilities to MOH/NMCP personnel. In other countries, where the human resources are adequate and management control systems meet foreign assistance standards, the transfer of responsibilities should be accelerated.

4. Expand the use of well-trained and effective foreign service nationals as PMI resident staff

- The use of FSNs is seen by many Mission personnel as a way to improve program performance both in terms of quality and “fit” with the national program. It also has the added advantage of reducing staffing costs. PMI's initial minimal staffing pattern structure (one USAID resident advisor and one CDC advisor) is overly rigid and not always cost-effective. Expanded use of FSNs is often seen as a component of strengthening country ownership and national capacity strengthening.

5. Adapt or fail: Acknowledge the success to date and initiate change as appropriate based on the local context

- PMI can celebrate its important contributions to expanded malaria control; paradoxically, though, this very success necessitates a rapid re-orientation for the program to sustain its gains to date. As PMI enters its second five years of existence, the epidemiologic, political, and financial environment is vastly different and continues to change rapidly.
- The biologic situation is changing rapidly. The success of malaria intervention package has changed the epidemiologic profile of malaria. The changing ecological situation in countries with reductions in malaria transmission requires different approaches, as changes in the geo-spatial location of disease leads to a need for increased focus on surveillance to manage epidemic malaria; as changes in the age-structure of mortality and morbidity occur; as insecticide and artemisinin resistance emerge and spread; and as vector biology is altered due to the different ecologic pressures brought about in part by the successful global efforts.
- The political times are different. There is a stronger global commitment to malaria control than has existed for almost 50 years, along with a strong bipartisan agreement with the USG to maintain U.S. global malaria investments. Adapting the program to the changing biologic/ecologic situation to sustain programmatic progress is crucial to sustaining global and national political commitment.
- The financial times are different. The period of rapid growth in the global resource base for global health is likely over. There is a profound imperative to adapt to maximize cost-effective program interventions as financial resources flatten or decline. The key challenge for PMI leadership will be to initiate and manage a rapid change process amidst a successful program.
- The history of malaria control has been one of temporary success followed by failure. PMI has helped create a success in this latest attempt at malaria control; figuring out a strategy for sustaining these advances and adapting to biologic, political, and financial challenges is essential for keeping history from repeating itself.

TECHNICAL RECOMMENDATIONS

1. Reevaluate the IRS strategy

Amidst increasing insecticide resistance, tough financial pressure, and limited data on the additive benefits of combining IRS operations with universal coverage of LLINs, PMI should reevaluate its IRS strategy. It is a relatively expensive approach and covers a small proportion of the at-risk population with current (and reasonably projected) financial resources; in addition, PMI faces less political pressure to spray than previously. On the other hand, the ability to rotate insecticides to reduce resistance pressures may favor the increased use of IRS under certain, limited circumstances. A strategic review of this core intervention at this time is appropriate.

2. Improve resistance monitoring for both insecticides and antimalarial (artemisinin) drugs

Insecticide and artemisinin resistance are major threats to the progress to date. Existing efforts in this area should be expanded and improved to ensure that high-quality, population-based, timely monitoring systems for insecticide resistance are developed on a priority basis. Tracking the global emergence and spread of artemisinin resistance requires surveillance across a much broader area than the PMI focus countries in Africa and will require increasing attention and resources.

3. Strengthen national surveillance and HMIS

Strengthening surveillance and HMIS systems to improve the quality and usefulness of routine program data is important to help meet the impact evaluation mandate. HMIS systems, in particular, are challenging to build, requiring long-term donor and host country support beyond the malaria sub-sector. These routine data systems need to include sufficient consumer expenditure and program cost data to allow for applied economic analyses (cost-effectiveness analyses).

4. Expand the PMI operations research component and advocate for an expanded global malaria research agenda

Focus the PMI research agenda on program-based, policy-relevant research, and expand research activities markedly across multiple countries to improve program efficiency and effectiveness. In collaboration with NMCP and national counterparts, facilitate widespread access to the wealth of data and experience embedded in the extensive global malaria control efforts. Use PMI's experiences and technical insights to inform and advocate for an expanded global malaria research program. This research program, funded from other resources, should be focused on important questions of an applied and more basic nature, so that the next generation of malaria drugs and interventions can be discovered, tested, and developed for widespread public health use.

5. Accelerate impact evaluation activities at appropriate levels of scientific rigor

As the PMI efforts enter their next phase, opportunities for longitudinal studies of impact are increasingly available. The impact evaluations to date have been somewhat slow in coming but a flood of information will be available if resources are made available to conduct the evaluations in a timely manner, and if a consensus can be reached on what constitutes an appropriate and acceptable level of scientific rigor.

ANNEX I: EVALUATION TEAM SCOPE OF WORK (SOW)

This impact evaluation of the U.S. Presidential Malaria Initiative (PMI) is split into three phases:

Previous SOW was:

Phase I: Planning/ Preparing the Impact Evaluation Framework. Documentation and background research including identification of key informants and background documents (e.g., DHS material), archival materials and other relevant sources as required, extensive focused interviews with the CDC and USAID and other U.S.-based key informants and stakeholders, and preparation of a framework and development of a detailed methodology in preparation for the impact evaluation. This phase includes the Washington, D.C.-based Team Planning Meeting.

This SOW includes the following:

Phase II: Field Work/Implementation. Actual field work and country/site visit travel, including key informant interviews, site visits (if any), and continued information/data collection to enrich the areas of focus identified in the framework. This phase will collect information from expert informants in each of the selected countries, analyze the information, and produce a draft impact evaluation report. It includes draft report discussions/analysis and writing; debriefings with USAID, the CDC, and other stakeholders; and draft report revision and submission.

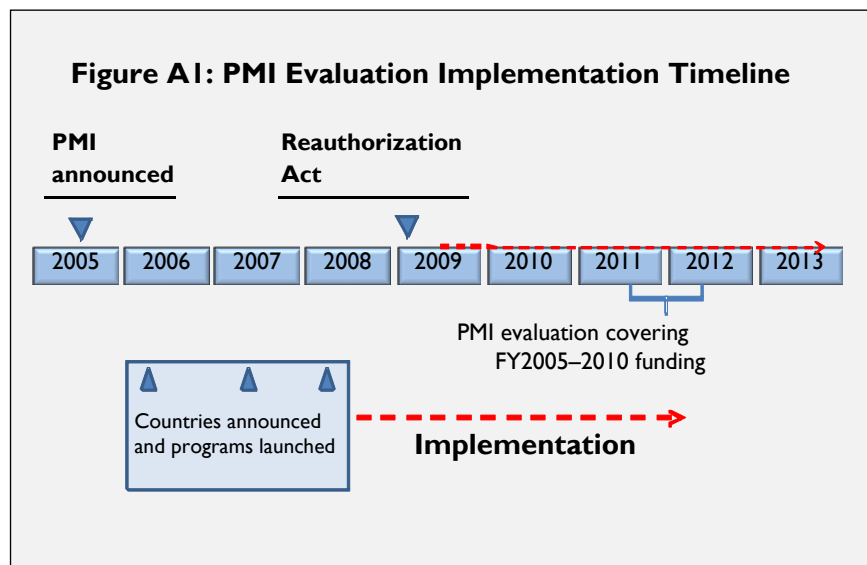
A future phase of the evaluation includes the following:

Phase III: Final Report Preparation. This phase includes any final report revisions and/or changes after submission of the final un-edited/un-formatted draft, and release of final report(s).

Evaluation Objectives and Framework

The evaluation of the PMI has at least two major elements: (1) a focus on proximal factors and issues, including the application of PMI operating principles and the partnership environment in which PMI operates, and (2) an examination of population-based outcomes and impact. The evaluation (see Figure 2) will examine the activities accomplished with

funding between FY 2005 and FY 2010. Recent experiences in the evaluation of multi-country health initiatives⁴⁸ should inform the conduct of the PMI evaluation. Drawing from these recent

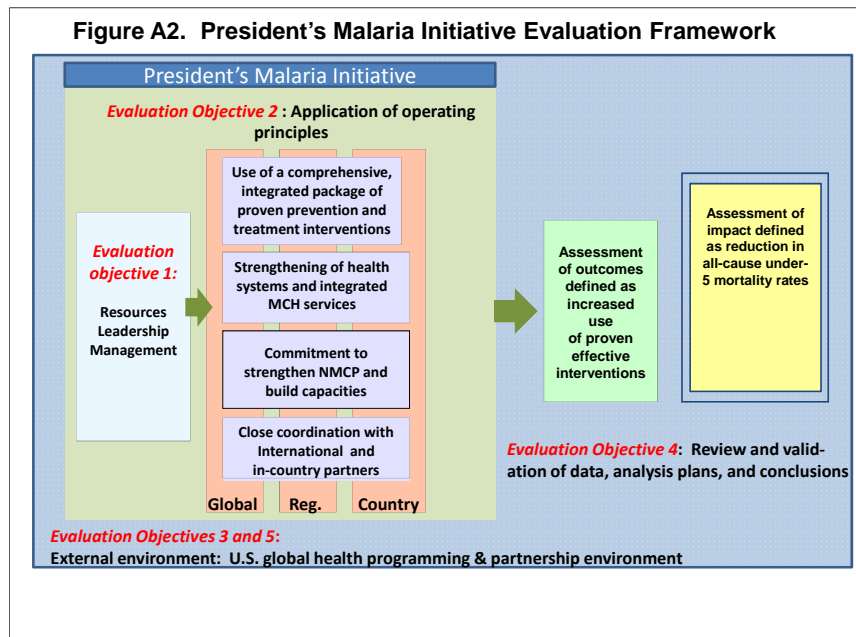


⁴⁸ Committee on the President's Emergency Plan for AIDS Relief (PEPFAR) Implementation Evaluation. *Plan for a Short-term Evaluation of PEPFAR Implementation. Letter Report #1.* 2005. Downloaded from <http://www.nap.edu/catalog/11472.html>.

lessons, the evaluation will carefully define and gauge the actual amount of time that programs have been fully implemented in each country. Efforts to measure population-based outcomes and impact will be designed accordingly.

The purposes of the PMI evaluation are to:

- Identify lessons learned across countries, garner input from the perspectives of a variety of actors, and identify areas for performance improvement.
- Assess population-based outcomes and impact.
- Identify lessons and share experiences with other U.S. Government engagements in global health initiatives.



In parallel with the purpose of the evaluation are the five objectives already described on page one. The evaluation framework (see Figure 3) shows the five objectives of the evaluation along with the associated components of program performance and population-based outcomes and impact. Objectives 1 through 5 will be addressed by an independent evaluation team. As a member of the Roll Back Malaria Partnership, PMI will be participating in a broader global effort to report on progress on malaria control in African countries between 2000 and 2010 led by the RBM Monitoring and Evaluation Reference Group. The results of this RBM evaluation will be released at a high-level United Nations event in September 2011. As part of this effort, PMI staff will help in the 15 PMI focus countries to collect and organize data and conduct preliminary analyses. Under Objective 4, the evaluation team will review and comment on the evaluation design and verify and endorse PMI M&E team’s data collection, analysis, and conclusions in the PMI countries.

The Global Fund to Fight AIDS, Tuberculosis and Malaria. Technical Evaluation Reference Group (TERG). Framework Document on the Scale and Scope of the Five-year Evaluation. Fourteenth Board meeting, Guatemala City, October 31– November 3, 2006. GF/B14/7. Annex 3. Available for download at <http://www.theglobalfund.org/en/terg/evaluations/5year/>.

GAVI Secretariat. “HSSDoc.1a -HSS Background Note.” February 19, 2008. Available at http://www.gavialliance.org/resources/HSSDoc.1a_HSS_background_note.pdf.

Bryce, J., C.G. Victoria, and the MCE-IMCI Technical Advisors. “Ten methodological lessons learned from the multi-country evaluation of the Integrated Management of Child Illness.” Health Policy and Planning, 20(Suppl. 1):i94-i105, 2005.

Macro International, Inc. Final Report Global Fund Five Year Evaluation Study Area 3. The Impact of Collection Efforts on the Reduction of the Disease Burden of HIV/AIDS, Tuberculosis and Malaria. May 2009.

Key Evaluation Questions

Objective 1: Evaluate how PMI resources, leadership, and management have advanced the initiative's goals and provide recommendations for improved performance.

This objective focuses on factors that are largely internal to PMI, including its management, leadership, and financial resources. These factors are most directly under the control of PMI personnel, who determine how the operating principles will be applied and set the stage for interaction with global partners and countries. This evaluation area will examine the extent to which the agencies and organizational units encompassed by PMI are operating as envisioned and identify areas for improvement.

The following are proposed as priority questions for this objective and are expanded upon below (bold indicates high priority):

- How well are U.S. agencies coordinating under the auspices of the Malaria Coordinator? Between headquarters and missions?
- What systems are in place to support PMI's mandate to devote considerable resources to direct procurement of commodities? How well have those systems worked? To what extent does the Central Procurement Supply Fund address country needs for urgent commodity support? What are the challenges encountered in developing and maintaining the Central Procurement Supply Fund?
- What steps have been taken and systems put in place to make PMI accountable and transparent? How are issues of PMI transparency and accountability viewed by partners? At country and global levels? What are the best practices and lessons learned from these practices?
- How well coordinated is PMI with other donors at all levels?
- Is PMI allocating resources according to the priorities outlined in its strategy?
- At the start-up of PMI, the initiative built on existing human resources in USAID and the CDC for staff and recruited technical advisors at country level. To what extent did this approach facilitate rapid and efficient start-up?
- Is PMI appropriately staffed to meet its objectives? Is the capacity of PMI—in terms of numbers, skill sets, and distribution of human resources—appropriate given its principles and mandate? Which skills sets are in most critical demand?
- What is the decision-making process around the allocation of resources to country programs and is it transparent and appropriate? Are factors specified in the Reauthorization Act (i.e., the size and demographics of the population with malaria, the needs of that population, the country's infrastructure, and the ability to closely coordinate U.S. efforts with the NMCPs of partner countries) used in determining resource allocation? How are factors such as existing pipelines, progress (or lack thereof) in current PMI-supported activities, and continued government commitment to malaria control taken into consideration in resource allocation decisions? How has PMI worked to move available resources to the implementation level? Were existing channels and mechanisms sufficient for the needs of the initiative? Have those mechanisms been modified or adapted in any way?

Objective 2: Evaluate the performance of the PMI in terms of putting its operating principles into practice.

Principle 1: Use of a comprehensive, integrated package of proven prevention and treatment interventions

What is the process through which the mix of interventions is determined in-country? Have the decision-making processes for determining the mix of interventions and strategies been inclusive of the NMCP and partners, and has that process been transparent to all PMI partners?

- Is the mix of interventions in-country appropriate to the country setting? Does the package of interventions supported by PMI represent the best fit given an array of factors, such as epidemiologic setting, level of country development, and availability of resources from the host country and other donors? To what extent are PMI resources targeted to populations at greatest risk?
- To what extent have community-based approaches been employed effectively by PMI programs to help achieve the desired results?
- Has operations research (OR) been identified and used effectively to examine and overcome specific implementation challenges? How well does the process through which issues for OR are identified, reviewed, and implemented work?
- What have been the approaches and the effectiveness of responses to implementation bottlenecks?
- How does PMI assess and ensure the quality of program implementation beyond tracking outputs? Have PMI's quality assurance and control efforts been adequate according to country plans, frequency of monitoring, and so on?

Principle 2: Strengthening of health systems and integrated maternal and child health programs

- Is there any indication that PMI investments have strengthened systems beyond malaria-specific components (e.g., pharmaceutical management, training, M&E, supervisory systems)?
- How have PMI activities been integrated into MCH programs within the 15 focus countries?
- To what extent are PMI policies and procedures aligned with recipient country systems (including program design, M&E, and program management)?
- To what extent are both public and private providers included in PMI programs? To what extent are the approaches for using the formal and informal sectors informed by the available evidence?
- To what extent have PMI investments had a positive long-term effect on host countries? For example, are there increased government commitment and capacity to control malaria within focus countries? What are the likely implications for programmatic sustainability? What factors will most effectively facilitate financial sustainability and the lasting effect of PMI resources?

Principle 3: Commitment to strengthen NMCPs and build capacity for country ownership of national malaria control efforts

- Has PMI enhanced the capacity necessary for sustainable malaria prevention, treatment, and care programs? Is PMI effectively building and strengthening human resources? Institutions? Information systems?
- To what extent have PMI-supported activities effectively aligned with and built on national malaria control strategies and programs? To what extent has the PMI demonstrated flexibility in aligning with and adapting to country systems?
- How does PMI manage differences between its data collection and reporting requirements and those of the national M&E framework? How do the goals that PMI assigned to each country align with the country's goals?
- From the perspective of stakeholders, has PMI put effective systems and procedures in place for providing managerial and technical support to countries? What have been the strengths

and weaknesses of these systems in providing support? What have been the impediments to the utilization of technical assistance?

Principle 4: Close coordination with international and in-country partners

- How has PMI worked to advance its goals and objectives through partnerships? What approaches does PMI utilize in-country to partner for improved impact? What approaches are used at regional or global levels?
- How have PMI funds been used to address systemic problems with implementation of Global Fund malaria grants? How effective are these mechanisms in identifying resource gaps and resolving implementation problems?
- Identify and analyze the extent to which PMI-supported activities coordinate with the projects and programs of other donors. Is PMI's strategy to engage other major actors, especially the Global Fund, effective?
- How effective is PMI's approach to engaging the private sector?
- To what extent has PMI's approach to harmonization among donors furthered national systems and programs?

Objective 3: Evaluate the wider partnership environment in which PMI operates at both global and country levels.

This objective focuses on PMI as a partner in an increasingly complex partner environment at both global and country levels.

- What has been the role and effect, both positive and negative, of PMI as a new actor in the donor landscape for malaria at the country and global levels? What role has PMI played in shaping the policies and priorities of the Global Fund through its participation on the board and in board committees?
- What do other major donors (e.g., the Global Fund, World Bank Malaria Booster Program, UNICEF) see as strengths and weaknesses in the PMI program and approaches? Is PMI perceived as having a unique niche among other donors?
- How well has PMI maneuvered in the partnership environment? At the global level? At the country level? To what extent could PMI improve malaria control outcomes through changed and improved partnership approaches?

Objective 4: Assess progress toward program outcomes and impact.

As noted above, PMI (in coordination with the RBM Monitoring and Evaluation Reference Group), will assist with the collection of data on the impact of activities related to prevention and treatment efforts in PMI countries as part of a larger RBM effort to evaluate progress of malaria control programs by September 2011. Under Objective 4, the external evaluation team should focus on assessing the quality of the evaluation and methods used to generate the outputs and outcomes data as shown in Figure 1. Accordingly, the following are priority questions:

- Has PMI devised a feasible, realistic approach to monitoring progress for the main interventions in the integrated package? For monitoring progress in regard to its four operating principles?
- What steps has PMI taken to ensure that the necessary epidemiologic data and other information are available from the focus countries to assess the initiative's outcomes? What are the major gaps in the needed evidence base for the assessment of population-based outcomes and impacts in the future?

- What are the strengths and weaknesses in PMI's M&E strategy and plans? To what extent are the data used to judge performance valid and reliable? Has PMI optimized its collaboration with partners to assure that the following data are in place: regular surveys with malaria modules and biomarkers to monitor coverage and health impact? Program data on inputs and processes? Information on service utilization, availability, and quality?
- What are the strengths, weaknesses, and threats to the soundness of the analytical approach and methods being used in the PMI impact evaluation to assess population-based outcomes and impact? How have PMI and its partners through the impact evaluation addressed issues of joint contributions to shared impact?

Objective 5: Use evidence as generated from the evaluation to make actionable recommendations for improvement of PMI and for U.S. involvement in global health initiatives.

How can lessons learned from the PMI experience inform U.S. approaches to global health initiatives? What are the strengths and weaknesses of building on existing U.S. capacities for global health initiatives? How can experience with PMI inform U.S. leadership in global health initiatives? What is the process by which PMI improvement needs are captured, prioritized, and responded to?

Evaluation Criteria

The PMI evaluation will assess whether goals are being achieved without the rigid use of control or comparison groups.⁴⁹ The evaluation will therefore determine the degree to which change has occurred over time by making comparisons with predetermined targets through analyses of baseline and follow-up data. Through this evaluation PMI does not seek to attribute changes in morbidity and mortality to its specific interventions but will instead measure national-level improvements that result from a variety of interventions and financing mechanisms.

The questions identified above take into consideration a number of evaluation criteria, including the following:⁵⁰

- *Relevance:* To what extent is PMI suited to the priorities and policies of the target group, recipients, and donors? Are the activities and outputs of the program consistent with the overall goal and the attainment of its objectives? Are the activities and outputs of the program consistent with the intended impacts and effects?
- *Effectiveness:* To what extent is PMI on track to achieve its objectives? To what extent are the objectives likely to be achieved? What were the major factors influencing the achievement or non-achievement of PMI's objectives?
- *Efficiency:* What is the relationship of PMI's outputs to its inputs? Are its activities the best use of scarce resources? Are there alternative, less costly means of producing the same outputs? Are objectives being achieved or on track to be achieved on time? Is the PMI being implemented in the most efficient way compared to alternatives?
- *Sustainability:* What are the major factors that will influence whether PMI's benefits are sustained? Has PMI made contributions toward long-term program and financial sustainability? Are the capabilities of the NMCP and the private and NGO sectors to sustain activities strengthened or improved?

⁴⁹ Habicht, J.P., C.G. Victora, J.P. Vaughan. "Evaluation designs for adequacy, plausibility and probability of public health programme performance and impact." *International Journal of Epidemiology*, 28(1):10-18, 1999.

⁵⁰ Development Assistance Committee. *DAC Principles for the Evaluation of Development Assistance*. OECD: Paris, 1991. Glossary of Terms Used in Evaluation in "Methods and Procedures in Aid Evaluation." OECD, 1986. *Glossary of Evaluation and Results Based Management (RBM) Terms*. OECD: Paris, 2000.

VII. METHODOLOGY—IMPLEMENTATION, PHASE 2

The evaluation will draw on multiple methods, both qualitative and quantitative, to address the range of issues included in the evaluation framework. Table 4 shows the relevance of each of the proposed methods to the evaluation objectives. The methods are outlined below.

Sampling of Countries and Projects

It will be important for the external evaluation to reach all 15 PMI focus countries with greater or lesser intensity (document review, telephone interviews, or field visits). The evaluation team should plan for members of the core team to make four country visits (two members visiting each country). In these four countries, core team members may conduct some telephone or video-conferencing to complement the work of the local consultants. The visits should occur following the release of the final 2010–2011 DHS reports for those countries. Potential countries include:

- Tanzania—data available now
- Malawi—final data possibly available by August 2011
- Angola—final data possibly available by August 2011
- Senegal—final data possibly available by November 2011
- Rwanda—final data possibly available by December 2011

In each country it is anticipated that 15 to 20 individuals would be interviewed.

As needed, a spreadsheet for all 15 countries should be prepared to assist in the interpretation of the information collected. Variables in the data base would include PMI budgets and contractors and grantees, and the amount allocated to each along with Global Fund grant monies, including amounts disbursed; Global Fund performance ratings for each grant; World Bank Booster (or other Bank) funds for the country; and other donor funding for malaria (as available).

VIII. LEVEL OF EFFORT TIMETABLE: ACTIVITIES AND OUTPUTS

The evaluation time line with four distinct phases of activities appears in Annex 1. It is recommended that the evaluation begin in early 2011. The estimated amount of time required to complete the implementation phase of the evaluation is up to 12 weeks between August and the November of 2011. Country visits would begin in summer 2011 and be based on the availability of the DHS results, as described above.

The following items are identified as deliverables for the evaluation team in Phase 2. The expected week of delivery for each appears in the activity time line.

Monthly Progress Reports will be submitted using an agreed-upon format. The reports will provide a succinct summary of progress against an agreed time frame and identify obstacles or delays encountered.

High-level Summary: The team will provide a three-page summary of preliminary conclusions/updates in advance of the UN malaria summit on September 21, 2011.

The Draft Evaluation First Report will assess progress on each of the five evaluation objectives and describe methods, findings, conclusions, and recommendations. The report will be submitted in draft form for the purposes of review and discussion by the technical oversight committee and modified based on input from committee members. The first report, in final form, is due two weeks after the final country visit.

The Final Evaluation Report will incorporate input from the technical oversight committee, including any information gaps identified by that group. The final report will include an executive summary suitable for distribution as a freestanding summary report. The final report will be accompanied by a series of PowerPoint presentations that will be used to present key findings and guide discussion at a dissemination workshop. The final draft report is due November 10, 2011.

Team Structure and Staffing Requirement

Successful completion of the evaluation will require a range of skills. It is envisioned that the PMI evaluation will require the skills and qualifications described below. The team shall consist of a team leader with broad public health experience, two malaria specialists, and a project management and planning specialist. Below outlines the ideal candidates. We recognize that not all the skills desired will be in a single individual and various team members will need to have complementary skill sets.

The team leader should have:

- Advanced specialist skills with 15+ years of results-oriented management experience in the field of public health, particularly in malaria
- Extensive experience in the evaluation of large-scale international programs
- Proven experience with oversight bodies, senior-level managers, and a broad range of stakeholders in evaluation agenda-setting, decision-making, and approval processes
- Proven leadership ability and proven ability to manage teams in the development and timely delivery of high-quality products
- Specialized technical expertise is needed in the following areas:
- Specialist skills (10+ years) in project management of complex multi-country activities involving both international and national experts
- Specialist skills in the conduct of multi-country program evaluations on behalf of international agencies
- Advanced specialist skills in the area of health systems development in developing countries
- Advanced specialist skills in the area of human resource capacity-building
- Advanced specialist skills in malaria programming with focus on both prevention and treatment aspects
- Extensive experience in the use of both quantitative and qualitative methods of evaluation
- Extensive experience in advising host countries on program development, implementation, and evaluation of maternal and child health and/or malaria programs
- Specialist skills with 10+ years of experience in synthesizing information from a broad range of source materials
- Proven ability to prepare a focused report based on input from multiple stakeholders
- Experience and publication of materials drawing from the scientific literature for non-specialist audiences

Other team members:

Malaria Specialist

- Advanced specialist skills in malaria programming with focus on both prevention and treatment aspects
- Advanced specialist skills in statistical analysis of household survey data (e.g., DHS and MICS) for both bivariate and multivariate statistical analyses focused on both outcomes (coverage) and impact (mortality)
- Extensive experience in the use of both quantitative and qualitative methods of evaluation
- Extensive experience in advising host countries on program development, implementation, and evaluation of maternal and child health, and malaria programs
- Specialist skills (10+ years) in project management of complex multi-country activities involving both international and national experts
- Specialist skills in the conduct of multi-country program evaluations on behalf of international agencies

Project Planning and Management Specialist

- Specialist skills (10+ years) in project management of complex multi-country activities involving both international and national experts
- Specialist skills in the conduct of multi-country program evaluations on behalf of international agencies
- Advanced specialist skills in the area of health systems development in developing countries
- Advanced specialist skills in the area of human resource capacity-building
- Extensive experience in the evaluation of large-scale international programs
- Proven experience with oversight bodies, senior-level managers, and a broad range of stakeholders in evaluation agenda-setting, decision-making, and approval processes

All team members must have proven ability to work with others in the development and timely delivery of high-quality deliverables. In addition to the skills and qualifications identified above, all members of the team should have advanced university degrees and general or advanced professional proficiency in English and one additional language.

ANNEX 2: INTERVIEW LIST

PMI INTERVIEW LIST—USAID

Al Bartlett, Senior Child Health Advisor
Richard Greene, HIDN Office Director
Bernard Nahlen, PMI Deputy Coordinator
Trent Ruebush, Senior Technical Advisor
Misun Choi, Malaria M&E Advisor
Rene Selgado, Technical Advisor
Christie Hershey, Infectious Disease M&E Advisor
Nathaly Herrel, Communication Advisor
Matt Sattah, Knowledge Advisor
Sonali Korde, Senior Commodities Advisor
Jennifer Murphy, Senior Technical Advisor, Commodities
Eric Tongren, CDC Liaison
Laura Andes, Malaria Element Head
George Greer, Senior Technical Advisor
Megan Fotheringham, Technical Advisor
Julie Wallace, Malaria Team Lead
Elissa Jensen, IRS Advisor
Michael MacDonald, Senior Entomologist
Martin Alilio, Senior BCC Advisor
Susan Youll, Senior Technical Advisor
Larry Barat, Senior Diagnostics Advisor

PMI INTERVIEW LIST—CDC

Bob Wirtz, Entomology Branch Chief
Michelle Chang, PMI Cluster Coordinator, Lead for Operational Research
Steve Yoon, Team Lead, PMI M&E
Manoj Menon, Medical Epidemiologist, M&E Team
Richard Kahn, Deputy Branch Chief for Management and Operations — for PMI budget
Kwame Asamoah, Technical Focal Point for Malaria in Pregnancy
David Gittelman, Public Health Advisor
Brady Penix, CDC
John MacArthur, Chief, Program Implementation Unit, Division of Parasitic Diseases and Malaria
David Gittelman, Public Health Advisor
Mark Eberhard, Director, Division of Parasitic Diseases and Malaria
Patrick Kachur, Malaria Branch

Namita Joshi, *CDC*
Michael Lynch, Division of Parasitic Diseases and Malaria
Scott Filler, Malaria Epidemiologist
Achuyt Bhattarai, *CDC*
Jessica Butts, M&E Fellow, Malaria Branch
Ellen Dotson, Division of Parasitic Diseases and Malaria
John Gimnig, *Entomologist, Division of Parasitic Diseases and Malaria*
Adeline Chan, *Entomologist, Division of Parasitic Diseases and Malaria*
Bill Brogdon, *Entomologist, Division of Parasitic Diseases and Malaria*
Laurence Slutsker, *Associate Director for Science for the CDC Center for Global Health*
Michael Aidoo, Molecular Vaccine Section, Immunology Branch, Division of Parasitic Diseases
John Barnwell, Chief of Research and Development Unit at Malaria Branch
Beatie Divine, Behavior Change Communication, *CDC*

GENEVA INTERVIEW LIST

Sandii Lwin, Manager, Bilateral and Multilateral Team, Global Fund
Scott Filler, Knowledge Management Unit, Senior Advisor Malaria, Global Fund
Luca Li Bassi, Manager, Pharmaceutical Advisory Services Team, Global Fund
Kirsi Viisainen, Manager, Program Effectiveness Team, Global Fund
Eline Korenromp, Senior Technical Officer Value for Money, Global Fund
Nathalie Zorzi, Manager, M&E Team, Global Fund
Marcel Lama, Senior Technical Officer, M&E Team, Global Fund
Olusoji Adeyi, Director, Affordable Medicines Facility — Malaria, Global Fund
Linden Morrison, East Africa & Indian Ocean Team, Global Fund
Victor Bampoe, Southern Africa Team, Global Fund
Mark Willis, West and Central Africa Team, Global Fund
Robert Newman, Director, Global Malaria Program, WHO
Awa Coll-Seck, Executive Secretary, RBM
Thomas Teuscher, RBM
Richard Carr, RBM
Richard Cibulskis, Senior M&E, Global Malaria Program, WHO
Jo Lines, Vector Control, Global Malaria Program, WHO
Abraham Mnzava, Vector Control, Global Malaria Program, WHO
Raman Velayudhan, Vector Control, Neglected Disease, WHO
Pascal Ringwald, Antimalarial Drug Resistance, WHO

ANNEX 3: EMAIL AND TELEPHONE QUESTIONNAIRES

GH TECH PMI EXTERNAL EVALUATION EMAIL QUESTIONNAIRE FOR HPN OFFICERS

Dear respondent,

The PMI leadership has commissioned an external evaluation. This exercise is managed by GH Tech, Washington DC, which has recruited a team to carry out the evaluation with the following members:

Professor Emeritus Rosemary Barber-Madden, Brazil

(formerly Mailman School of Public Health and University of Brasilia)

Dr. M. Kabir Cham, The Gambia (formerly WHO)

Dr. Allan Schapira, Philippines (formerly WHO)

Dr. Kojo Yeboah - Antwi, Boston University

Professor Jonathon Simon, Boston University (Team Leader)

This questionnaire is sent to USAID HPN Officers in those PMI countries which are not selected for visits by the external evaluation team. A more comprehensive version is sent to the PMI RAs, and a telephone interview will be conducted with National Malaria Control Program (NMCP) managers. The information will be treated as confidential by the PMI evaluation team, and in the preparation of the evaluation report all efforts will be made to ensure that the source of any information cannot be individually identified. Please provide a succinct answer to each question preferably with a single sentence, a short sentence supplemented with bullet points, or selection of one of multiple answers. It is requested that you do not consult colleagues when filling out the questionnaire, as it is important to obtain the perspectives of staff with different positions. If you would like to have clarification on any question, please send an email to Jonathon Simon, (jonsimon@bu.edu).

Completed questionnaires should be returned via email as soon as possible and no later than September 9, 2011, to Mr. Bram Brooks, (mib@bu.edu) CGHD, Boston University, 801 Massachusetts Ave., 3rd Floor, Boston, MA 02118, USA.

MANY SINCERE THANKS! —The Evaluation Team

Name of Country:

Respondent's name:

Position:

E-mail:

Date of response:

A. PMI ORGANIZATION AND STAFFING

1. What is your role in the PMI program?
2. What are the lines of communication between HQ and country missions?
3. Is PMI in the country where you work adequately staffed to meet its objectives?
 - a. Is the capacity of PMI, in terms of numbers, skill sets, and distribution of human resources, appropriate given its principles and mandate?
 - b. Which skill sets are in most critical demand?
4. Are there job descriptions for each Resident Advisor (please attach if available)?
 - a. How have tasks been shared/divided by the Advisors?
 - b. What role, if any in your country, are FSNs playing?
 - c. Have you faced specific challenges in managing an interagency initiative?
5. At the start-up of PMI, the initiative decided to recruit a Resident Advisor from each agency (USAID and CDC). What were the advantages and disadvantages of this approach?
 - a. Should the approach change moving forward?
 - b. If yes, please explain.
6. What are the complementarities (if any) between USAID and CDC in PMI planning and implementation?

B. PROGRAMME IMPLEMENTATION

1. PMI principles call for working in partnership with governments and other agencies.
 - a. What role/activities do you play in helping PMI accomplish this goal?
2. Cooperating agencies and contractors play a major role in PMI activities. Please comment on the strengths and weaknesses of this approach to accomplishing PMI's goals.
3. What have been the greatest successes in managing and implementing PMI?
 - a. How have you built on these?
4. What have been the greatest challenges in managing and implementing PMI?
 - a. How have these been addressed?

C. GENERAL

1. Are there positive or negative lessons from PMI (policies, mechanisms, implementation, M&E, etc.) which could be important for the work of USAID?
 - a. If yes, please describe.
1. Please note any other insights related to the work of PMI, which you would like to bring to the attention of the evaluation team.

Thank you very much for taking the time to address these questions.

GH TECH PMI EXTERNAL EVALUATION EMAIL QUESTIONNAIRE FOR PMI RESIDENT ADVISORS (RAS)

Dear Respondent,

The President's Malaria Initiative (PMI) leadership has commissioned an external evaluation of its performance during its initial 4 years. This exercise is managed by GH Tech, Washington DC, which has recruited a team to carry out the evaluation with the following members:

Professor emeritus Rosemary Barber-Madden, Brazil

(formerly Mailman School of Public Health and University of Brasilia)

Dr. M. Kabir Cham, The Gambia (formerly WHO)

Dr. Allan Schapira, Philippines (formerly WHO)

Dr. Kojo Yeboah- Antwi, Boston University

Professor Jonathon Simon, Boston University (team leader)

This questionnaire is sent to PMI RAs in those PMI countries, which are not scheduled for visits by the external evaluation team. A shorter version is sent to the USAID HPNs, and a telephone interview will be conducted with National Malaria Control Program (NMCP) managers. The information will be treated as confidential by the PMI evaluation team, and in the preparation of the evaluation report all efforts will be made to ensure that the source of any information cannot be identified. Please provide a succinct answer to each question preferably with a single sentence, a short sentence supplemented with bullet points, or selection of one of multiple answers. It is requested that you do not consult colleagues when filling out the questionnaire, as it is important to obtain the perspectives of individual staff with different positions. If you would like to have clarification on any question, please send an email to Dr. Jonathon Simon (jonsimon@bu.edu).

Completed questionnaires should be returned via email as soon as possible and no later than September 9, 2011, to Mr. Bram Brooks (mib@bu.edu) CGHD, Boston University, 801 Massachusetts Ave., 3rd Floor, Boston, MA 02118, USA.

MANY SINCERE THANKS!—The PMI Evaluation Team

Name of Country:

Respondent's name:

Position/Job Title:

E-mail:

Date of response:

Please answer some questions about yourself:

For how long have you been in your present position?

Before starting as RA in PMI, for how long had you worked in malaria control or research?

For how long had you worked in public health, field research, or other development work in a malaria-endemic country?

What is your nationality?

What is (are) your academic degree(s):

A. PMI ORGANIZATION AND STAFFING

1. What are your roles and responsibilities as PMI Resident Advisor?
 - a. Do you have a job description (please attach)?
 - b. How do you divide and allocate tasks between the PMI RAs/FSNs?
 - c. From whom do you receive technical support (CDC/HQ, USAID/HQ, own professional networks, other)?
2. PMI decided to staff country programs with one Resident Advisor from CDC and one from USAID. Given your experience to date, what would you recommend as the optimal staffing pattern for country programs during the next phase of PMI activities?
 - a. What role should FSNs play?

B. PRIORITY SETTING ON PLANNING AND RESEARCH

1. MOPs
 - a. In your opinion, are the MOPs effective planning and programming tools?
 - i. If yes, why?
 - ii. If not, why not?
 - b. Should the MOPs be annual or multi-year exercises?
 - i. If yes, why?
 - ii. If not, why not?
 - c. Are the MOPs effective in fostering partnerships with government and/or other development actors involved with malaria control?
 - i. If yes, why?
 - ii. If not, why not?
2. Research
 - a. What operations research has been carried out to examine and overcome implementation challenges?
 - b. How were the research questions identified?
 - c. How is the research implemented (government research groups, PMI personnel, external research groups)?

- d. Have the results/findings been used?
 - i. If so, how?
 - ii. If not, why not?
- e. Going forward, how should PMI organize the research activities?

C. COMMODITIES

- 1. How does the procurement and distribution system for malaria commodities function at country level?
 - a. Is it solely within government or are parallel systems operating (faith-based, private sector, U.S. Government contractor-managed)?
 - b. What percentage of total malaria commodities (ACTs, LLINs, insecticides for IRS and SP) in your country are purchased by PMI?
- 2. What has been the role of the emergency Central Procurement Supply Fund?
 - a. If it has been used, why?
- 3. How has PMI collaborated with MoH/NMCP, Global Fund, other bilaterals, WB Booster, etc. in commodity procurement?
 - a. How has these relationships affected PMI's effectiveness?

D. PERFORMANCE OF THE PMI IN TERMS OF PUTTING ITS OPERATING PRINCIPLES INTO PRACTICE

Strengthening health systems and integration

- 1. What health system components beyond malaria-specific components have the PMI investments strengthened?
 - a. And how?
- 2. Have PMI activities been integrated into the maternal and child health programmes (FANC, IMCI, or CCM)?
 - a. If yes, how?
 - b. If not, why not?

Strengthening NMCP capacities and country ownership of malaria control efforts

- 1. Has PMI strengthened the capacity of the NMCP to lead the national malaria control efforts?
 - a. If yes, how?
 - b. If not, why not?
- 2. What managerial and technical support has PMI provided to the country programmes?
 - a. How effective/successful have these technical assistance been?
 - b. What have been the challenges in utilizing this technical assistance?
 - c. Has PMI engaged both public and private providers/formal and informal sectors in its programmes?
 - i. If yes, how?
 - ii. If not, why not?

E. PARTNERSHIP ENVIRONMENT IN WHICH PMI OPERATES AT COUNTRY LEVEL

1. What challenges have PMI faced in working with in-country partners?
2. In which ways has PMI collaborated in the broader partnership environment, e.g.:
 - a. Were key partners (which?) involved in the design of PMI strategies and approaches at country level?
 - b. Was PMI involved in similar processes for other partners?
 - i. If yes, which?
 - c. Are there MOUs/agreements between PMI and any major partnership for cooperation/collaboration or financing?
 - i. If so, for what purpose?
 - ii. If not, should there have been?

F. GENERAL

1. What have been the greatest successes in managing and implementing PMI in your country?
 - a. How have you built on these?
2. What have been the greatest challenges in managing and implementing PMI?
 - a. How have they been addressed?
3. Are there positive or negative lessons from PMI (policies, staffing patterns, mechanisms, implementation, M&E, etc.)?
 - a. If yes, please describe.
4. Please share any other insights related to the work of PMI, which you would like to bring to the attention of the evaluation team.

Thank you very much for taking the time to address these questions.

GH TECH PMI EXTERNAL EVALUATION NATIONAL MALARIA CONTROL PROGRAMME MANAGER/COORDINATOR

Telephone Interview Questionnaire

Name of Country:

Name of Respondent:

Title/Job Responsibility:

Please answer some questions about yourself:

How long have you been manager of NMCP?

What did you do before you were appointed?

What is your profession?

What are your academic degrees?

A. GENERAL QUESTION AND RELATIONSHIP TO PMI

1. Please provide an overview of NMCP
 - a. Structure within government
 - b. Human resources
 - c. Financing (internal and external)
2. In which ways has PMI collaborated with the NMCP?

B. PROGRAMME INTERVENTION MIX

1. How deeply involved was NMCP in the MOP process?
2. Has PMI adapted its policies and procedures to align with the country's national malaria strategy and systems to enhance smooth implementation of the package of intervention?
 - a. If yes, how?
 - b. If not, why not?

C. CAPACITY STRENGTHENING

1. In your opinion, has the PMI strengthened the capacity of the NMCP to lead the national malaria control efforts?
 - a. If yes, how?
 - b. If not, why not?
2. What managerial and technical support has PMI provided to the country programmes?
3. Has PMI made contributions to strengthen the NMCP systems?
 - a. If so, how has this functioned?
 - b. If not, why not?

D. PROGRAMME SUPPORT

1. What has been the major contribution of PMI in commodity procurement?
 - a. What are the successes and challenges encountered?
2. Have PMI activities been integrated into the maternal and child health programmes (e.g., FANC, IMCI, CCM)?
 - a. If yes, how?
 - b. If not, why not?
3. Has PMI contributed to strengthening health systems?
 - a. If yes, explain which areas and how?
4. In what areas has PMI technical assistance been provided?
 - a. What have been the challenges in utilizing this technical assistance?
5. Evaluate the quality of the PMI staff. Do they have:
 - a. The level of field experience you would expect from them?
 - b. The right skill mix to assist your programme?
 - c. Sufficient intercultural skills?

E. OPERATIONS RESEARCH

1. Were operations research/applied field research carried out with PMI support?
 - a. If so, to what extent were the findings useful for NMCP?
 - b. If yes, how?
2. Has PMI strengthened research capabilities in the country?
 - a. Are these capabilities relevant for NMCP's needs?
 - b. Have the right national institutions been selected from the viewpoint of NMCP?

F. PARTNERS

1. How has PMI collaborated with other malaria partners outside Ministry of Health in the country?
 - a. How have these relationships affected national programme effectiveness?
2. How would you rate PMI as a partner for NMCP on a scale from 1 (antagonistic) to 5 (excellent)?
 - a. What adjectives would you use to describe PMI?
3. In comparison with other malaria partners working in the country:
 - a. What are the strengths and advantages of PMI?
 - b. What are the weaknesses and disadvantages of PMI?

G. SUMMARY QUESTIONS

1. What have been the greatest successes in managing and implementing PMI?
 - a. How have you built on these?
2. What have been the greatest challenges in managing and implementing PMI?
 - a. How have they been addressed?

Thank you very much for taking the time to address these questions.

ANNEX 4: PMI OPERATIONS RESEARCH PROPOSAL SUMMARY

FY06/07

Country	Project Details	Mechanism	Total Budget (\$000)	Funding Status	Recommended for Funding?
Angola	Epidemiologic survey of malaria in Luanda	Julie Thwing, CDC	60	FY07	NA
Malawi	Health facility assessment	CDC-Malaria Alert Centre	30	FY07	NA
Malawi	Anemia/parasitemia survey in 6 districts	CDC-Malaria Alert Centre	50	FY07	NA
Malawi	SP efficacy study	CDC-Malaria Alert Centre	40	FY07	NA
Rwanda	Evaluation of home-based management of malaria in 5 districts	BASICS	50	FY07	NA
Tanzania	Evaluation of treatment of severe malaria	Kachur/Kahigwa-CDC, Ifakara Health Institute	390	FY07	NA
Tanzania	Focused evaluation of National Net Voucher Program	Mponda/Hansen, Ifakara Health Institute, LSHTM	700	FY07	NA
Tanzania	Evaluation of DDT's repellent vs. killing effect	Wirtz/Kileen - CDC, Ifakara Health Institute			NA
Uganda	Validation of verbal autopsies	Quick - CDC, LSHTM	300	FY06	NA
Uganda	Home-based management of fever	Malaria Consortium	100	FY06	NA

FY08

Country	Project Details	Mechanism	PI	Funding \$000			Recommended for Funding?
				Core Total Projected	Country Total Projected	Total Budget	
Benin (BE-2)	(1) A phase III trial to assess the protective efficacy of insecticide-treated nets (ITNs) + indoor residual spraying (IRS) with a non-pyrethroid insecticide in an area where Anopheles gambiae s.s. has high levels of pyrethroid resistance, (2) A phase II evaluation of ITNs + IRS (non-pyrethroid) to manage An. gambiae s.s. pyrethroid resistance and to promote continued efficacy of ITNs in Benin	CREC	Prof. Akogbeto	0	300	300	Yes
Benin (BE-3)	Evaluation of technology for determining when to replace insecticide-treated (mosquito) bed nets (ITNs)	CREC	Steve Smith	37	0	37	Yes
Ethiopia (ET-1)	Evaluation of the efficacy of barrier spraying to protect Ethiopian populations from malaria epidemics	RTI		50 (100)	0	100	Withdrawn
Ethiopia (ET-2)	Adherence to artemether-lumefantrine (AL) for routine treatment of uncomplicated malaria in Ethiopia	CDC to RHU		0	120 (120)	120	Yes
HQ-1 Kenya, Malawi, Senegal	Phase III field evaluation of long-lasting insecticide treated nets	Kenya = CDC to KEMRI; Malawi = CDC to Malawi College of Med; Senegal = USAID thru WHO to UCAD	John Gimnig	190.8	0	190.8	Yes

Country	Project Details	Mechanism	PI	Funding \$000			Recommended for Funding?
				Core Total Projected	Country Total Projected	Total Budget	
HQ-2	Validation and comparison of physician panel and candidate algorithm coding methods for verbal autopsy data using international ICD procedures	USAID to Measure/Eval (UNC)	Measure	175	0	175	Yes
Kenya (KE-1)	Longevity of insecticides used for IRS	CDC to KEMRI	John Gimnig	0	100	100	Yes
Kenya (KE-2)	Evaluation of integrated vector control in high and low transmission areas of western Kenya	CDC - KEMRI	Adam Wolkon	93	100	193	Yes
Kenya (KE-4)	An evaluation of sentinel site verbal autopsy (VA) representativeness	CDC - KEMRI		125	75	200	Withdrawn
Liberia (LI-1)	An evaluation of the use of rectal artesunate by community health workers as a pre-referral drug for severe malaria	USAID to WHO	Rachel Bronzan/EISO	0	100	100	Withdrawn
Mali (MA-1)	Integrated vector management: Interaction of larval control and IRS on Anopheles gambiae density and vectorial capacity for human malaria	USAID to MRTC thru RTI	MRTC	0	110	110	Yes
Mali (MA-2)	Development of a pilot dry season vector control strategy in Mali	USAID to MRTC thru RTI	MRTC	0	80	80	Yes
Mali (MA-3)	A mixed-methods evaluation of the EPI contact method as both monitoring tool and intervention for malaria control and prevention in Mali	CDC	Amy Patterson	85.6	34.4	120	Yes
Senegal (SE-1)	Longevity of insecticides used for IRS	USAID to WHO to UCAD	Ousmane Faye	120 (120)	0	120	Withdrawn

Country	Project Details	Mechanism	PI	Funding \$000			Recommended for Funding?
				Core Total Projected	Country Total Projected	Total Budget	
Tanzania (TZ-1/2)	IRS and LLIN: Integration of methods and insecticide mode of actions for control of African malaria vector mosquitoes	USAID to IHRDC	Walter Reed or Ifakara	237.5	0	237.5	Yes
Tanzania (TZ-3)	A project to develop and evaluate an adaptation of routine disease reporting to include malaria diagnoses by RDT result in Tanzania	CDC for Joint Malaria Program (???)	Hugh Reyburn	0	88 (88)	88	Yes
Zambia (ZA-1)	A comparative assessment of sulfadoxine-pyrimethamine for treatment of uncomplicated malaria illness in small children and prevention of malaria in pregnancy	CDC to TDRC		0	100 (200)	200	Yes
Zambia (ZA-2)	Zambia Integrated Management of Malaria and Pneumonia Study (ZIMMAPS)	USAID to Boston University	BU	168 (168)	0	168	Yes

FY09

Country	Project Details	Mechanism	PI	Funding \$000			Recommended for Funding?
				Core Total Projected	Country Total Projected	Total Budget	
Malawi (MW-6)	A pilot of interventions to improve patient adherence to a treatment regimen of artemether-lumefantrine in Malawi		Jacek Skarbiniski, CDC		140	140	Yes
Senegal (SE-3)	Assessment of diagnostic and treatment algorithm		Julie Thwing, CDC		75	75	Yes
Zambia (ZA-3)	Durability and insecticide persistence in LLINs		Allen Craig, CDC		80	80	Yes

FY10

Country	Project Details	Mechanism	PI	Funding \$000			Recommend ed for Funding?
				Core Total Projected	Country FY10 Total	Total Budget	
Ghana (GH-1)	Prevalence of Plasmodium falciparum parasitemia and anemia in children under 5 years of age at baseline and following annual vs. biannual IRS in Bunkpurugu-Yunyoo district, northern Ghana	RTI	Dr. Paul Psychas, CDC		305	305	Yes
Mali (MA-4)	Monitoring SP resistance and the effectiveness of IPTp for the control of malaria in pregnancy	MRTC?	Meredith McMorro, CDC		100	100	Yes
Tanzania (TZ-4)	Placental parasitemia among women who have not had IPTp) for malaria in Zanzibar	MAISHA Award/Jhpiego	Natalie Hendler, JHPIEGO		122	122	Yes
Tanzania	The combined use of IRS and LLINs for malaria reduction in endemic rural Tanzania	London School of Hygiene and Tropical Medicine	Mark Rowland, LSHTM		0	1,600	Yes
CDC Core - DWLs	Evaluation of durable insecticide treated wall liners as a replacement for IRS	CDC/MAC	Kim Lindblade, CDC		0	650	Yes

FY11

Country	Project Details	Mechanism	PI	Funding \$000			Recommended for Funding?
				Country FY11 Total	Country FY12 Total Projected	Total Budget	
Malawi (MW-8)	Evaluation of severe malaria case management in Malawi	College of Medicine/Malaria Alert Centre	Jacek Skarbinski	175	0	175	Yes
Tanzania (TZ-5)	Pregnant women and infants as sentinel groups for monitoring impact of interventions to reduce malaria transmission in the general population	NMCP Implementation Letter	Peter McElroy, Resident Advisor	180	0	180	Yes
Ethiopia (ET-3)	School-based surveillance of malaria — Investigation of approaches for outbreak detection and response	Malaria Consortium	Richard Reithinger & Larry Barat	200	0	200	Yes
Ethiopia (ET-4)	Integration of larval source management (LSM) in the Malaria Control Strategy for the Oromia Regional State, Ethiopia	RTI/IVM project contract with Liverpool School of Tropical Medicine	Richard Reithinger & Michael MacDonald	100	0	394	Yes

ANNEX 5: IMPACT EVALUATION BASED ON DATA AND INFORMATION FOR THE 15 PMI COUNTRIES AVAILABLE BY MID-2011

METHODS

The analysis is based on visual examination of available data on impact, outcomes, outputs, and contextual determinants by year from 2000 to 2010/2011.

Outcome and Impact Data

Indicator data concern outcomes (coverage of curative and preventive services for malaria) and impact (all-cause under-5 mortality, malaria prevalence, anemia in children, and malaria morbidity and mortality).

Any change toward improvement in these indicator data is critically assessed: is it a true improvement, or is it likely to be due to chance variability or changes in measurement methods? Absence of trend or worsening will be similarly examined.

If epidemiological changes appear to be real, are they likely to relate to changes in malaria intervention coverage levels, or could they more likely be due to changes in other (contextual) determinants?

Sources:

Intervention coverage indicator data: DHS, MICS, MIS

All-cause child mortality (ACCM): idem. ACCM values found by a survey in a given year are assumed to reflect—approximately—the situation in that year and the four preceding years; they are presented graphically accordingly.

Malaria (parasite) prevalence, anemia: MIS

Malaria morbidity and mortality: WHO World Malaria Reports 2008–10

Output Data

- Number of LLINs delivered by year
- Number of persons protected by IRS by year, crude figure and related to total population
- Number of RDTs and ACT treatments delivered by year

Sources:

Annual reports from PMI, GFATM, and other major partners involved in implementation

Contextual Determinants of U5 Mortality and Malaria[

- Measles immunization (WHO/UNICEF)
- Rainfall (International Research Institute for Climate and Society, Columbia University)
- Female primary school completion rate (UNESCO)
- Proportion of population with access to sanitation (WHO/UNICEF)

The exploration of this data is supplemented by information from scientific publications. Conclusions are qualitative and concern reductions in ACCM and malaria burden and the plausibility of causal relationships between interventions and impact.

Attention is drawn to the limitations of the data, as discussed in detail in the source publications. In particular, the information on malaria cases, admissions, and deaths may be affected by not only the quality issues, which are common to most health management information systems, but also to variations related to changes in health service provision. The strengthening of malaria control, which has taken place in all PMI countries, may have been accompanied by increased recording and reporting of cases and deaths; at the same time, case definitions may have changed, usually becoming more restrictive. Considerable caution must therefore be applied when examining these data.

PMI COUNTRIES

1. Angola	103
2. Benin.....	108
3. Ethiopia	113
4. Ghana	118
5. Kenya.....	123
6. Liberia	128
7. Madagascar	133
8. Malawi	138
9. Mali	143
10. Mozambique	148
11. Rwanda	153
12. Senegal.....	158
13. Tanzania.....	164
14. Uganda.....	169
15. Zambia.....	174

I. Angola

PMI started in Angola in FY 2006 (Round 1). Angola has 13 million inhabitants in 2011, all at risk of malaria.

Prevention

The total number of ITNs distributed over the last three years is around 4 million, enough to cover about 8 million persons by 2009–2010. However, we have seen a slight decrease in ITN utilization from 2007–2010/2011 MIS, from 22% to 20% for pregnant women and 18% to 16% for children under 5. IPTp coverage has increased from 3% to 18%, but is still very far from the PMI standard. There are some discrepancies in the IRS data from PMI and WHO, but the proportion of the population protected by IRS is small.

Case Management

Significant quantities of ACTs were distributed in 2008–2009, although the measured coverage of febrile episodes by ACTs in 2010 was only 11%. This could have contributed to the reduction in anemia.

Contextual Determinants

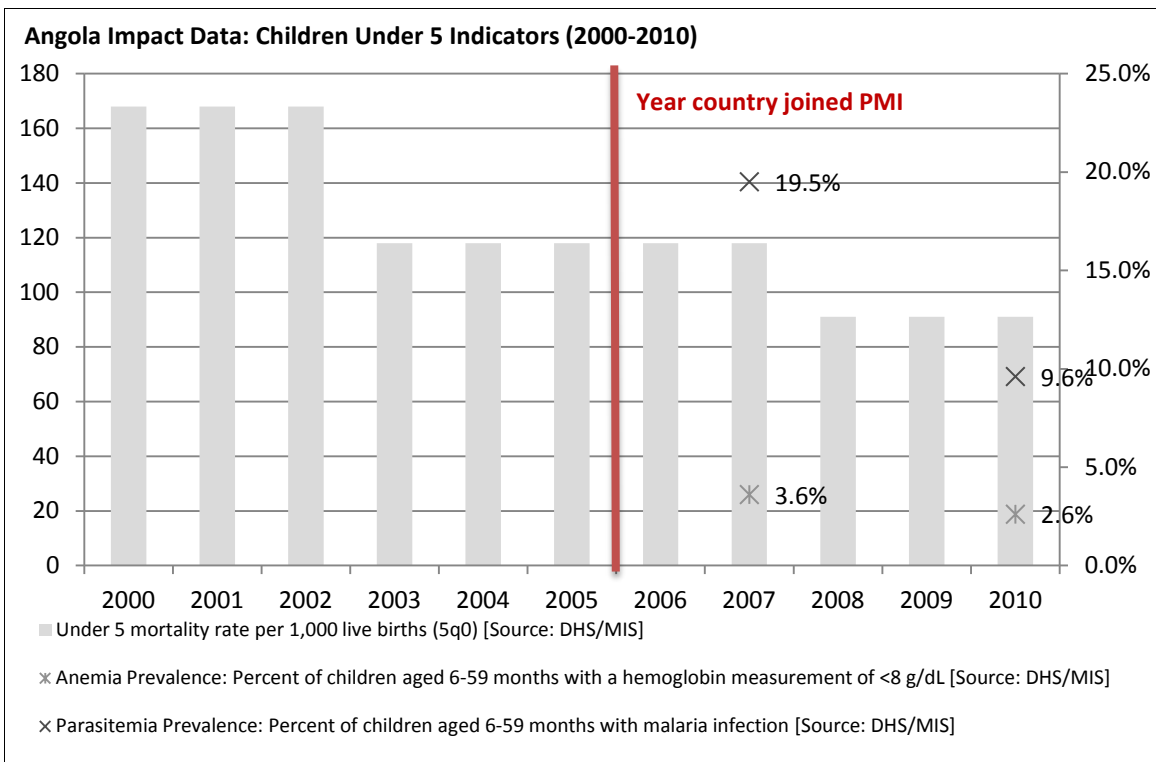
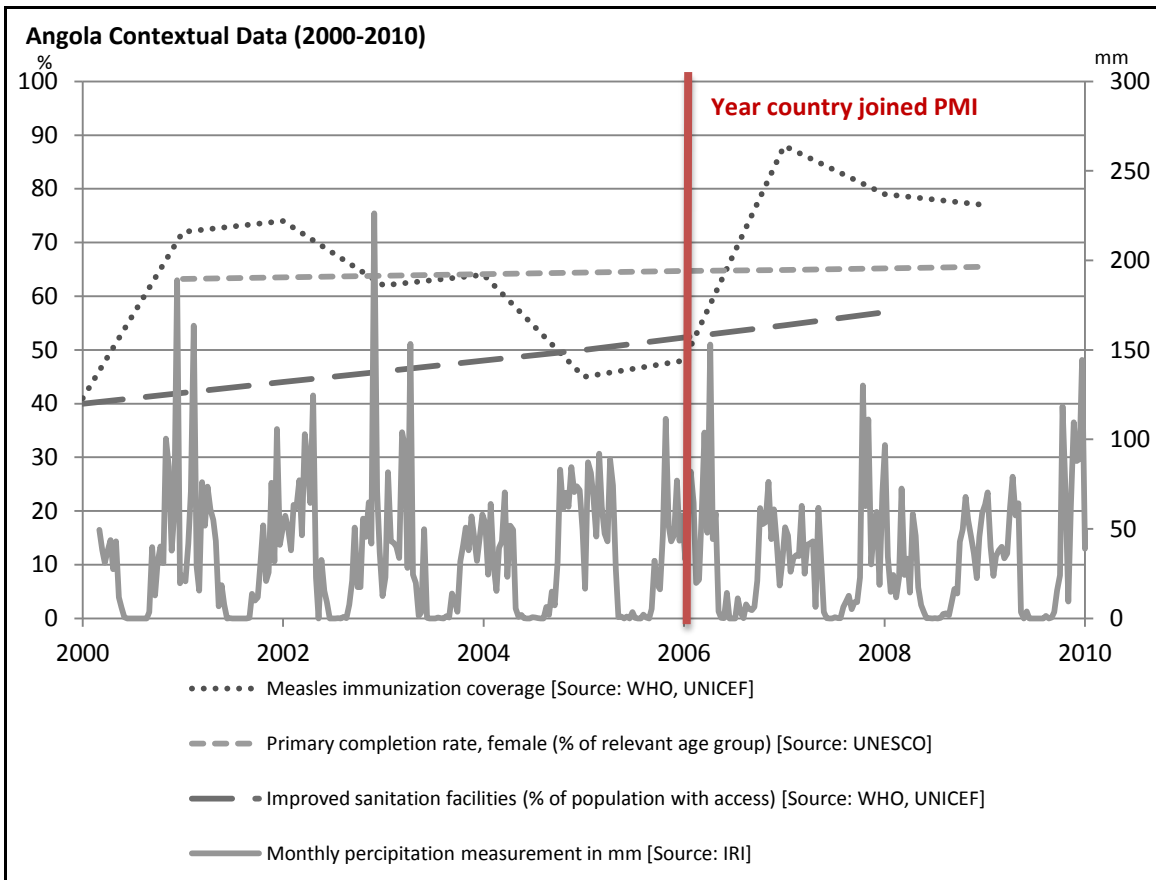
After a decade-long civil war, the country's health services are still being built up. It is therefore reasonable to assume that a number of contextual determinants could have been improving since the late 1990s. Measles vaccination coverage was somewhat better from 2007–2009 than in the years immediately preceding the start of PMI, in 2006. Furthermore, our chart indicates exceptionally high rainfall during some months in the years 2001 and 2003. This might have increased the malaria risk in those years.

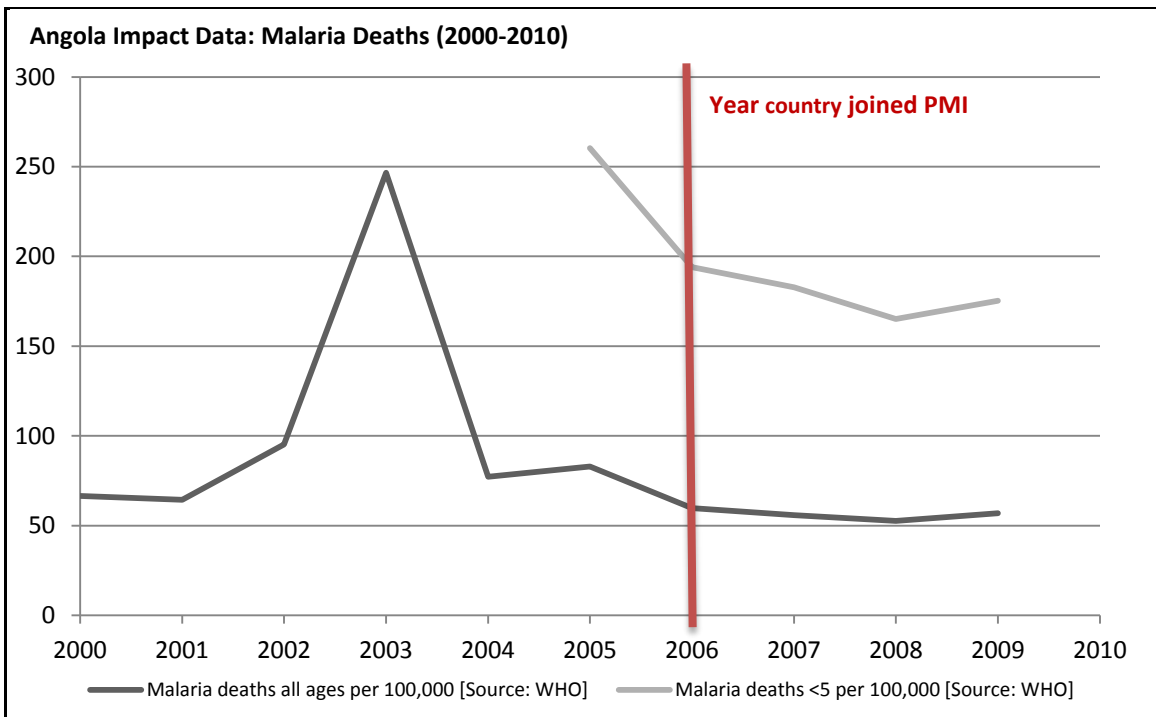
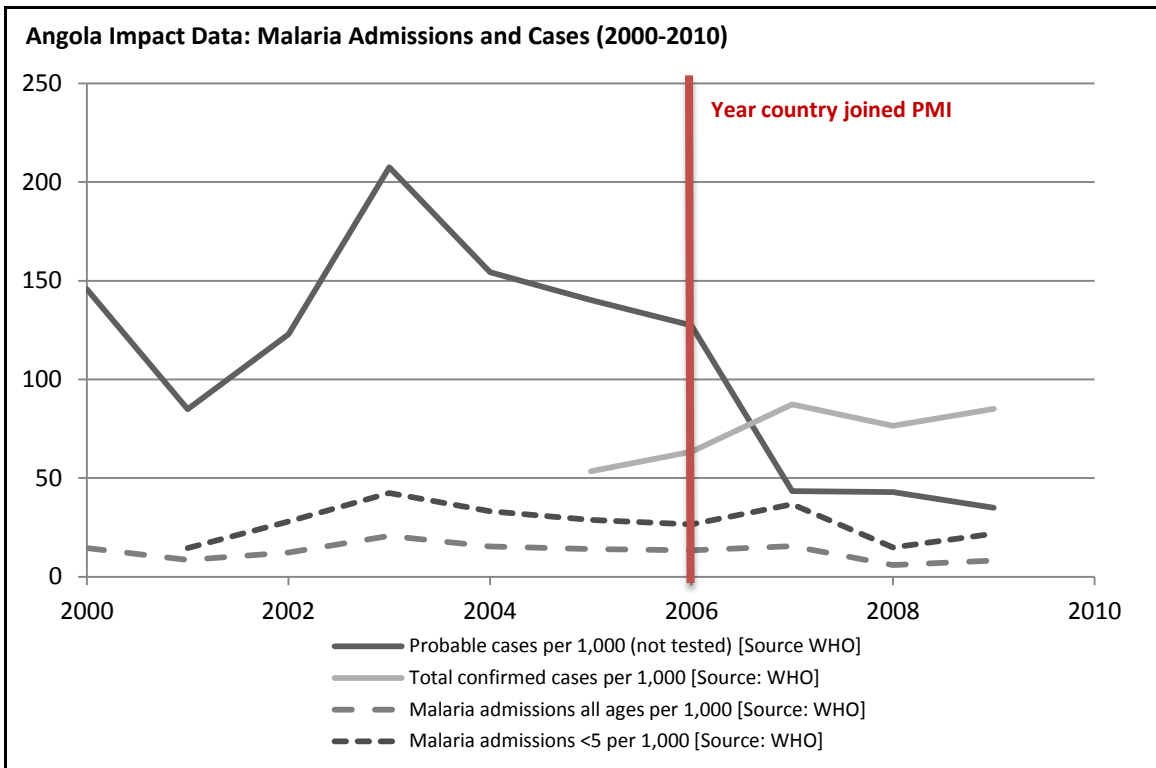
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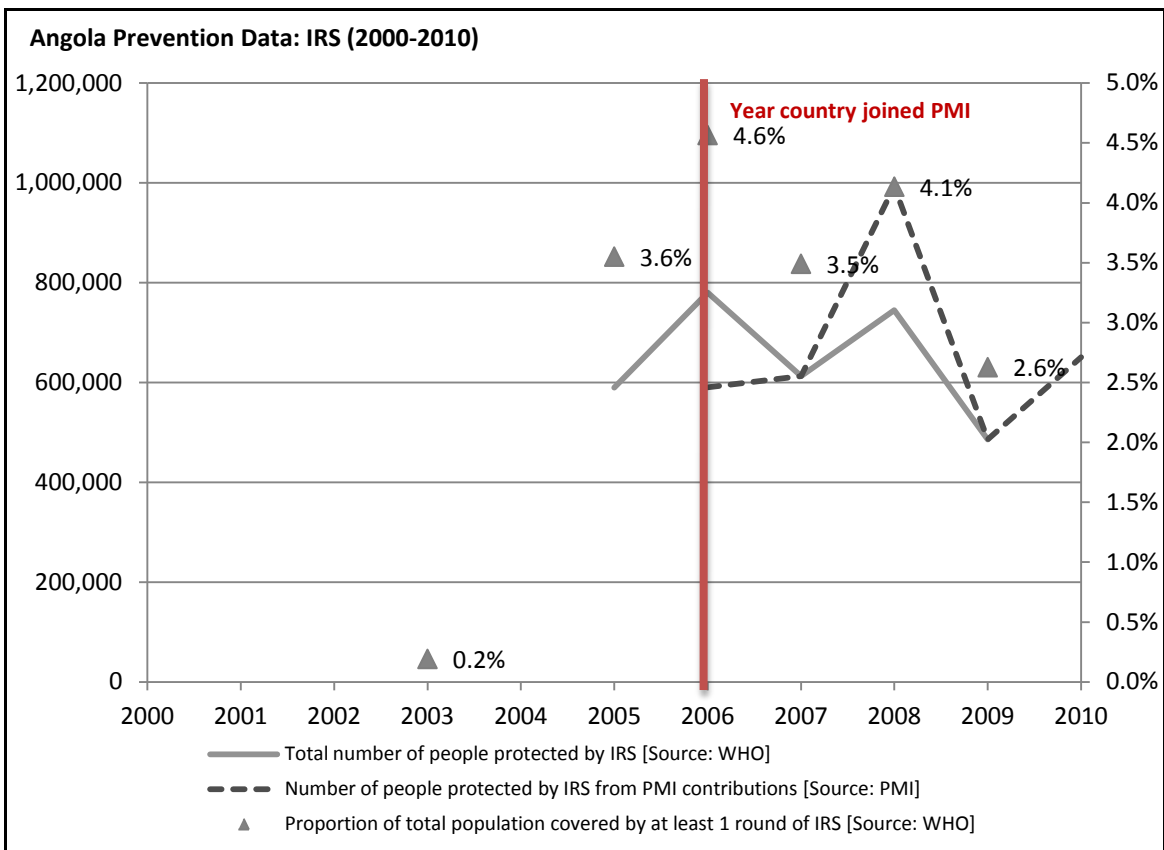
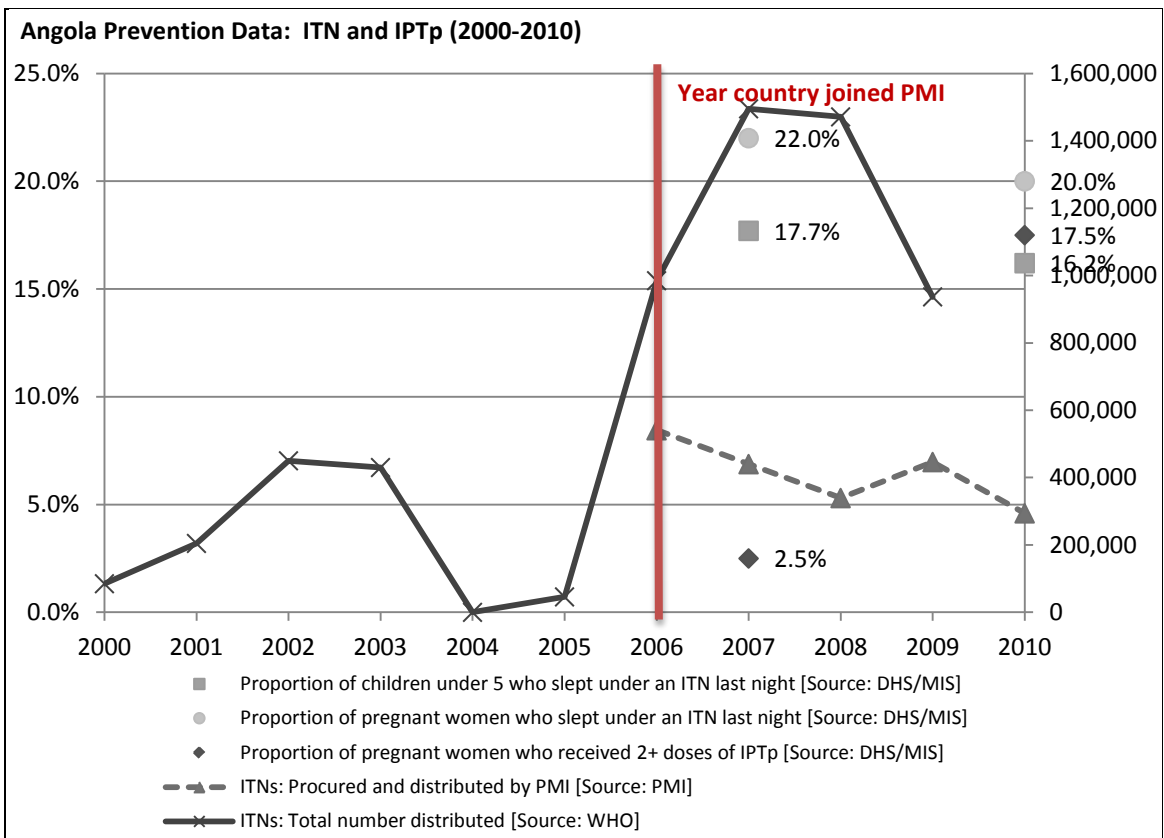
There is a marked reduction in prevalence of parasitemia in young children, from 19.5% in 2007 to 9.6% in 2010/2011, and a reduction of severe anemia from 3.6% in 2007 to 2.6% in 2010/2011. A major part of this can only be ascribed to a reduction of the malaria burden. The trends in malaria cases and deaths from HMIS are difficult to interpret. This would require a closer examination of concomitant developments in health service coverage. The increase in the number of confirmed cases can be considered a positive sign, probably reflecting increased diagnostic testing.

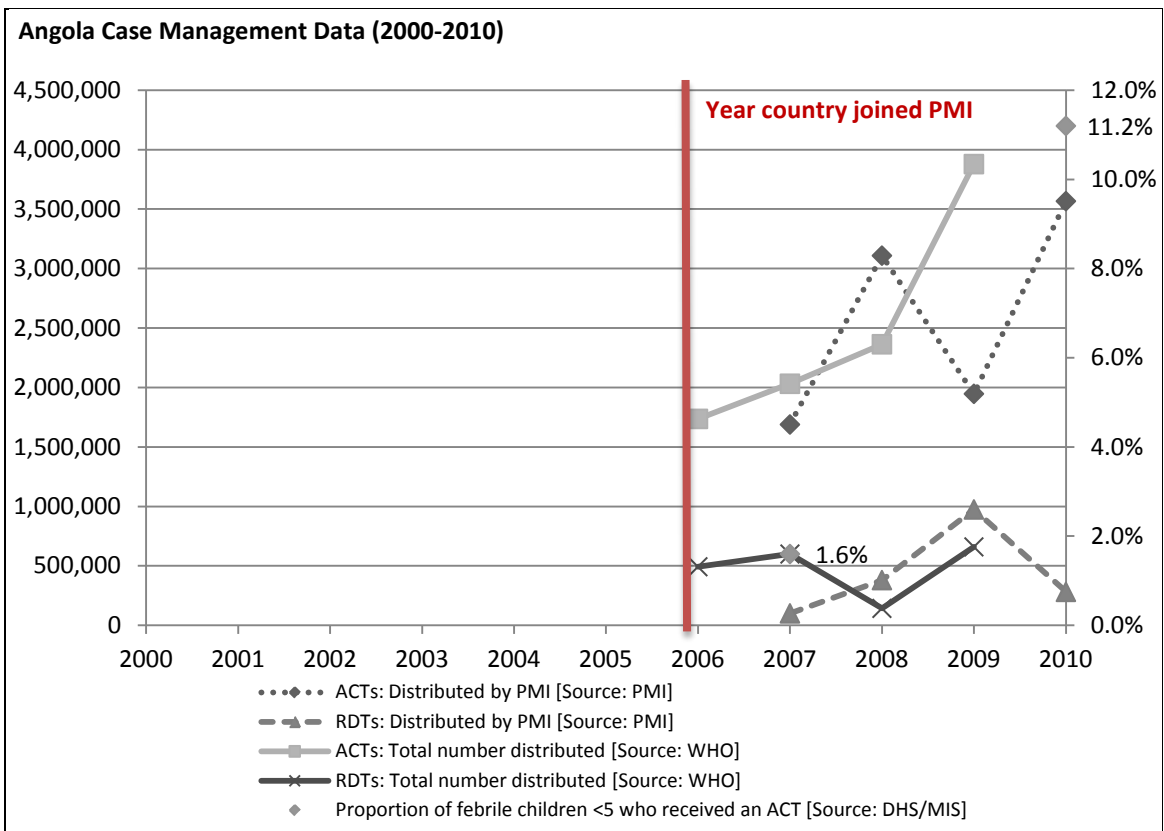
Conclusions

There has been good impetus on ITN distribution and ACTs, but the measured coverage rates in surveys have remained too low. The marked reduction in anemia and parasitemia prevalence in children from 2007–2010/2011 is an encouraging sign. The latest MIS data has also shown a decrease in under-5 mortality rate from 118 deaths to 91 deaths per 1,000 live.









2. Benin

PMI started in Benin in FY 2008 (Round 3). Benin has 9.3 million inhabitants in 2011, all at risk of malaria. Malaria transmission is generally seasonal.

Prevention

There was slow increase in ITN coverage starting in 2001 with a marked increase in 2007 and 2009. In 2006, one-fifth of young children and pregnant women were protected by ITNs with a very small percentage of pregnant women receiving two or more doses IPTp (0.1%). The NMCP distributed 2 million LLINs during 2007–2009, sufficient to cover a high proportion of children under 5 and pregnant women. However, the coverage rates have not been measured since 2006. IRS was introduced by PMI in 2008. From 2008–2009, approximately 500,000 people were protected by a single annual round in areas with relatively high malaria transmission and high child mortality rates. In 2010, 650,000 (5.7% of the national population) were covered.

Case Management

After the start of PMI, there was rapid scale-up of ACT and RDT distribution. ACT coverage rate for children under 5 is unavailable in the specified time period. PMI reports indicate that approximately 2.7 million treatment courses of ACT were delivered in 2009, sufficient to treat 60% of suspected malaria cases reported in the public sector, and over 100% of the probable and confirmed cases.

Contextual Factors

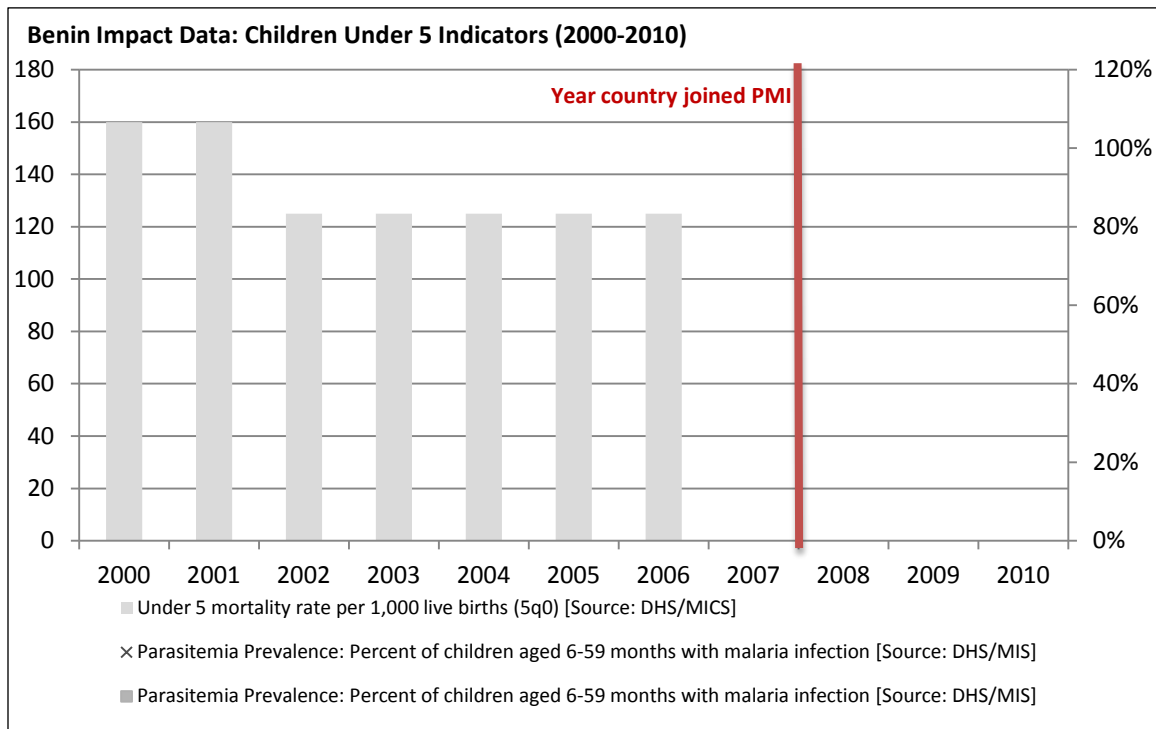
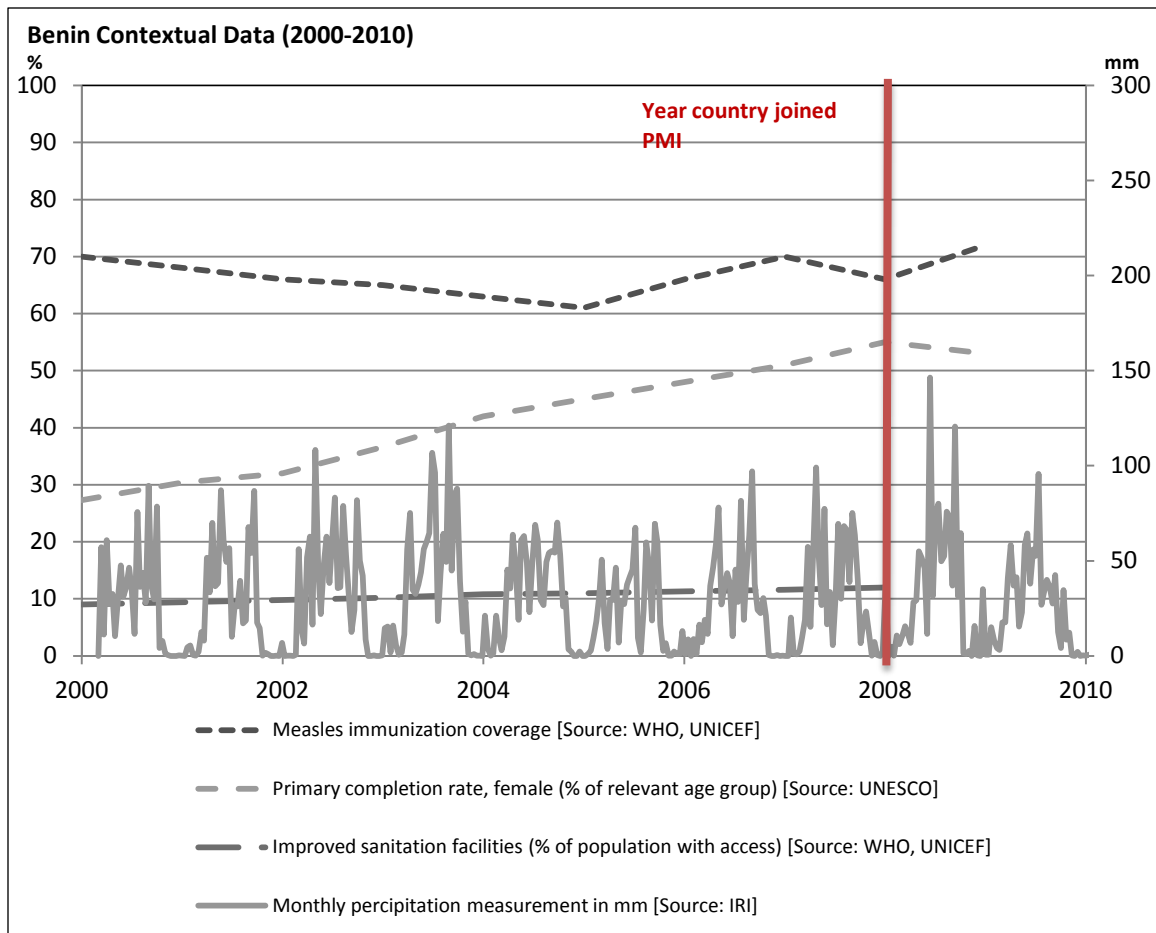
A considerable increase in the proportion of girls completing primary school may explain some of the reduction in ACCM. An overall change in precipitation trend is not apparent; however, increased precipitation in 2008 may have contributed to some of the rise in malaria cases and deaths, as reported to WHO, during that year.

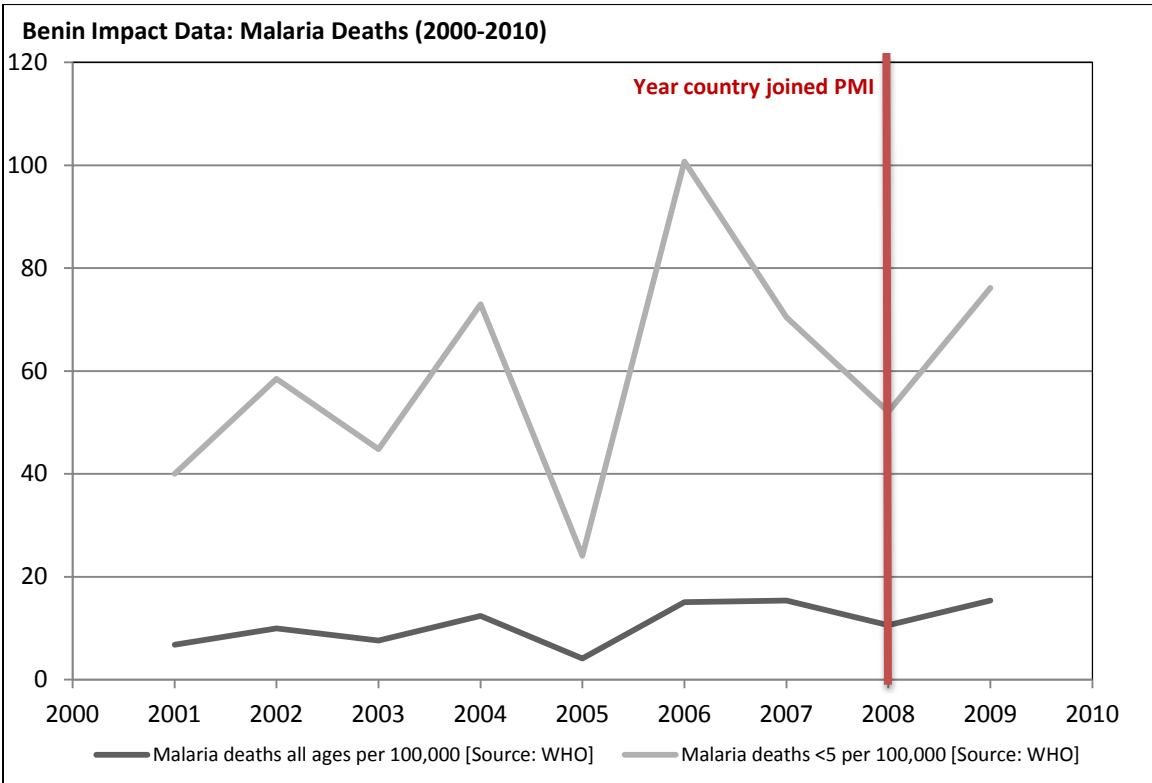
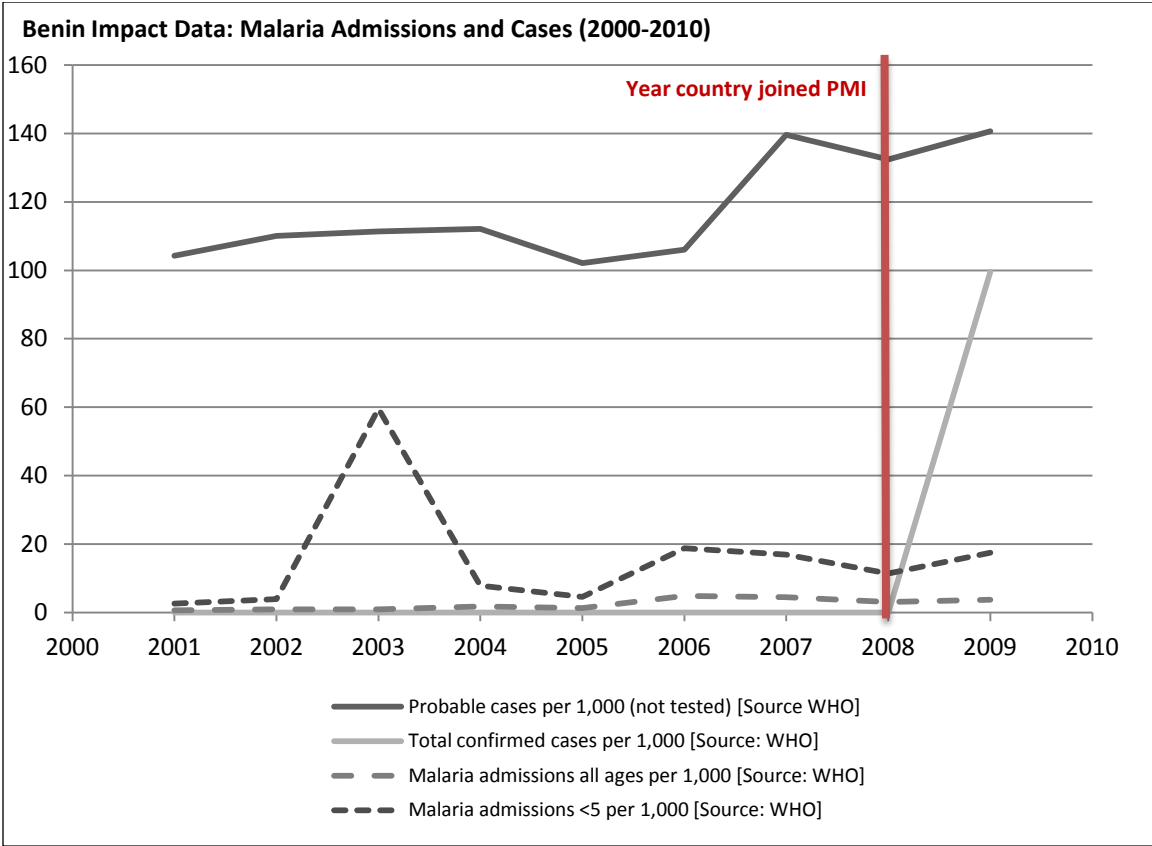
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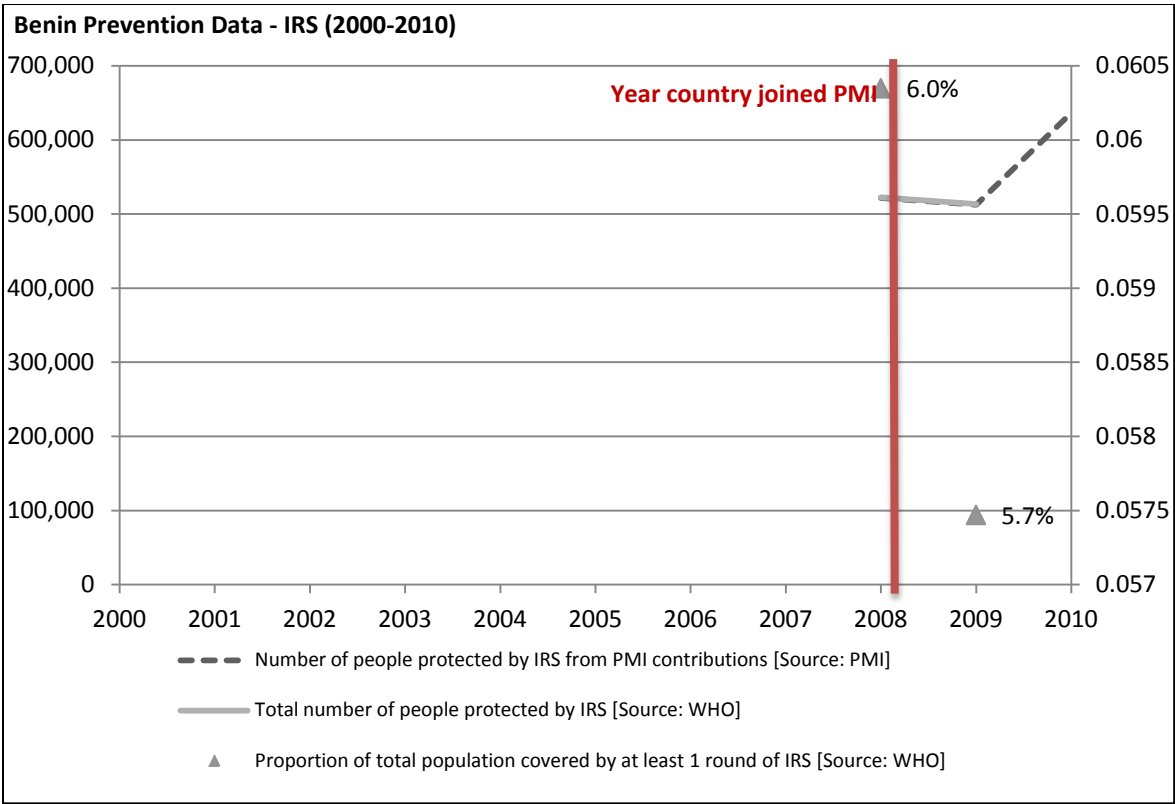
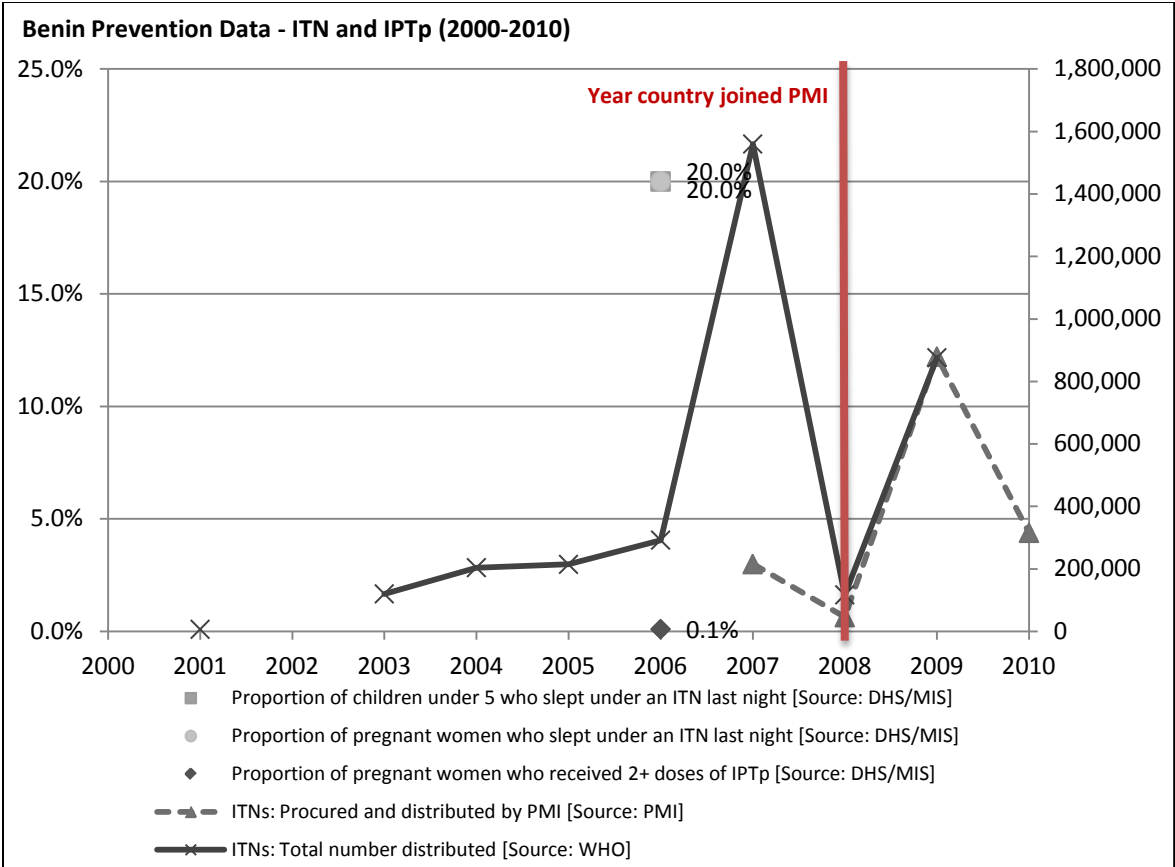
With no recent DHS or MIS data, it is difficult to assess the impact of under-5 mortality in Benin as a result of PMI. The numbers of reported cases and deaths have been consistently increasing, possibly due to improved reporting completeness and increased use of RDTs since 2007.

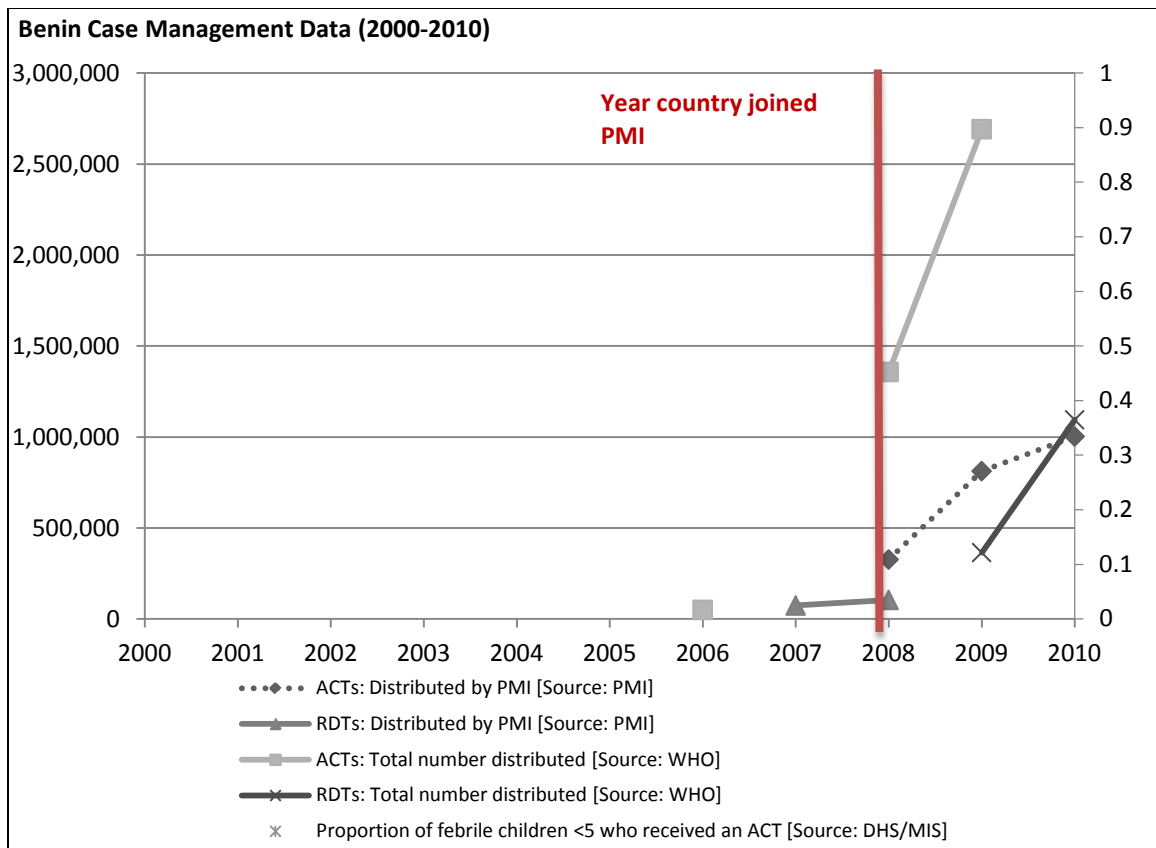
Conclusions

It is not possible to draw any conclusions about outcomes and impact after the start of PMI in 2008; however, the scale-up of malaria prevention and treatment measures in Benin over the last few years are strong programmatic accomplishments.









3. Ethiopia

PMI started in Ethiopia in FY 2008 (Round 3) and has concentrated its operations in the state of Oromia.

Ethiopia has 90.9 million inhabitants in 2011, two-thirds at risk of malaria. Malaria is endemic with differing intensity of transmission, except in the central highlands (above 2,000 meters) where there is little risk of malaria.

Prevention

A dramatic increase in ITN coverage started in 2004 with over 9 million ITNs distributed in 2006. This marked increase resulted in considerable increase in the proportion of children and pregnant women sleeping under ITNs, from 1%–2% in 2005 to one-third in 2007. IRS was supported in Oromia by PMI in 2008 and has protected 2 million residents in 2010. In 2009, DDT was replaced by deltamethrin on the basis of insecticide susceptibility studies.

Case Management

A few years before implementation of PMI, a rapid scale-up in the distribution of ACTs and RDTs took place. ACT coverage rate for children under 5 is unavailable in the specified time period. Over 8 million ACT treatment courses delivered in both 2008 and 2009 were sufficient to treat all reported malaria cases in the public sector. PMI contributions have led to continued support of ACTs and RDTs in Ethiopia by the end of the decade.

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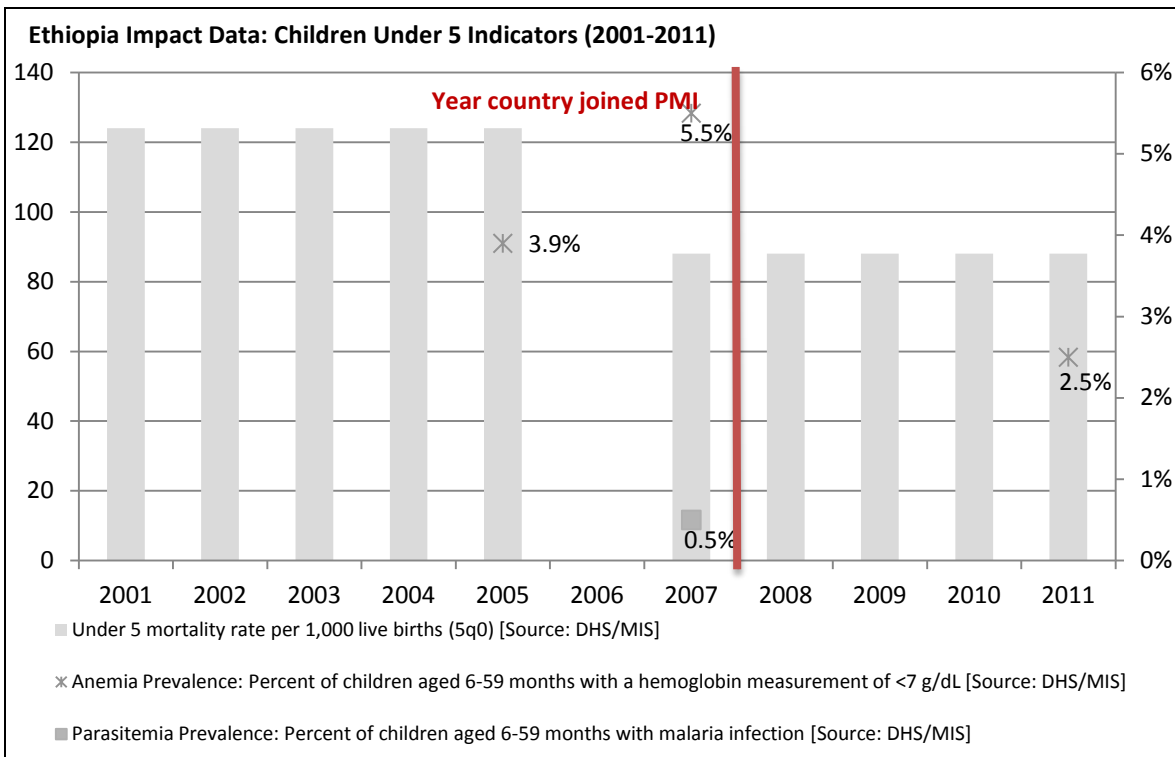
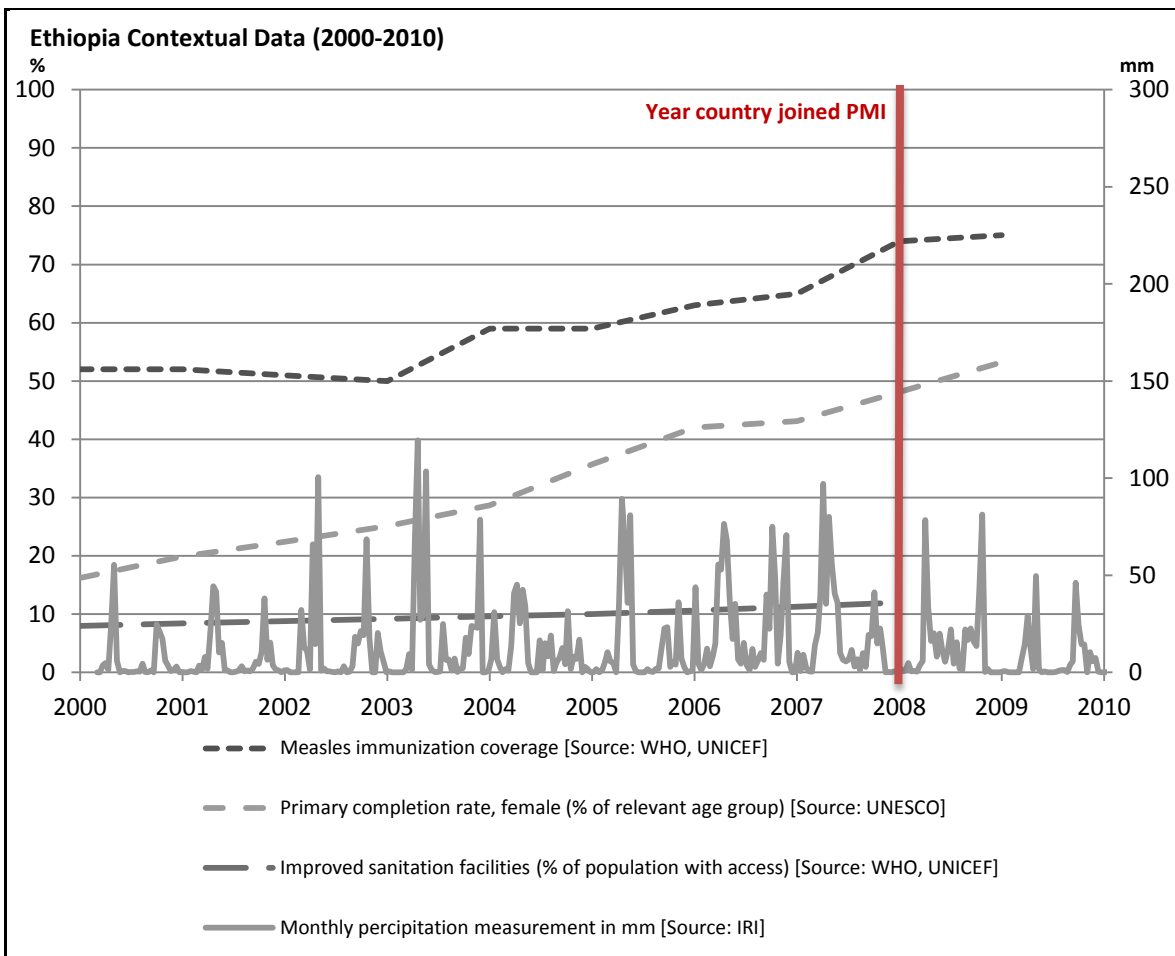
ACCM in Ethiopia has seen a 29% reduction since 2005. With the exception of a nationwide malaria epidemic in 2003–2004, an overall reduction in the number of reported malaria deaths has been observed in Ethiopia. A slight increase in the number of confirmed malaria cases was observed after implementation of PMI, possibly due to increased use of RDTs, increased health-seeking behavior, and improved reporting completeness. From 2007–2011 the anemia prevalence among children decreased from 5.5% to 2.5%; this is likely to be explained mainly by improvement in the malaria situation.

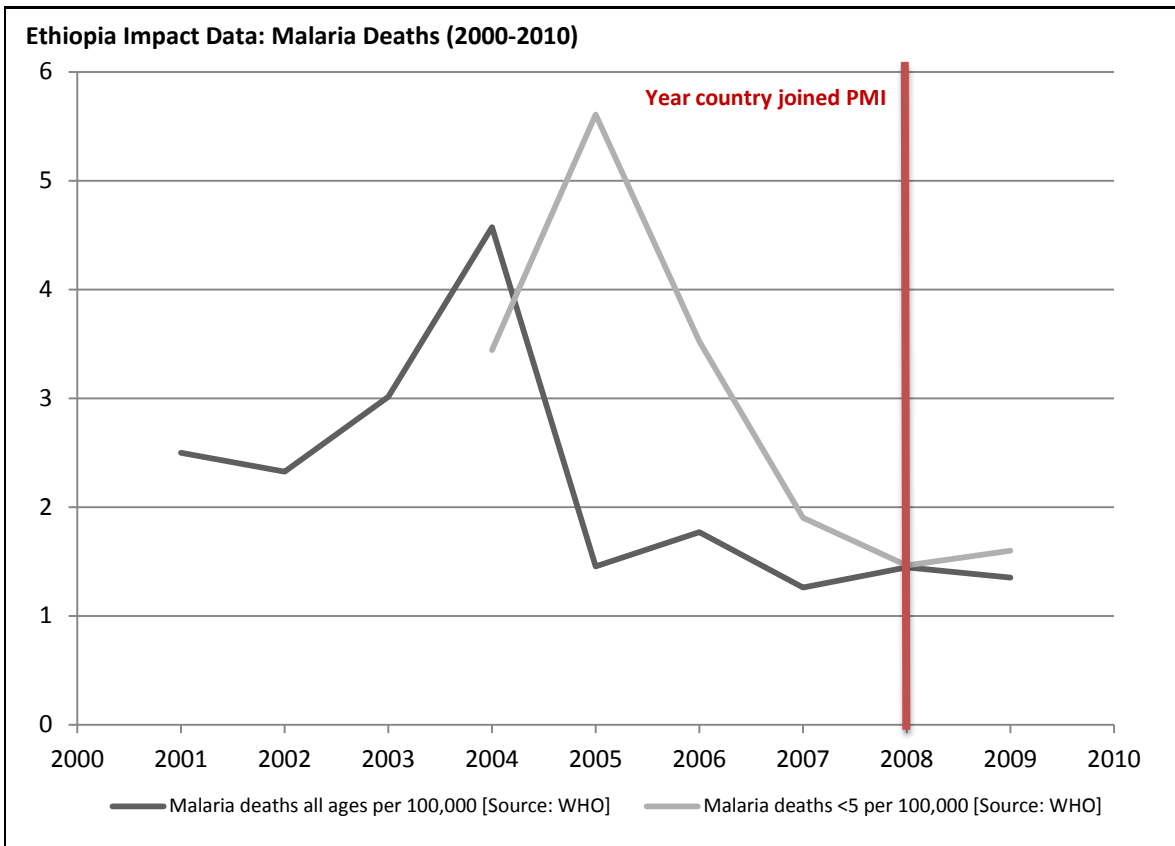
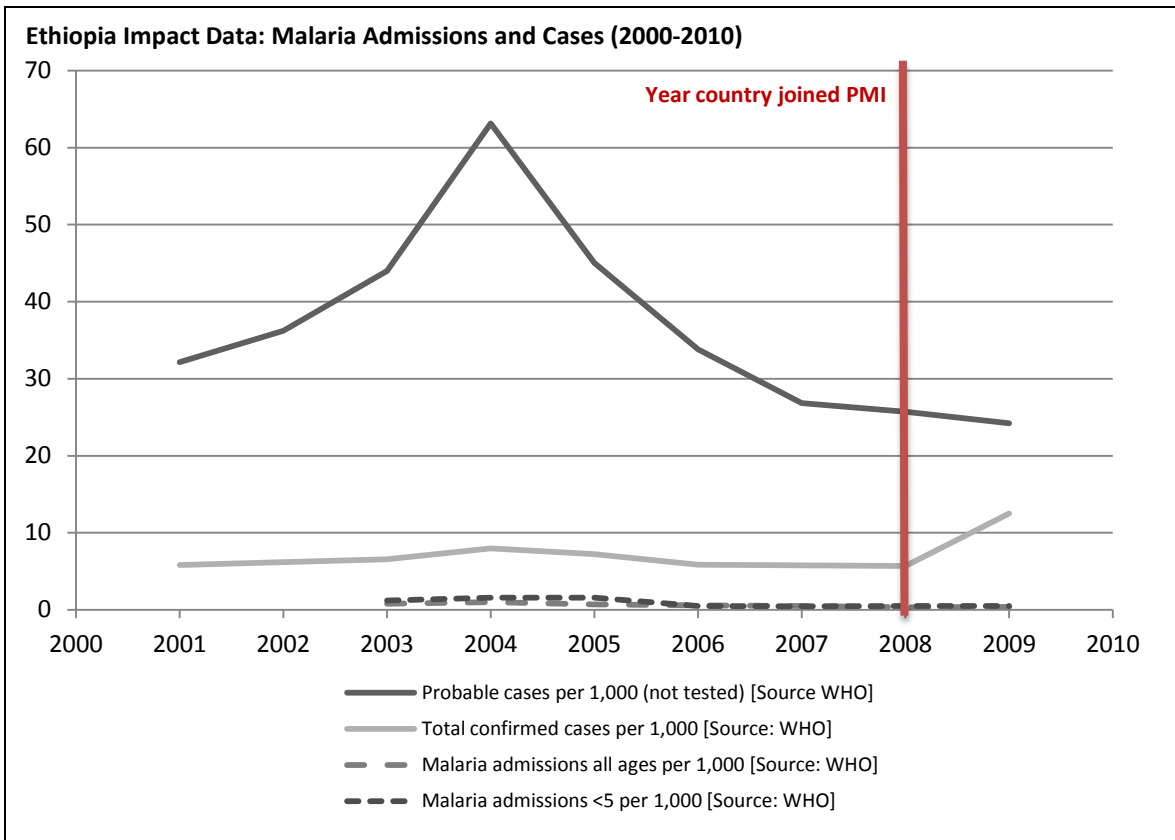
Contextual Factors

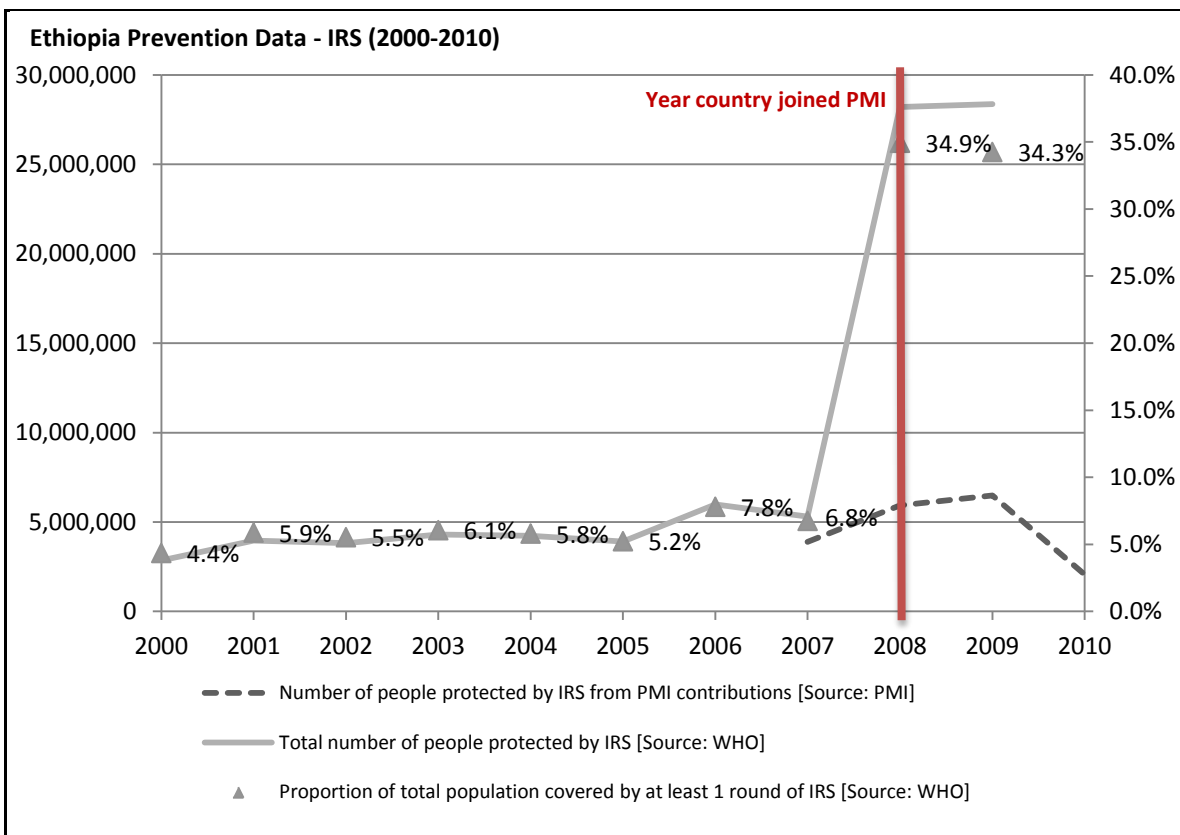
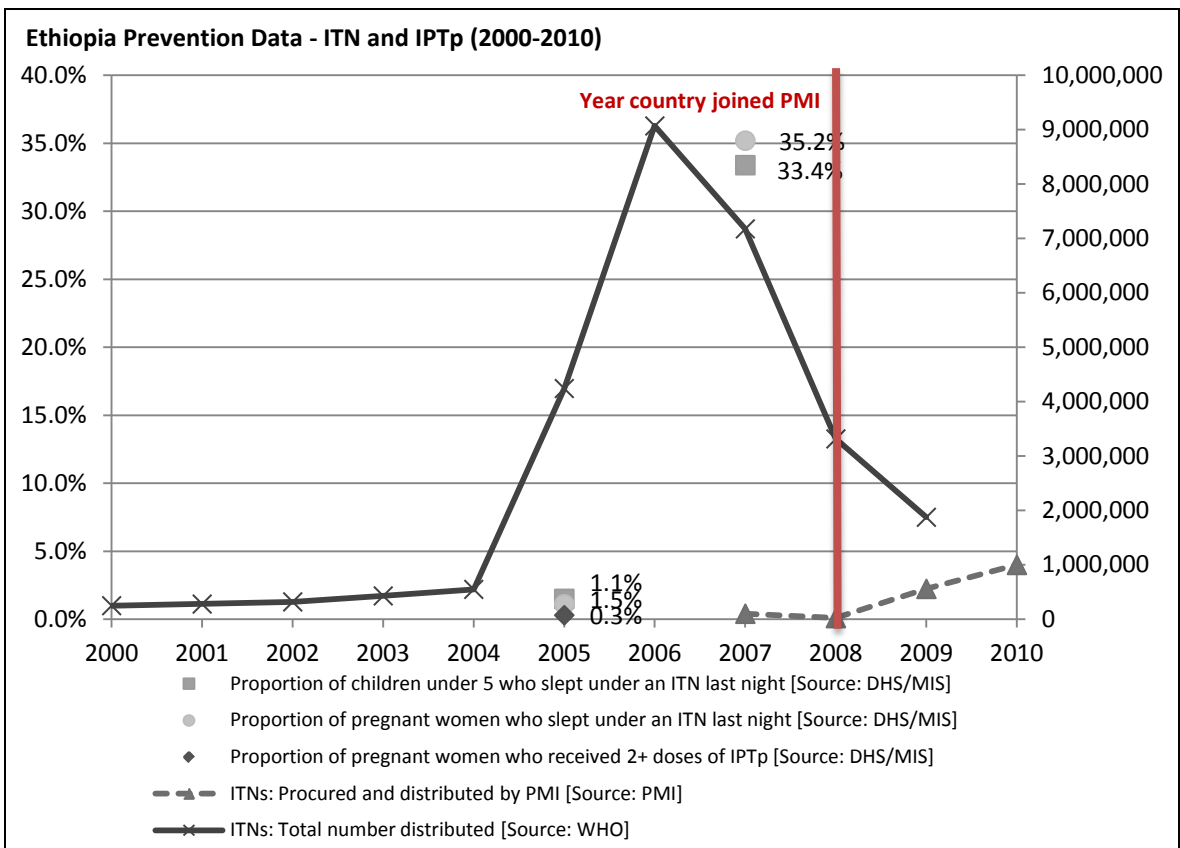
A considerable increase in the proportion of girls completing primary school and measles immunization coverage may explain some of the reduction in ACCM. An overall change in precipitation trend is not apparent; however, increased precipitation in 2003 may have contributed together with famine and SP resistance to the severe malaria epidemic which occurred in 2003–2004.

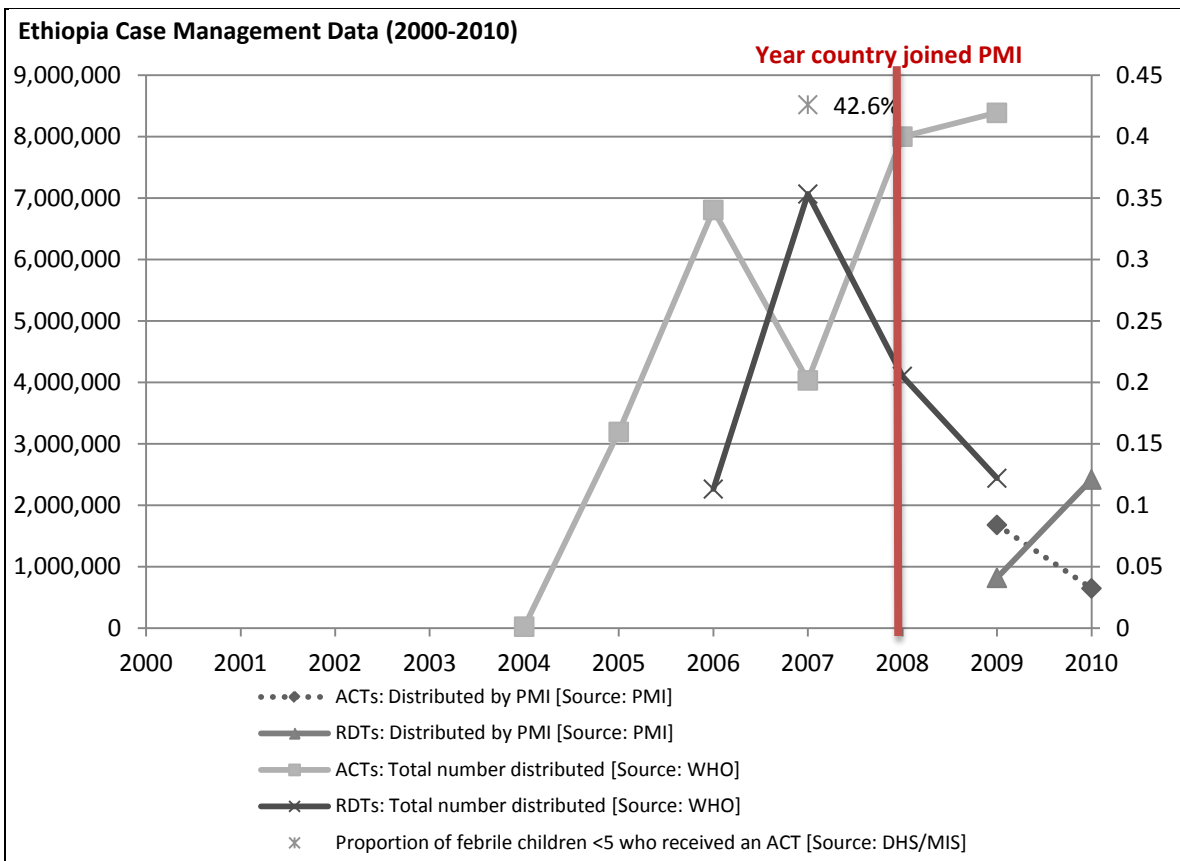
Conclusions

The fact that there has not been a major epidemic in Ethiopia since 2004 is encouraging. The continued decline in malaria-related mortality also supports the assumption that the interventions implemented have continued to reduce malaria risk. For an evaluation of PMI it will be of great interest to examine detailed data on Oromia and the rest of the country. ACCM data has to be analyzed with great caution, as the main malaria burden in the country is probably not in the under-5 group.









4. Ghana

PMI started in Ghana in FY 2008 (Round 3). Ghana has 24.8 million inhabitants in 2011, all at risk of malaria.

Prevention

A dramatic scale-up of ITNs started in 2005 with over 10 million nets distributed in 2006. This resulted in increased ITN coverage, from 2%–3% in 2003 to 20% of pregnant women and 28% of children under 5 sleeping under ITNS in 2008. These coverage rates are, however, disappointingly low given the scale of implementation. IPTp has seen an impressive rise in coverage, from 1% of pregnant women receiving two or more doses of IPTp in 2003 to 44% in 2008. IRS protected about 850,000 (3%) of the population at risk in 2010.

Case Management

Implementation of PMI resulted in rapid scale-up of the distribution of ACTs, with close to 10 million ACTs distributed in 2008. ACT coverage rate for children under 5 is unavailable in the specified time period. In 2009, 4 million courses of ACT were delivered in Ghana, sufficient to treat all suspected malaria cases. PMI contributions have also led to increased distribution of RDTs, with 1.2 million RDT distributed in 2009. It is interesting to note that a reduction in ACT and RDTs distribution by PMI was seen in 2010.

Impact

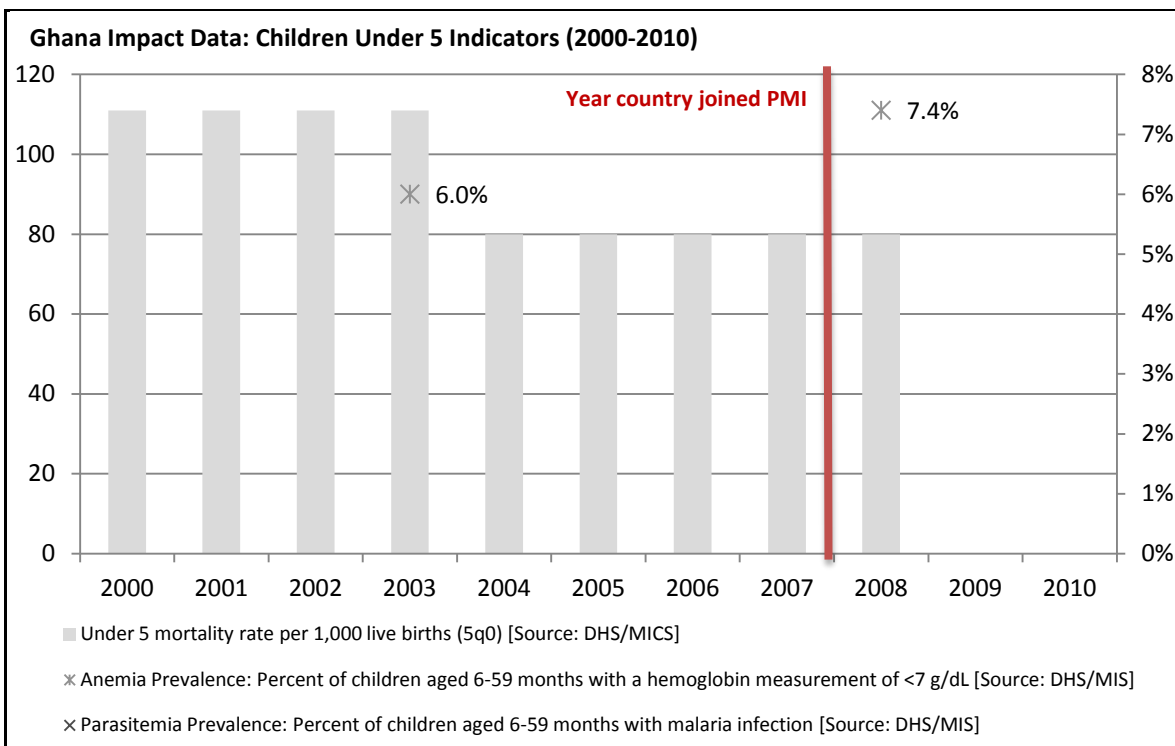
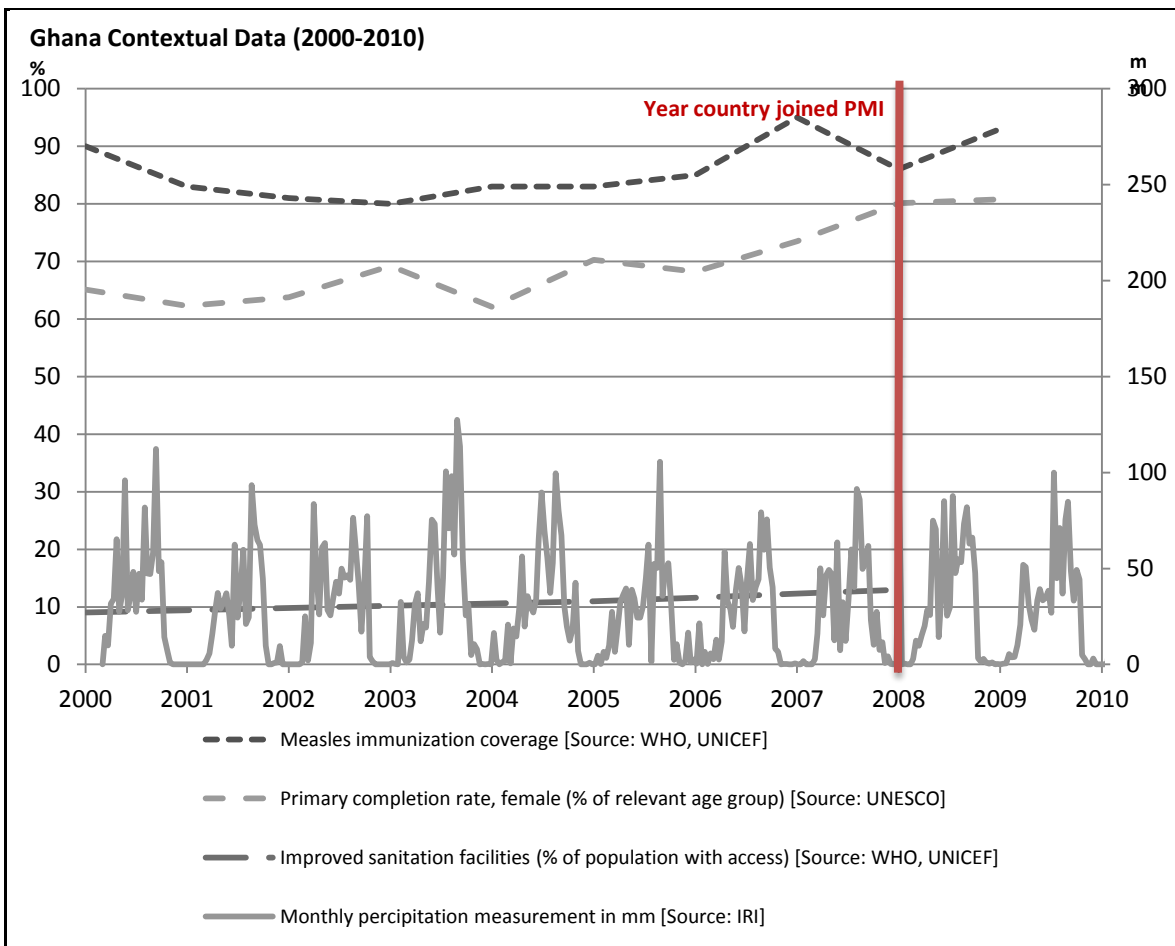
ACCM has seen a 28% reduction from measurements in 2003 to 2008. Without more knowledge of the health services, it is difficult to interpret the trends in cases and admissions. The apparent decline in malaria cases and admissions after 2000 could be explained at least to some extent by changes in standards for recording of cases. However, the decline in probable cases and the increase in confirmed cases in recent years indicate an improvement in service provision.

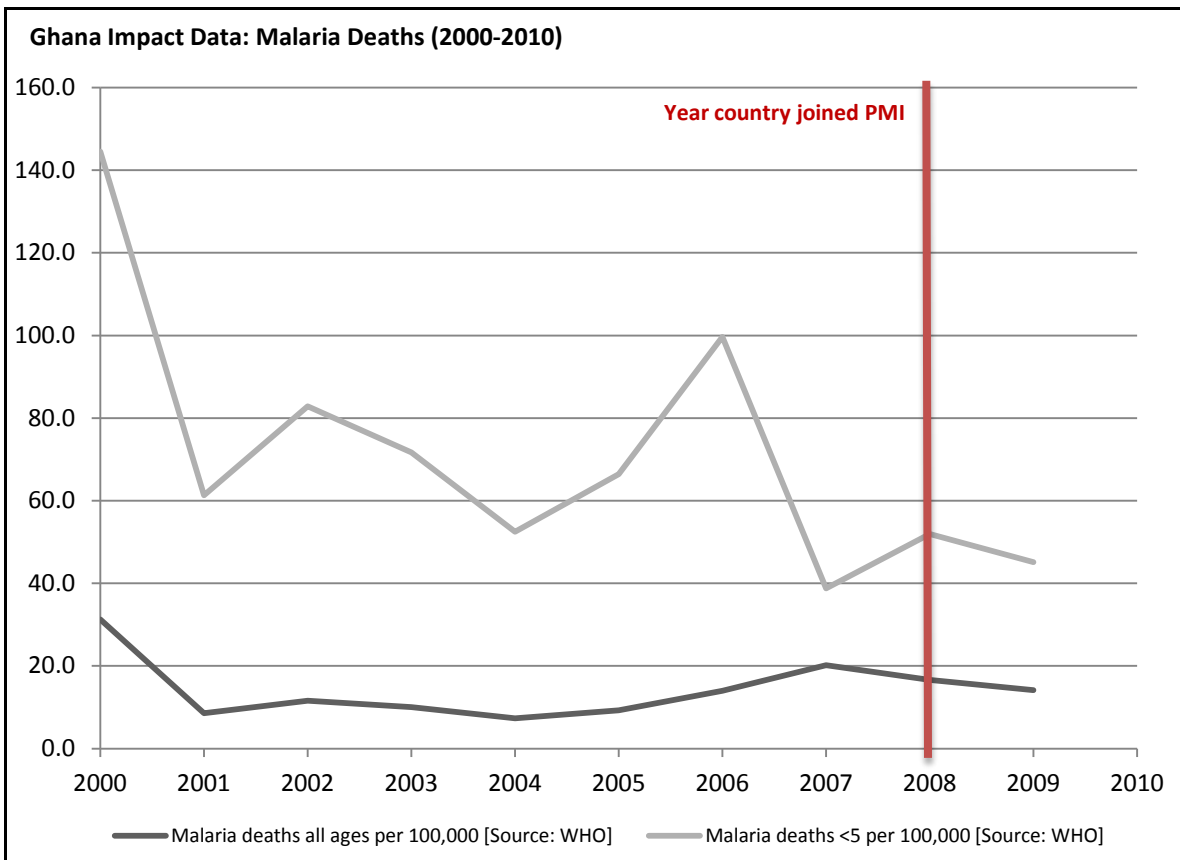
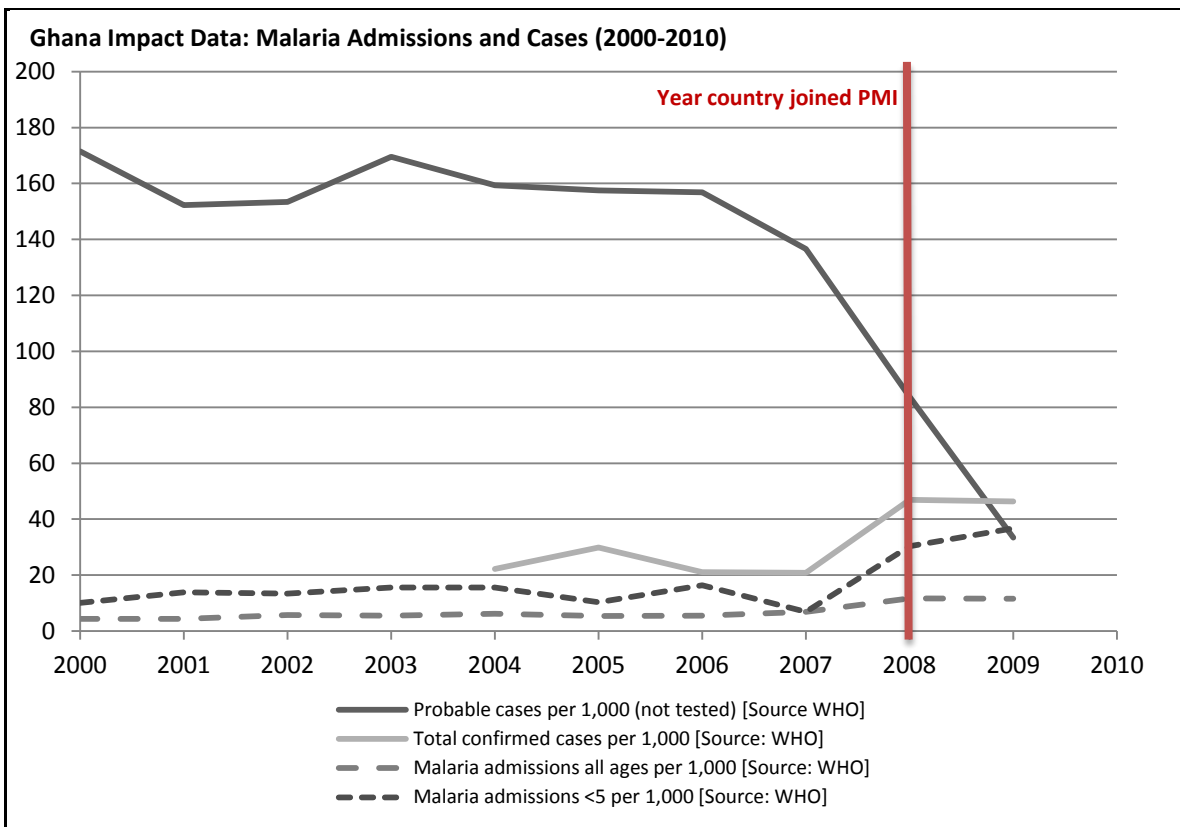
Contextual Factors

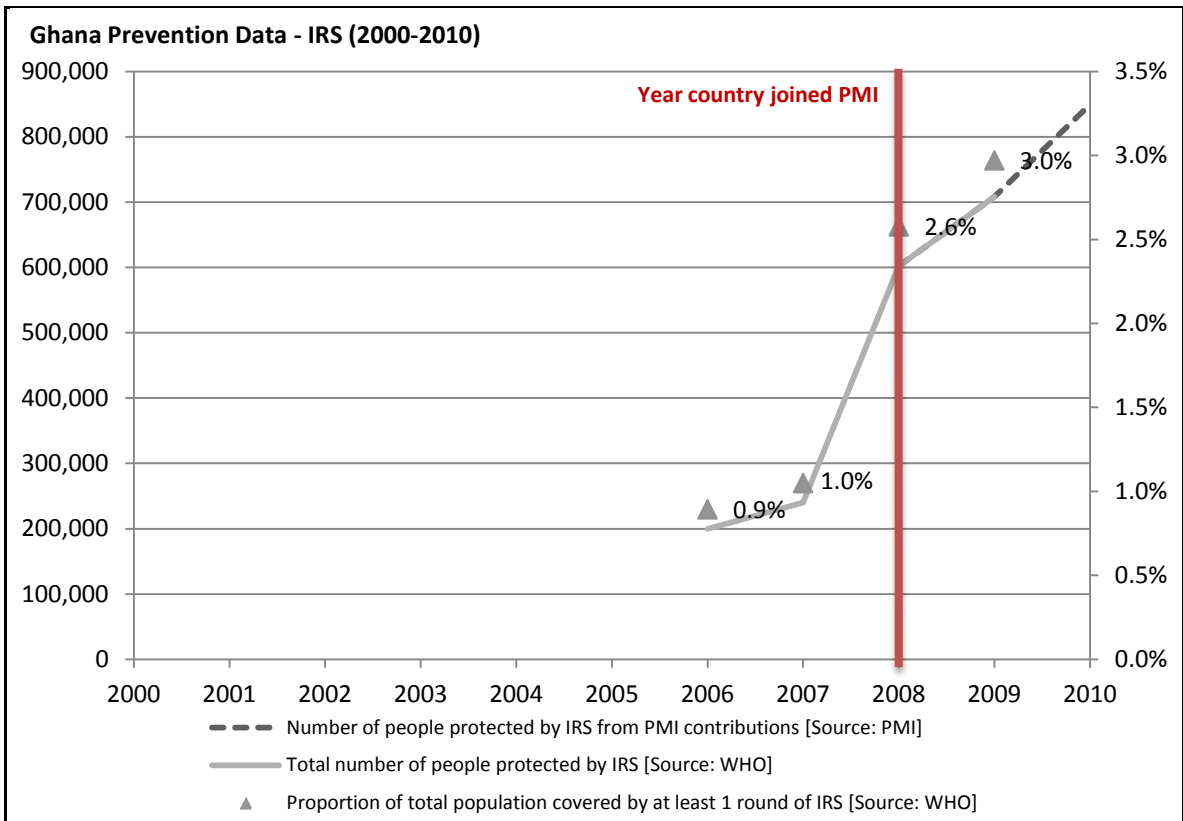
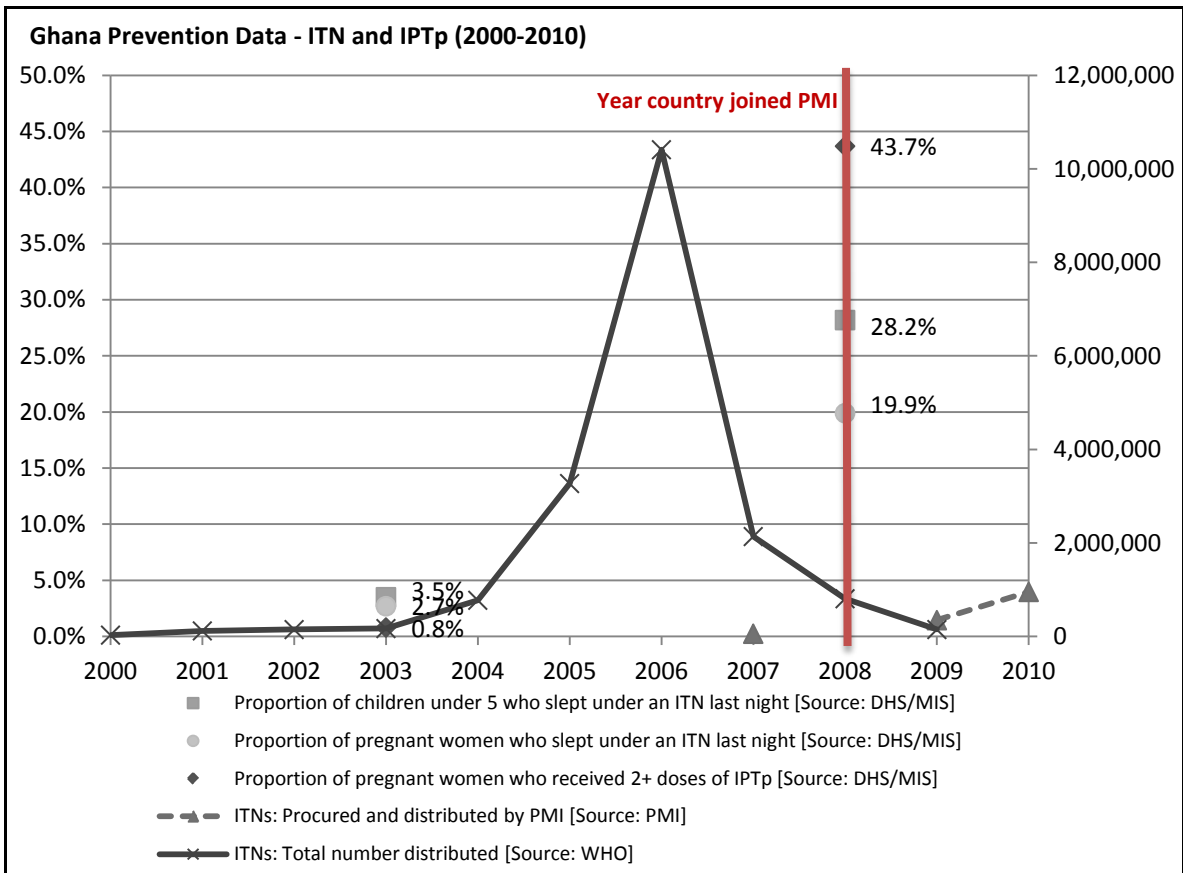
The slight increase in measles immunization coverage is unlikely to explain much of the reduction in ACCM. An overall change in precipitation trend is not apparent. Surprisingly, the prevalence of anemia in children increased between 2003 and 2008. This makes it difficult to attribute any of the ACCM reduction to malaria control.

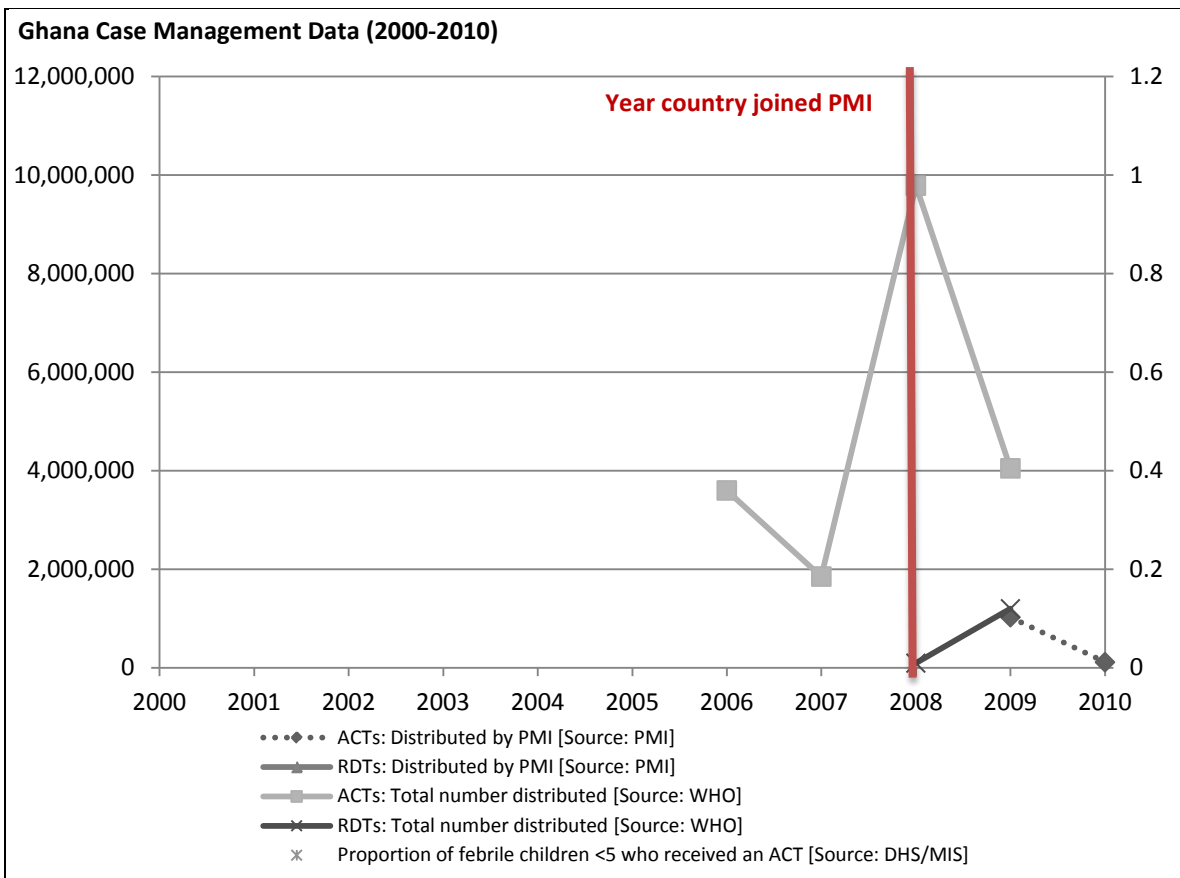
Conclusions

It is difficult to say anything about impact. More attention should be given to monitoring the use of distributed ITNs and to monitoring prevalence of anemia and parasitemia.









5. Kenya

PMI started in Kenya in FY 2008 (Round 3). Kenya has an estimated population of 38.6 million inhabitants in 2011, with two-thirds at risk of malaria. There is intense malaria transmission in Western Kenya and unstable, variable malaria in the highlands.

Prevention

Several large ITN distributions have taken place over the last decade, the first in 2002 (5.5 million ITNs) and the second in 2006 (7.1 million ITNs). The increase in ITN distribution over the last decade has resulted in a considerable increase in ITN coverage, the proportion of children under 5 and pregnant women sleeping under ITNs having continued to increase from approximately 6% in 2003, to 40% in 2007, and close to 50% in 2009. IPTp has also seen a modest increase in coverage, from 5% of pregnant women receiving two or more doses of IPTp in 2003, to 13% in 2007, and 14% in 2009. PMI, with support from the Global Fund, implemented IRS in selected districts, providing protection for about 3 million people at risk in 2008. PMI support provided protection for 1.5 million people in 2009 and 2 million people in 2010.

Case Management

Implementation of PMI resulted in a rapid scale-up in the distribution of ACTs in Kenya, with close to 8 million ACTs distributed in 2008. ACT coverage rate for febrile episodes in children under 5 stood at 29% in 2008. To date, half a million RDTs have been distributed with PMI support, with plans to procure 2 million in 2011.

Impact

ACCM in Kenya has seen a 36% reduction from 2003–2008. The number of probable malaria cases indicates an increasing trend over the last decade. The lack of data on malaria admissions and confirmed malaria cases makes it difficult to understand whether this trend represents improved reporting or a real increase in incidence. In addition, no reports of malaria deaths were provided for 2006–2009. While prevalence of parasitemia increased, anemia decreased from 2007–2010. Of the two, anemia is probably the more robust indicator, being less subject to short-term variations in transmission.

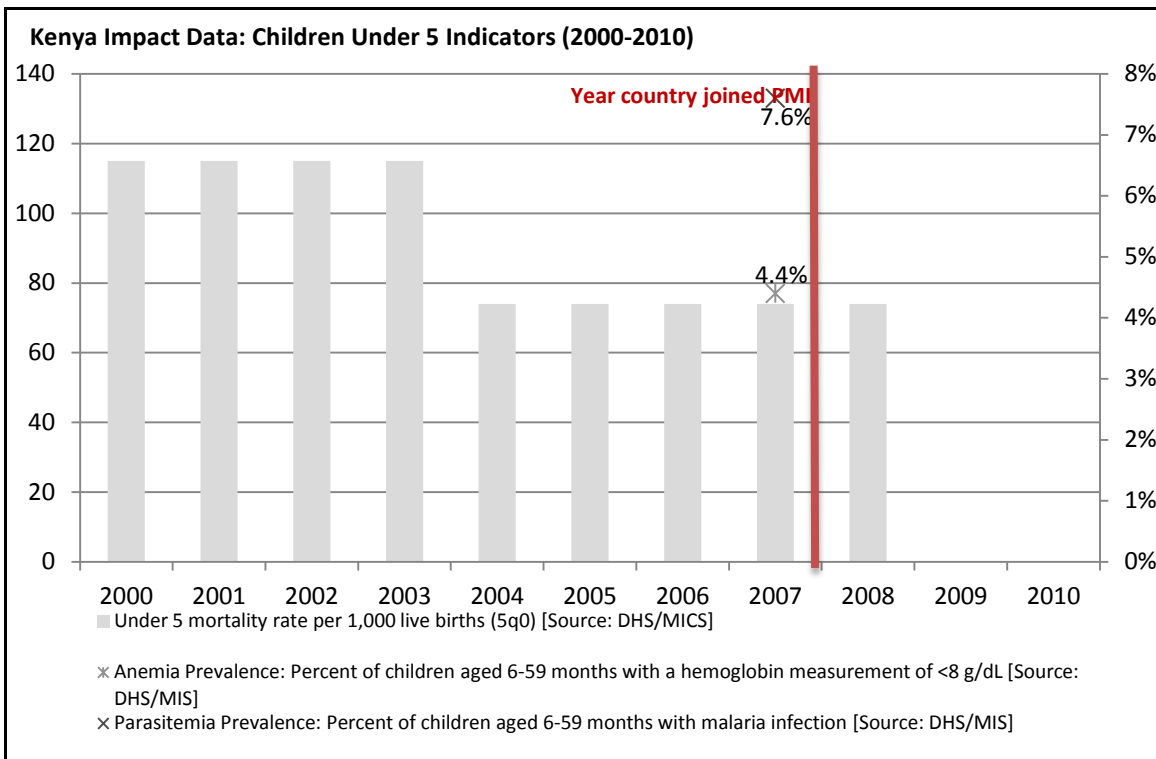
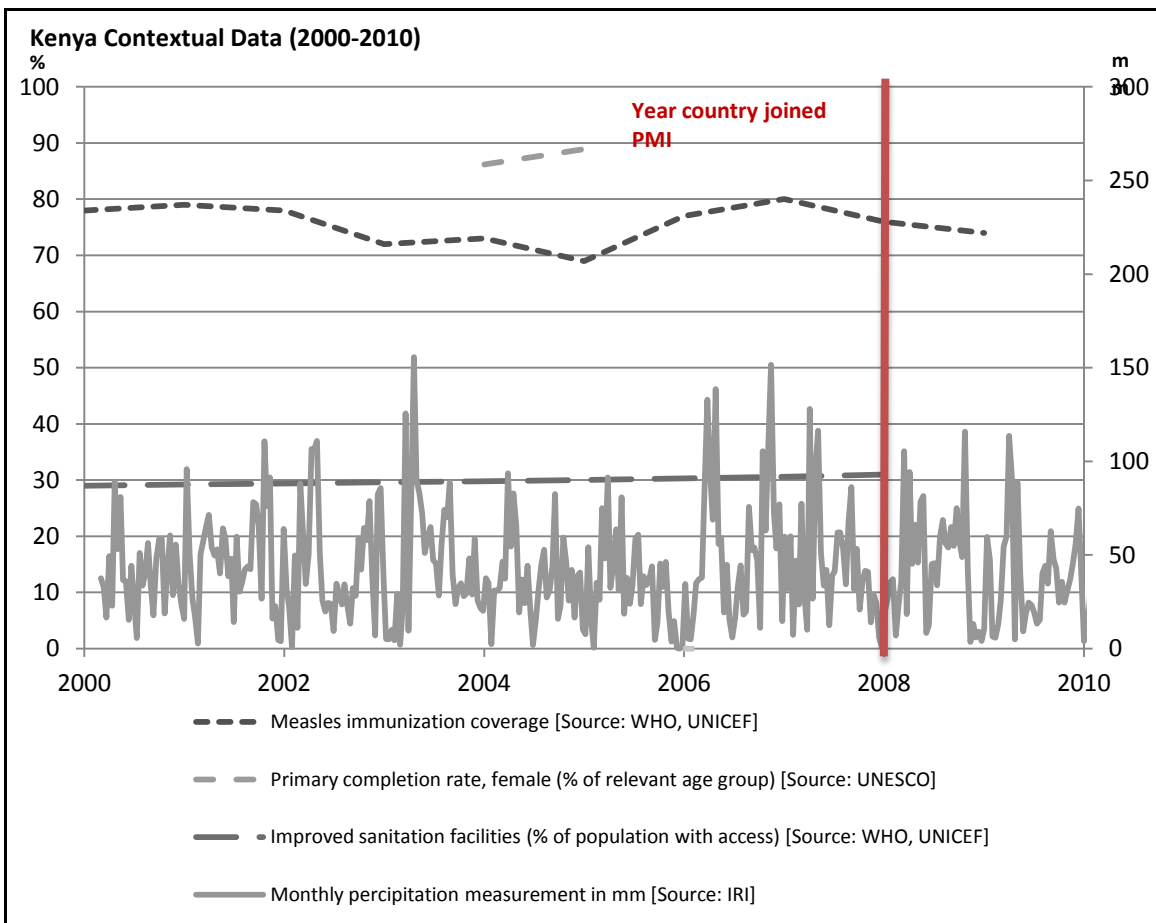
Contextual Factors

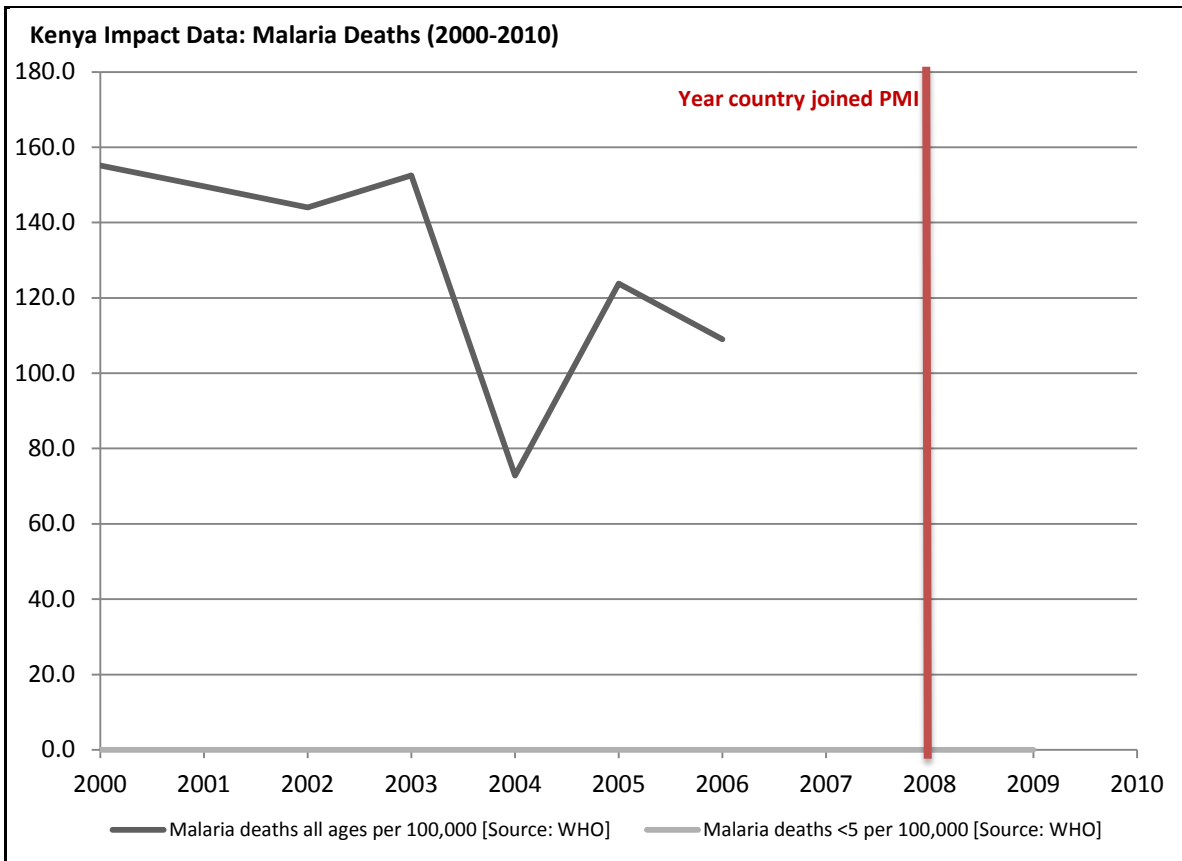
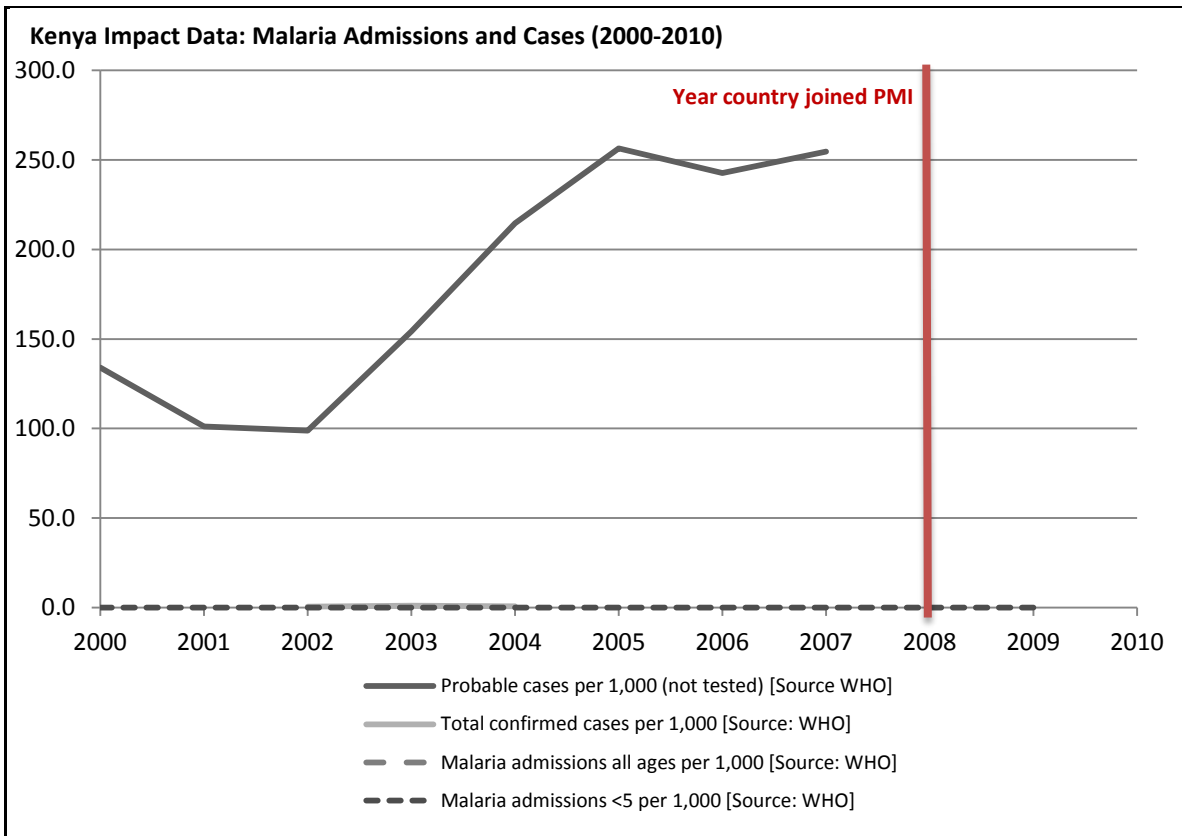
Key contextual factors recorded—measles immunization coverage, improved sanitation facilities, and precipitation measurements—do not indicate any overall change in trend.

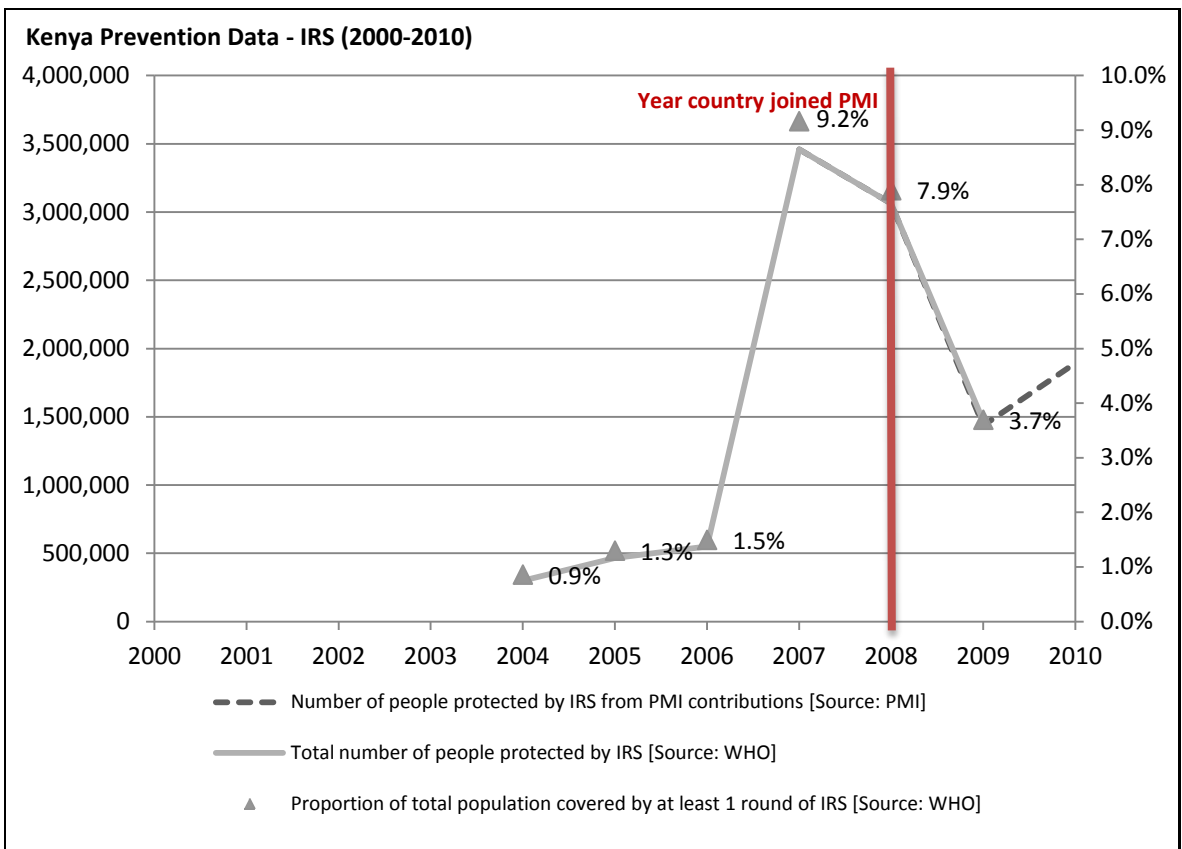
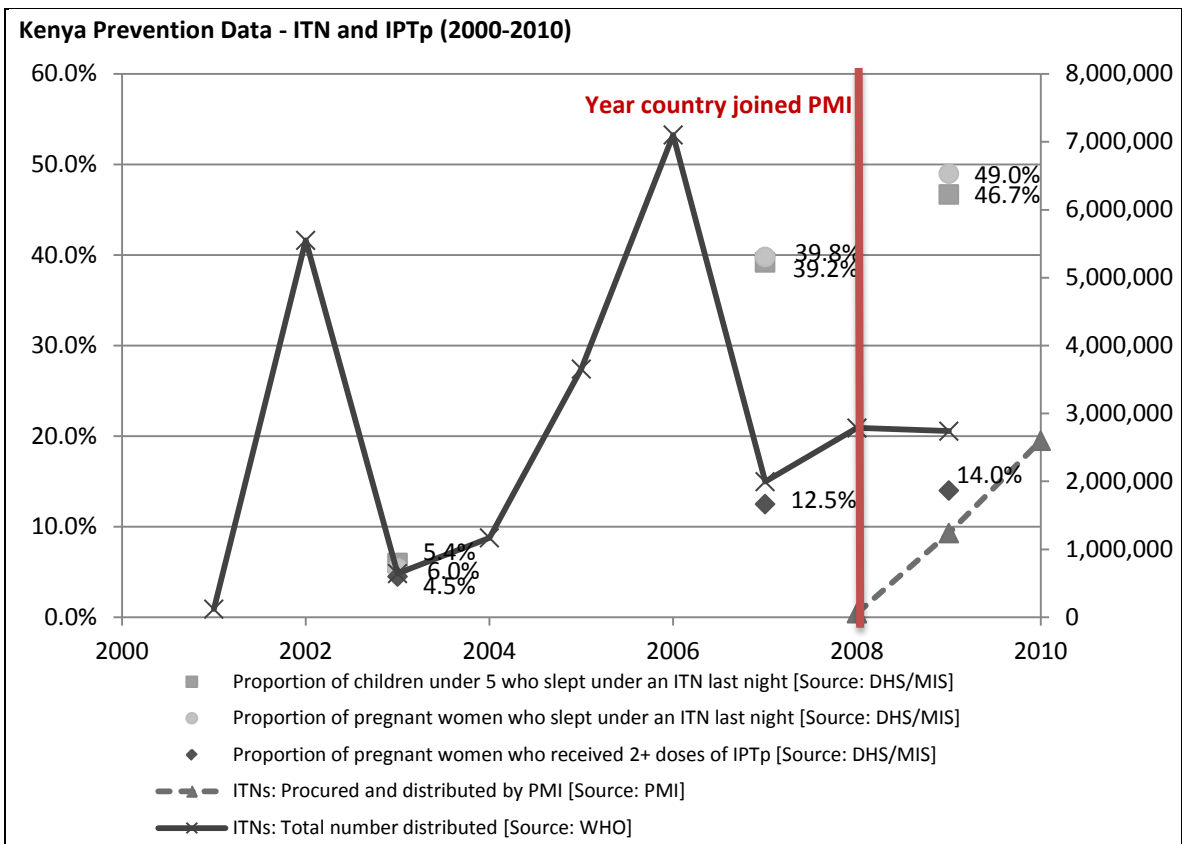
Conclusions

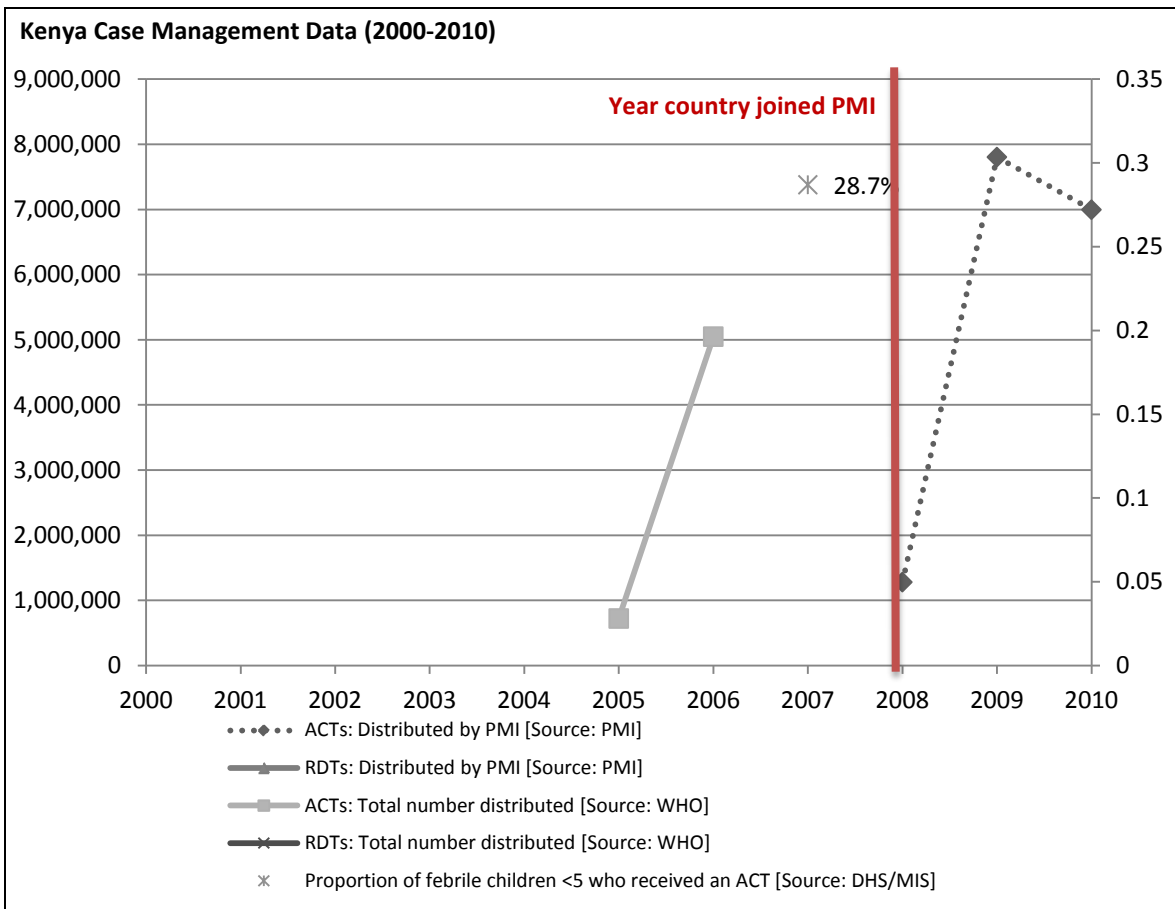
Data from several publications indicate a steady reduction in malaria incidence in at least some areas of Kenya since the beginning of the decade—i.e., a trend—which started before large-scale implementation of ITNs and ACTs and which may have something to do with the introduction of SP for case management and perhaps some contextual factors. A recent study on pediatric admissions across the country indicates that in some areas the decline in malaria admission rates can plausibly be ascribed to interventions.⁵¹ It is therefore likely that the marked reduction in ACCM presented here has some relation to an improvement in the malaria situation. The high coverage of LLINs, the well-targeted and successful IRS, and the relatively high coverage of ACTs for febrile episodes in children recorded in 2008 justify optimism about the possibility of recording impact from scale-up in future surveys.

⁵¹ Okiro, E.A. et al. “Changing malaria intervention coverage, transmission and hospitalization in Kenya.” *Malaria Journal* 9:285, 2010.









6. Liberia

PMI started in Liberia in FY 2008 (Round 3). Liberia has 3.8 million inhabitants in 2011, all at high risk of malaria. Malaria transmission is perennial in most parts of the country. Up until 2003, Liberia has experienced intermittent civil war for more than a decade, with disruption of almost all health services in the country.

Prevention

ITN distribution started in 2005 and has increased with 750,000 ITNs distributed in 2009. Based on the latest MIS data from 2009, the proportion of children under 5 who slept under an ITN the night before the survey was 26%, while the proportion for pregnant women was slightly higher at 33%. IPTp rates in Liberia stood at an impressive 45% in 2009. PMI funds supported IRS implementation in Liberia, with 300,000 (8%) people protected in 2009 and 410,000 people protected in 2010.

Case Management

Implementation of PMI resulted in rapid scale-up in the distribution of ACTs and RDTs in Liberia, almost entirely supported by PMI funds. At the end of 2010, 1.6 million ACTs and 1.2 million RDTs were distributed in Liberia. ACT coverage rate for children under 5 was 30% in 2009, which is quite impressive given the context.

Impact

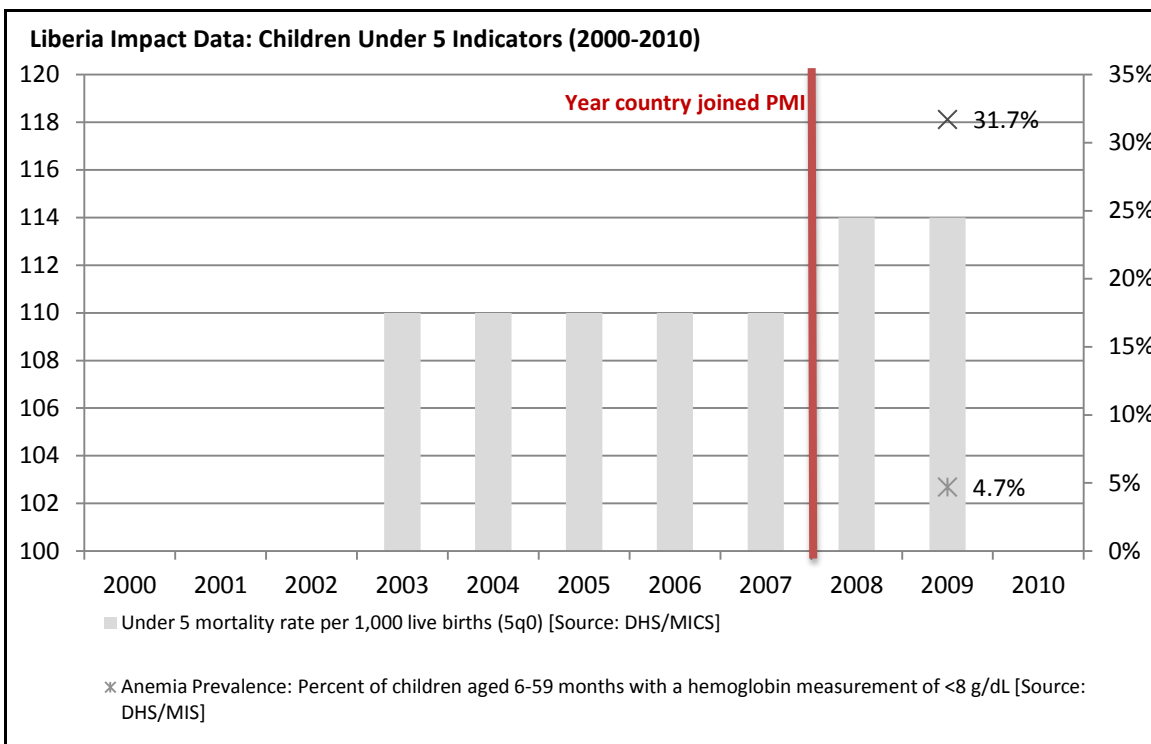
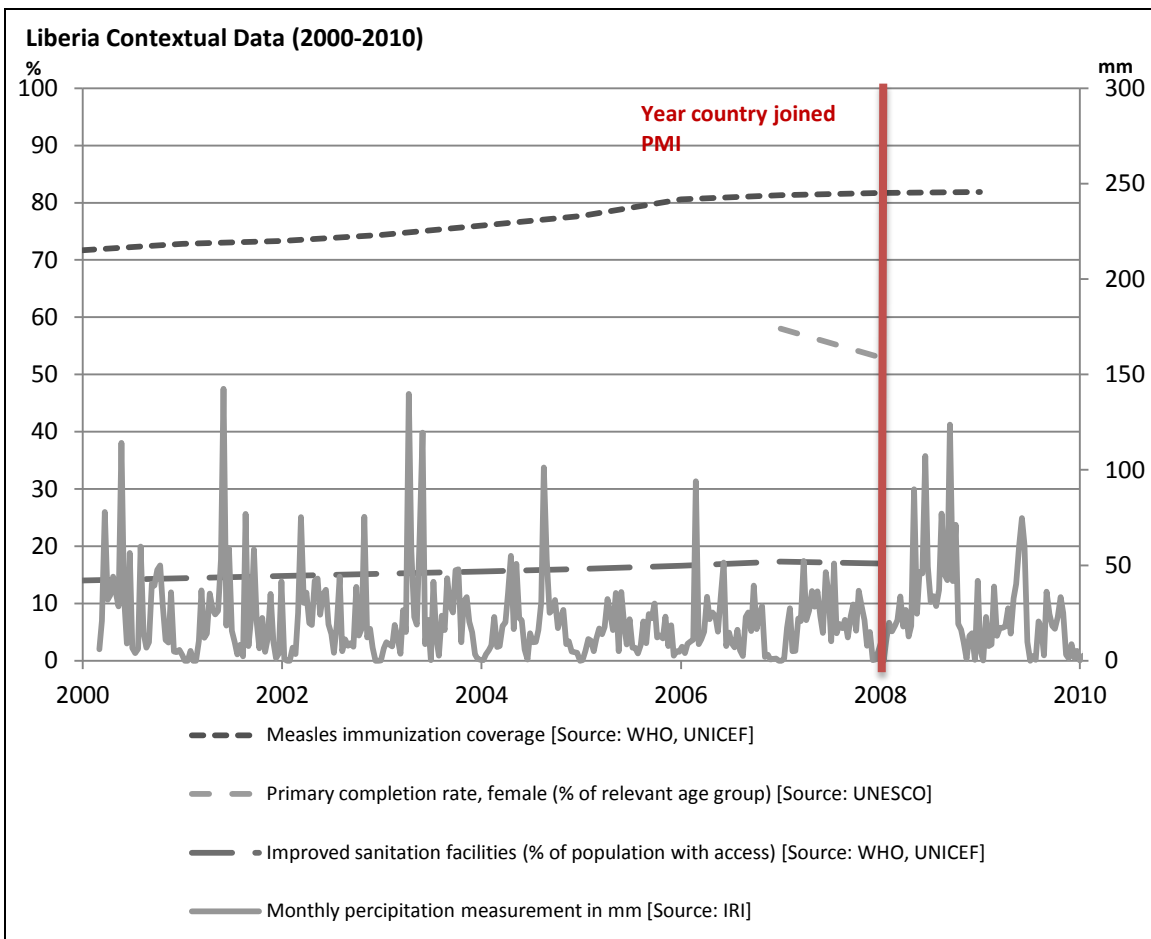
ACCM under 5 in Liberia has seen a small 4% increase from measurements in 2007–2009. Due to unavailability of historical data for the period 2000–2004, recently recorded malaria cases and deaths cannot be compared to a longer reference period. The increase in malaria admissions and deaths may be a result of improved reporting and may not reflect a true increase in malaria burden in Liberia.

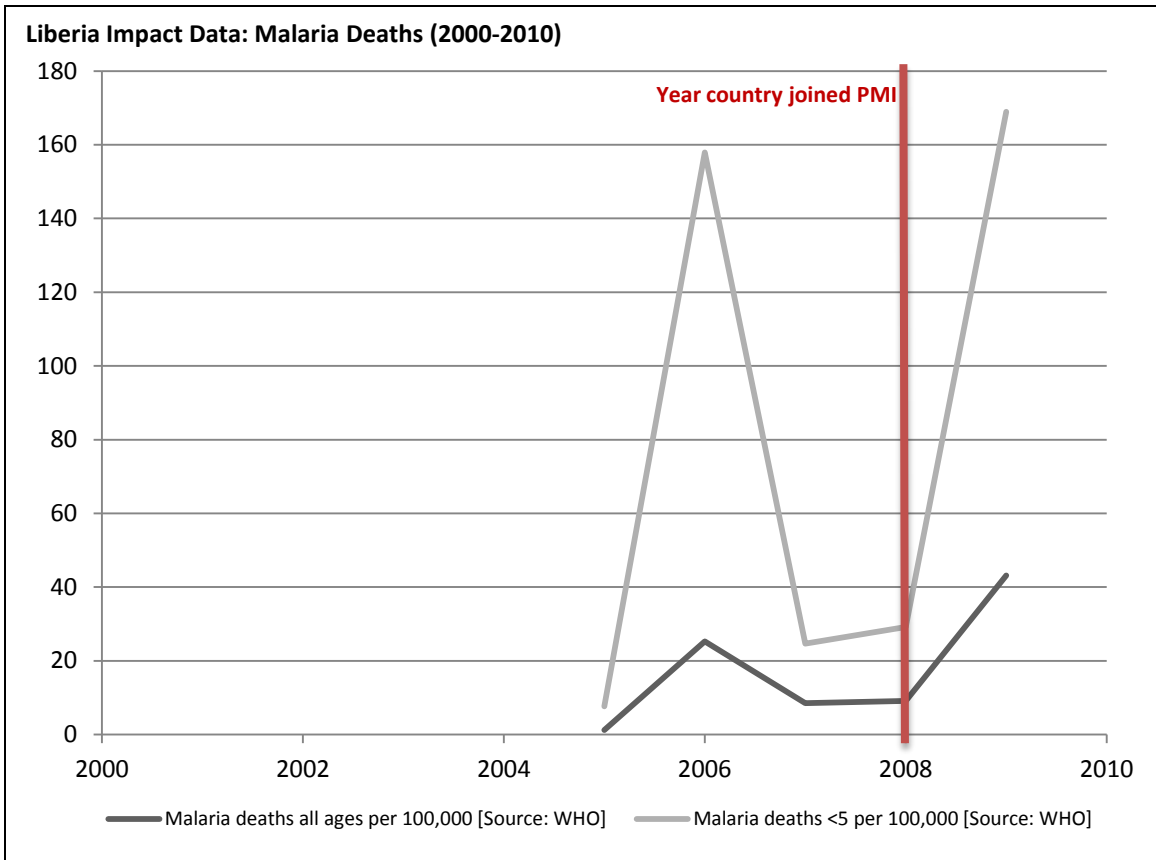
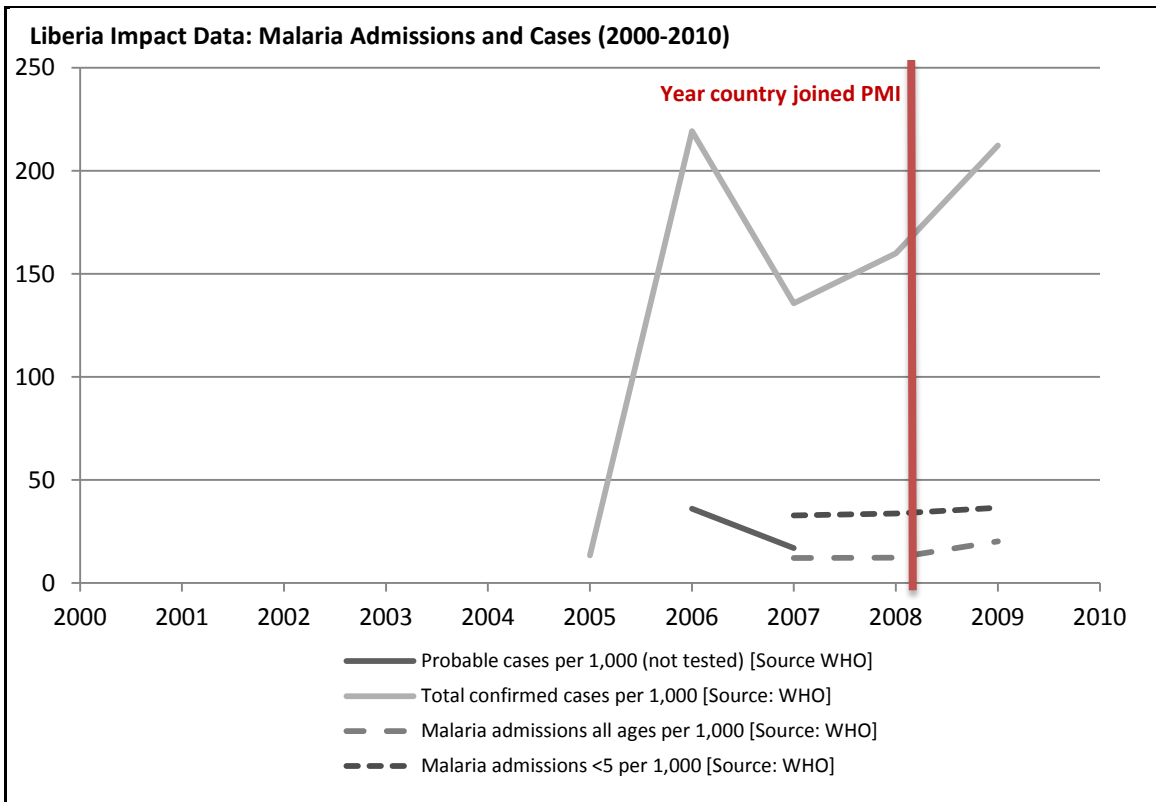
Contextual Factors

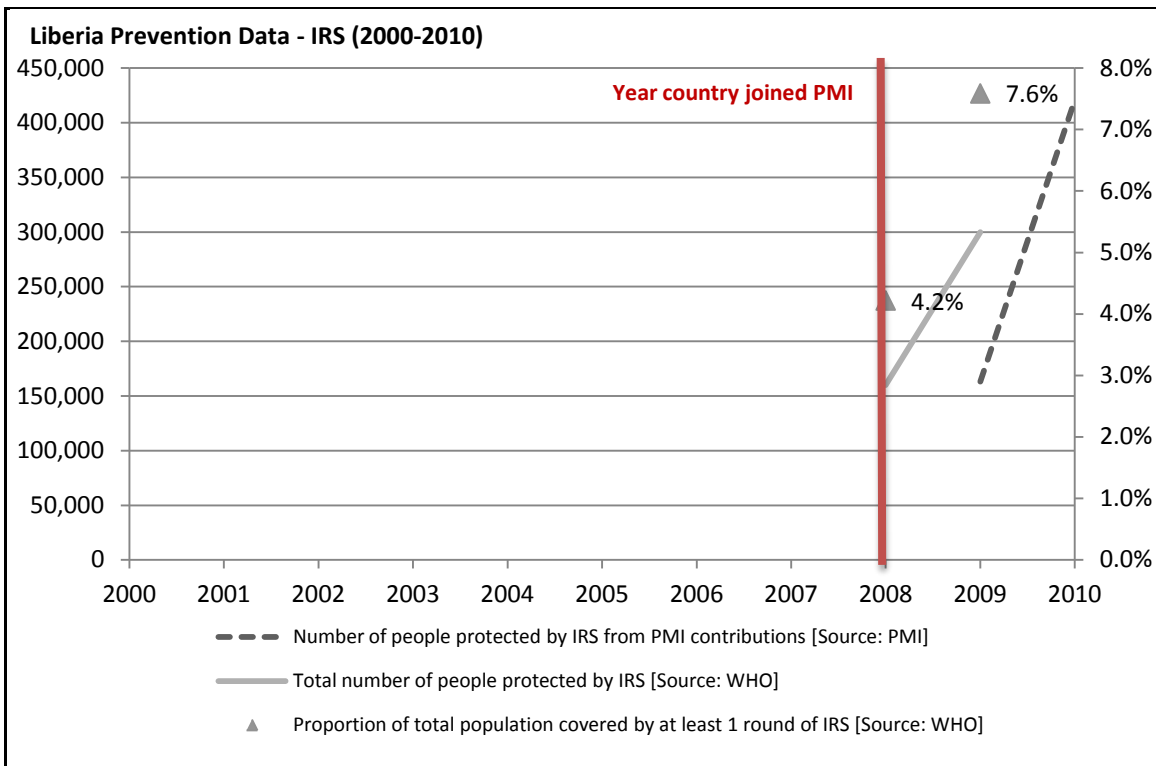
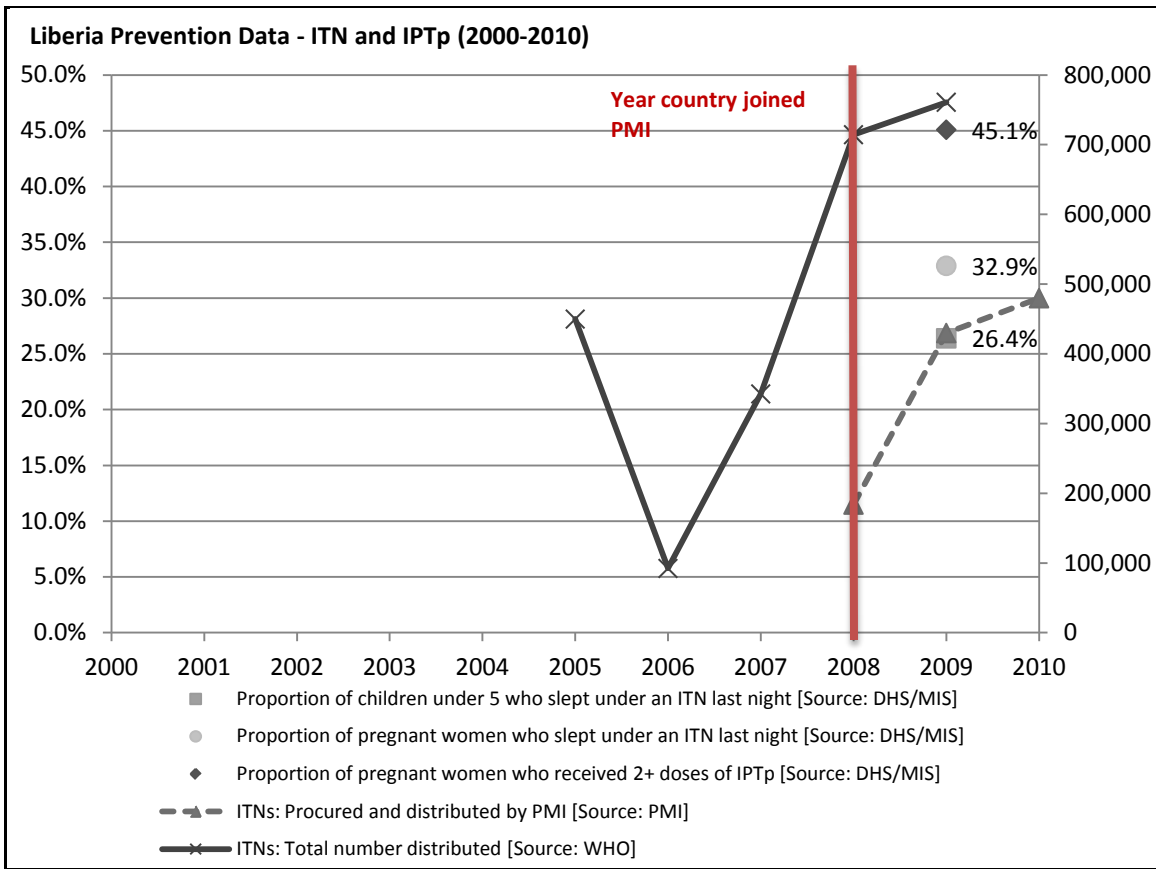
The slight increase in measles immunization coverage may result in reduction of ACCM, even though DHS data indicates a small rise in under-5 mortality. An overall change in precipitation trend is not apparent.

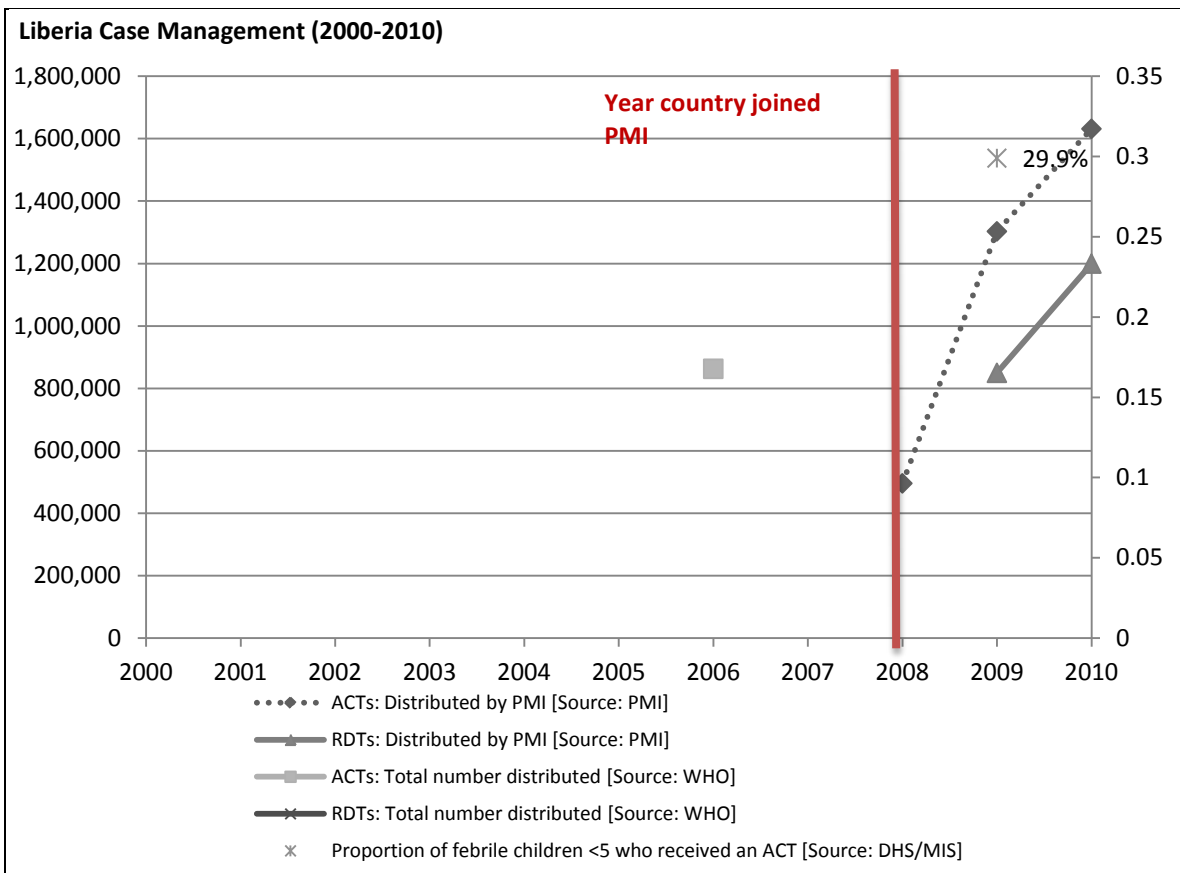
Conclusions

It is too early to say anything about impact. ITN coverage has increased well, but the impetus needs to be maintained.









7. Madagascar

PMI started in Madagascar in FY 2008 (Round 3). Following the political crisis and coup d'état in March 2009, direct U.S. Government financial and technical support to the current transitional government had been suspended until a freely and fairly elected government was in place. Humanitarian assistance that did not directly engage the public sector was allowed to continue, which included all PMI activities. Some PMI activities had to be refocused to the community level to conform to this requirement.

Madagascar has 21.9 million inhabitants in 2011, all at risk of malaria. Malaria in Madagascar is stable in the north, east, and west. The south has seasonal and unstable malaria due to the semi-desert climate, and the central highlands have low epidemic-prone transmission. Three-quarters of the population lives in low-transmission areas that are prone to epidemics, with a quarter living in areas of high risk.

Prevention

ITN distribution began in 2001 and has been increasing ever since—as many as 3.4 million ITNs were distributed in Madagascar in 2007. PMI has contributed 3.6 million ITNs or 49% of the 7.3 million ITNs distributed during the rolling campaign from 2009–2010. Based on the latest MIS data from 2009, the proportion of children under 5 and pregnant women who slept under an ITN last night was 76% and 71%, respectively. IPTp rate in Madagascar was 21% in 2009, but the intervention is probably not needed in the highlands. PMI-supported IRS protected 2.9 million people in 16 health districts in 2010.

Case Management

The distribution of ACTs and RDTs was initiated in Madagascar in 2007. The program delivered 400,000 treatment courses of ACT in 2009, sufficient for all malaria cases treated in the public sector. As a result of the political crisis that started in 2009, there has been limited use of PMI funds toward distribution ACTs and RDTs in Madagascar. ACT coverage rate for children under 5 is unavailable within the specified time period.

Impact

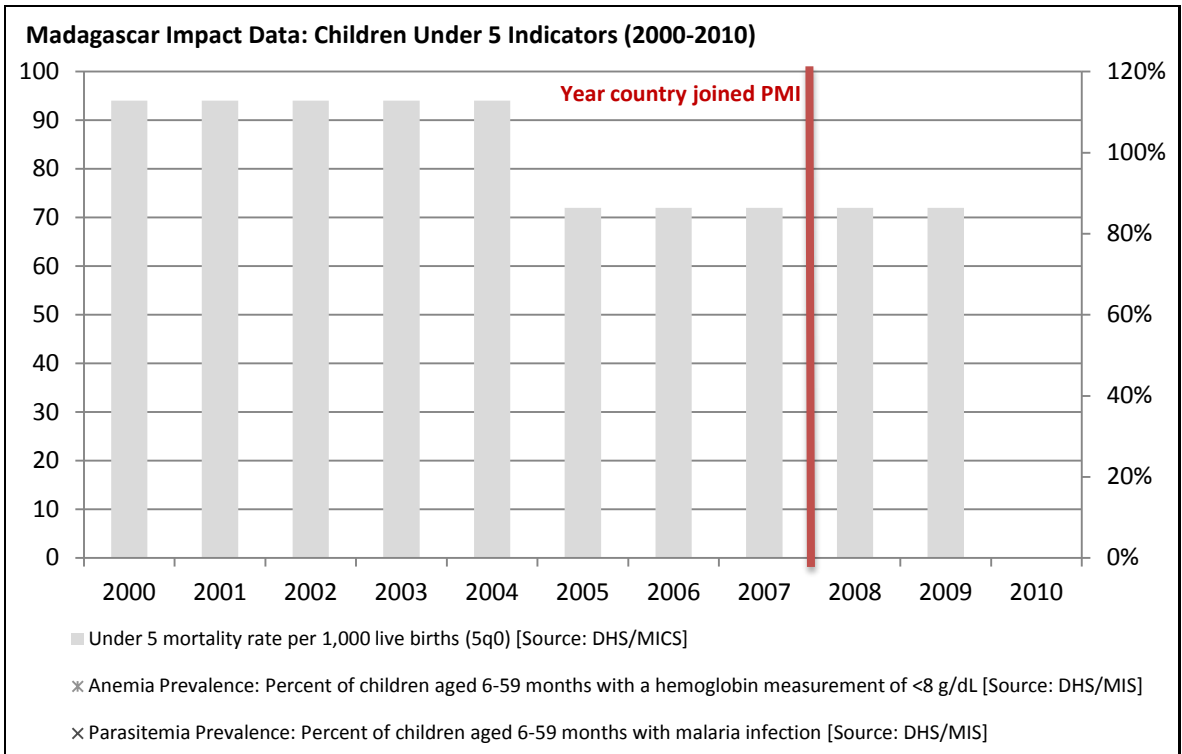
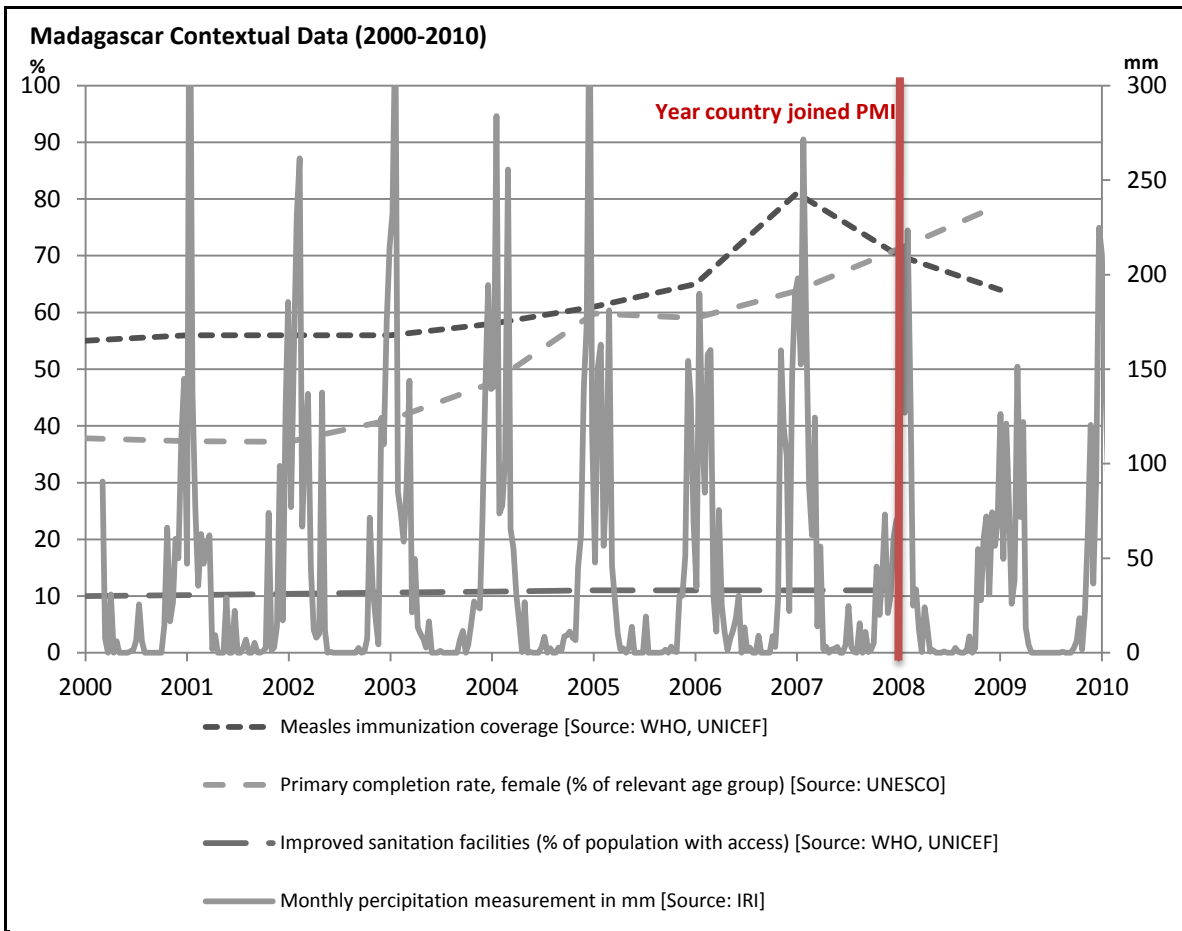
ACCM under 5 in Madagascar has seen a 23% decrease from 2004–2009. Historical data suggest a decreasing trend in malaria cases and deaths. Some of the decline in reported cases and deaths may be due to incompleteness of reporting in 2009.

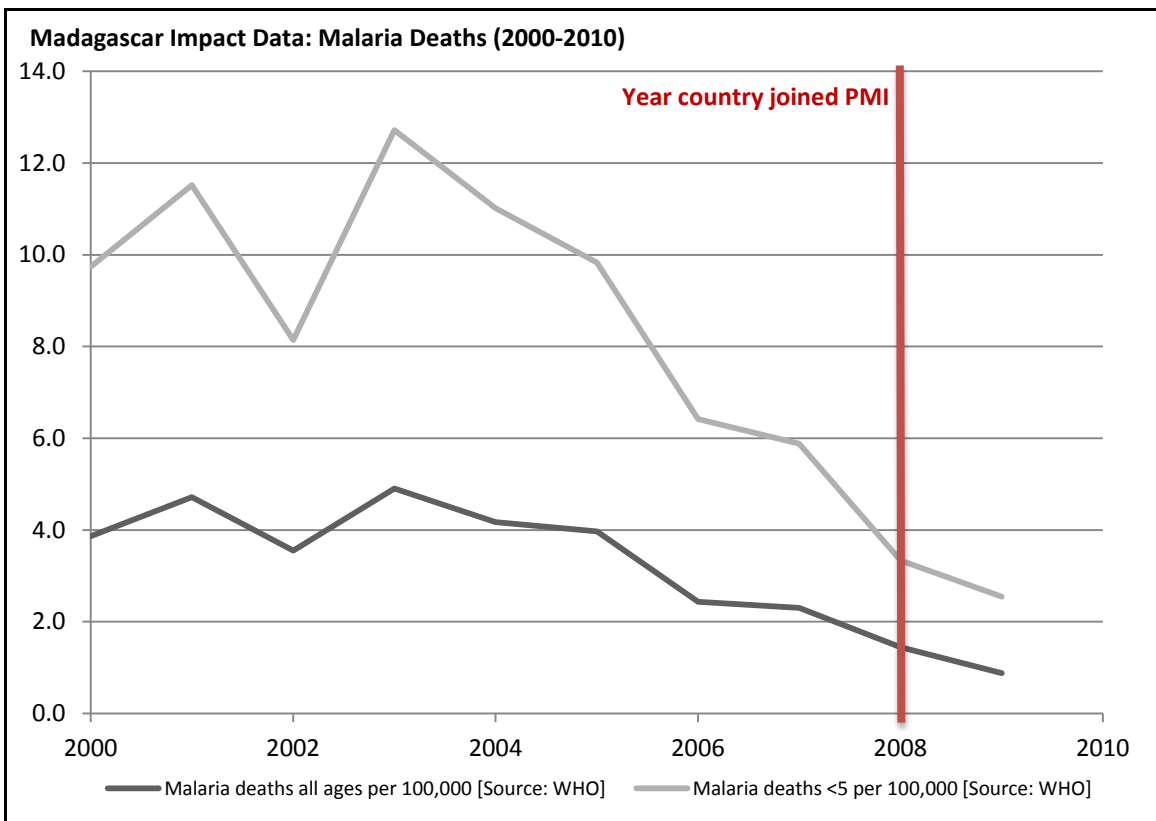
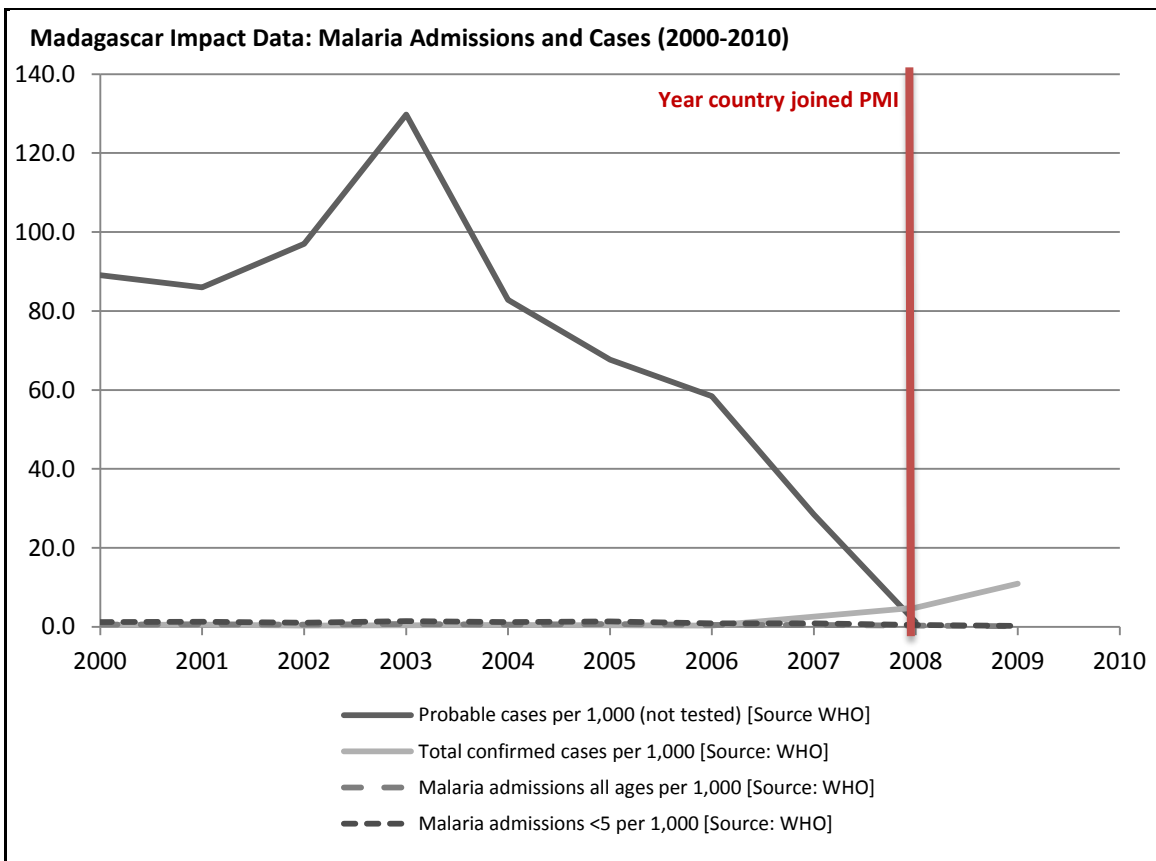
Contextual Factors

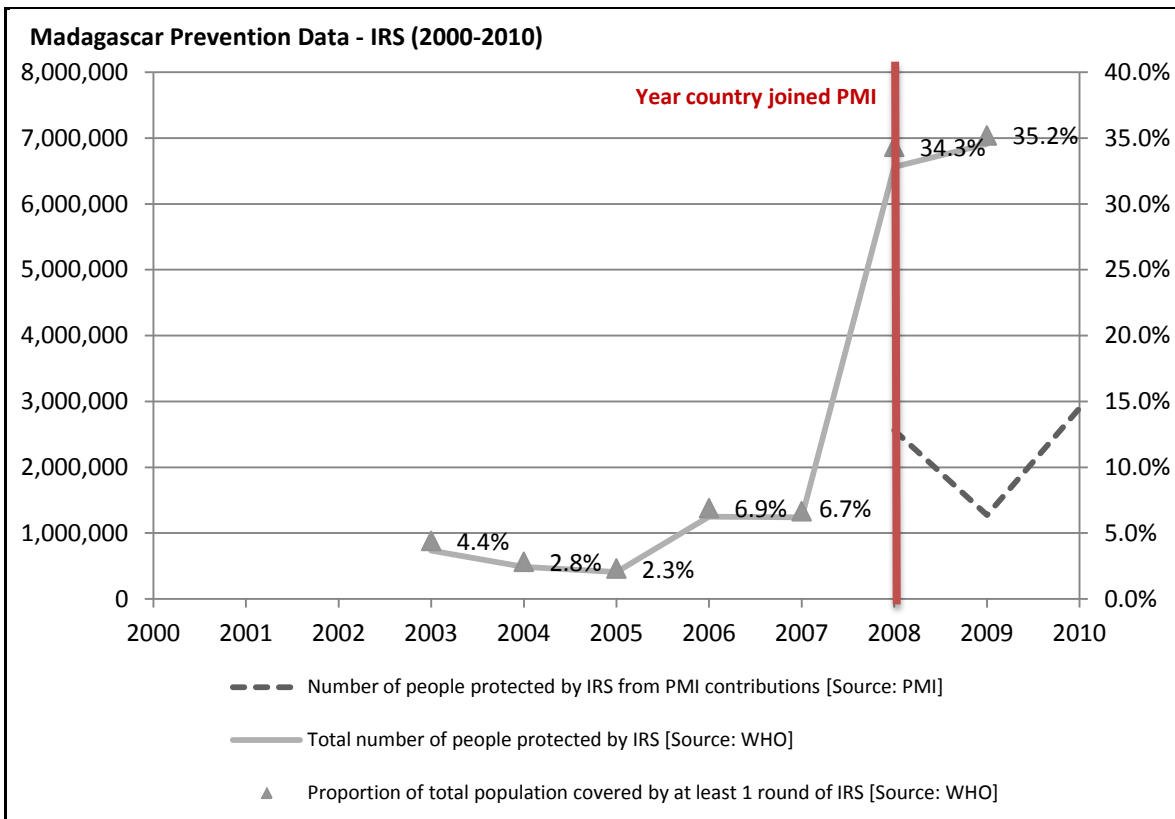
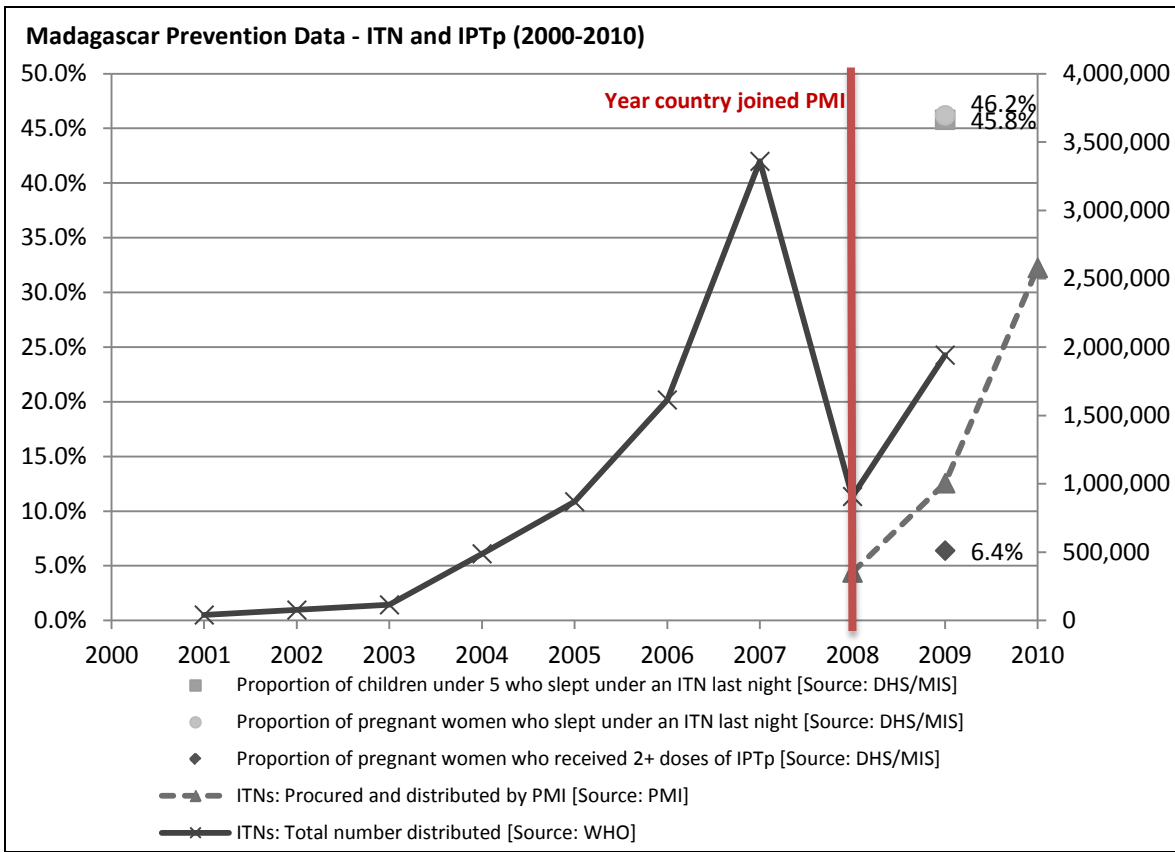
The considerable increase in primary school completion rate among girls between 2003–2007 may result in reduction of ACCM in the near future. Measles immunization coverage has been increasing until 2007; since then a declining trend in vaccination rates has been observed. An overall change in precipitation trend is not apparent.

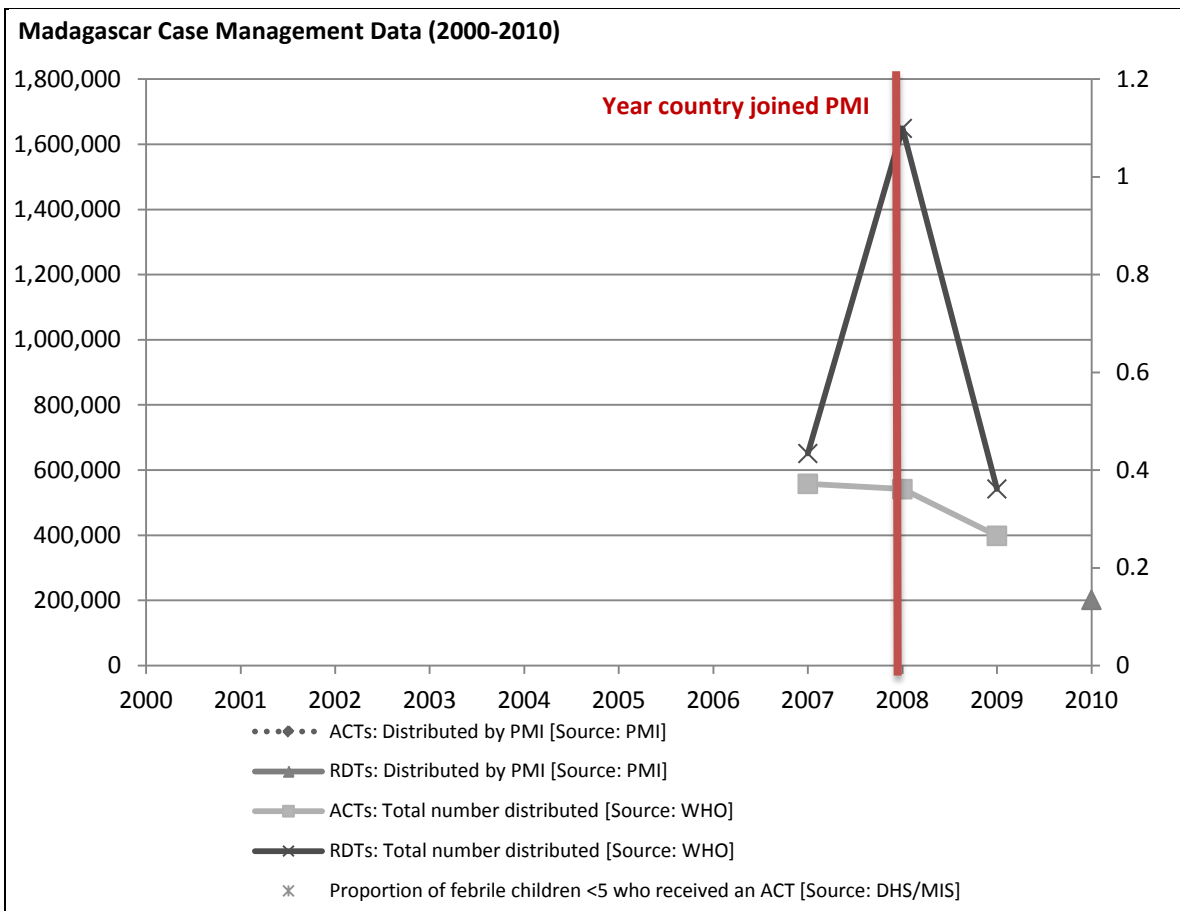
Conclusions

All the data suggest that there has been a steady improvement in the malaria situation since around 2003, partially related to malaria control and partially to contextual factors, which are not completely understood. PMI has probably contributed more by strengthening quality than by scaling up. As most of the population lives in areas of unstable malaria, caution must be applied in interpreting ACCM data for evaluation of malaria control.









8. Malawi

PMI started in Malawi in FY 2007 (Round 2). Malawi has 15.9 million inhabitants in 2011, all at risk of malaria.

Prevention

There has been steady progress in ITN scale-up toward high coverage rates by 2010. The IRS coverage reported by the WHO is lower than according to latest PMI information.

Case Management

Substantial numbers of ACTs have been distributed by PMI. The declining trend could be a good sign, but this would have to be analyzed in more depth.

Impact

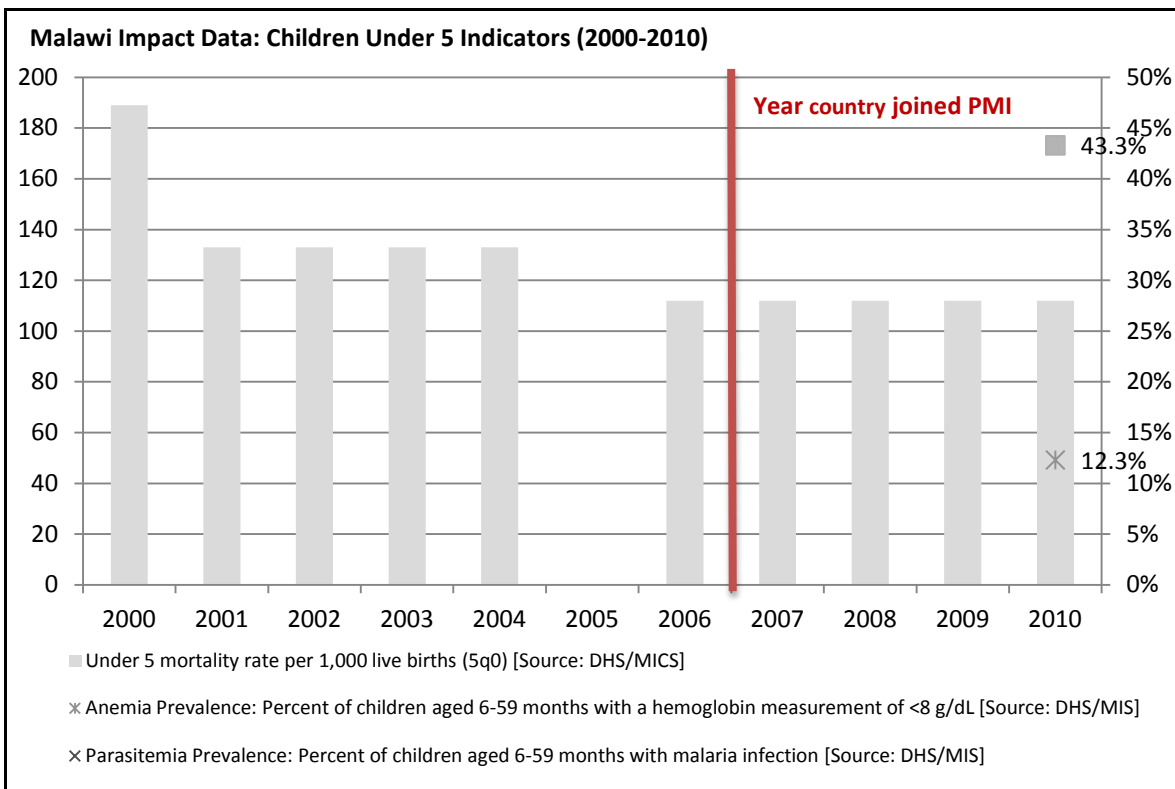
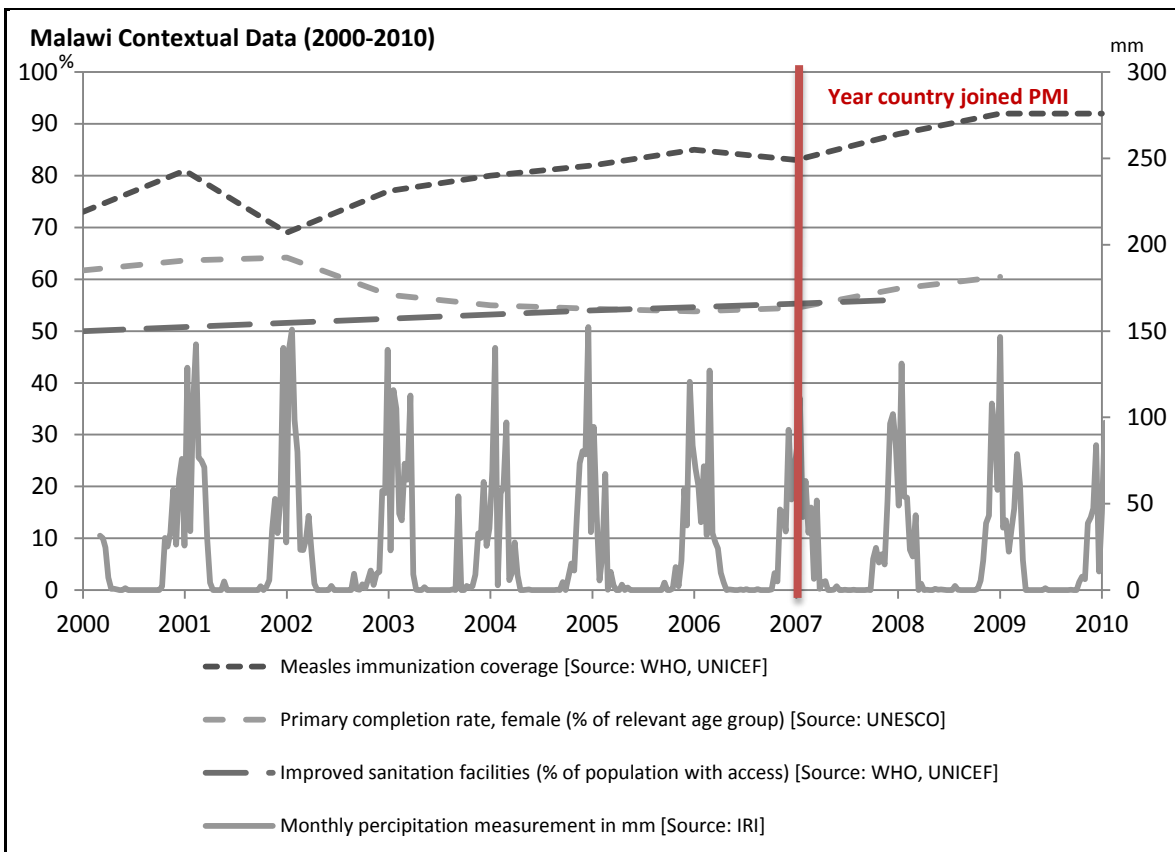
There has been a reduction in ACCM between measurements in 2004 and 2010. However, anemia and parasitemia levels were still high in 2010 (single measurements).

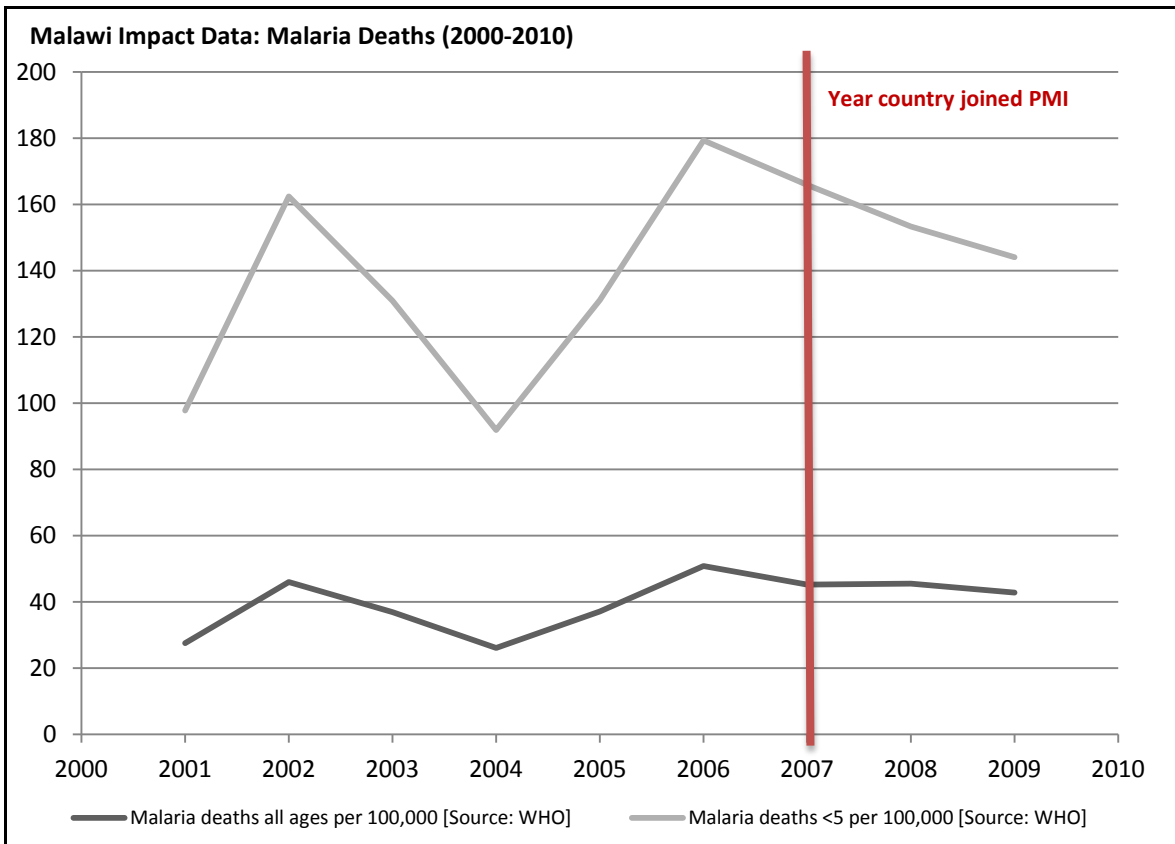
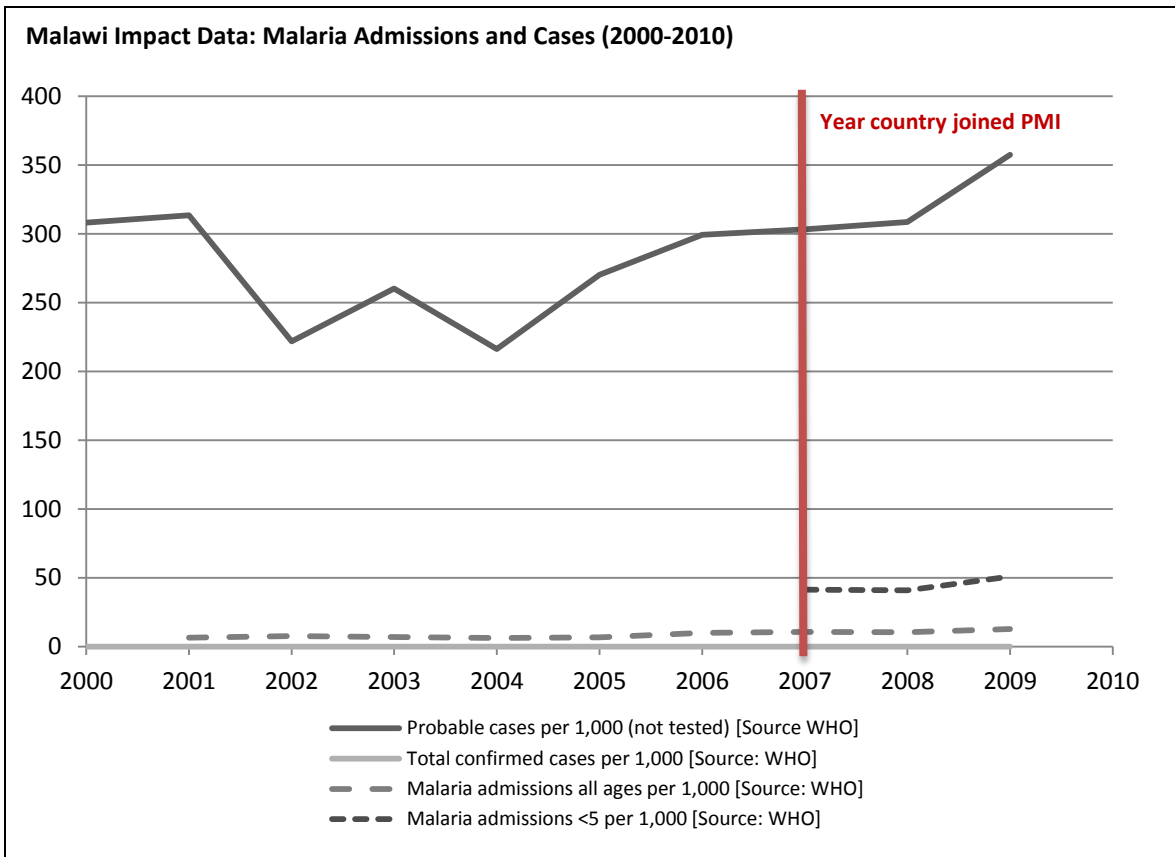
Contextual Factors

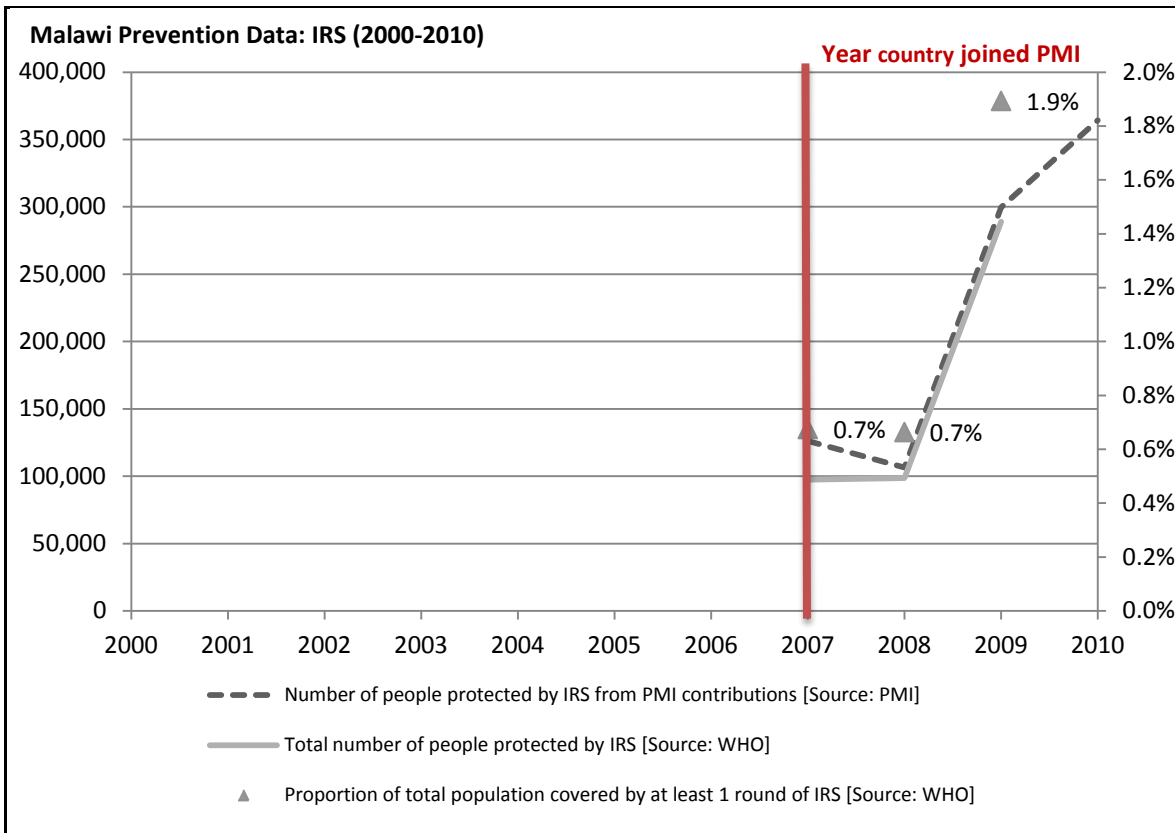
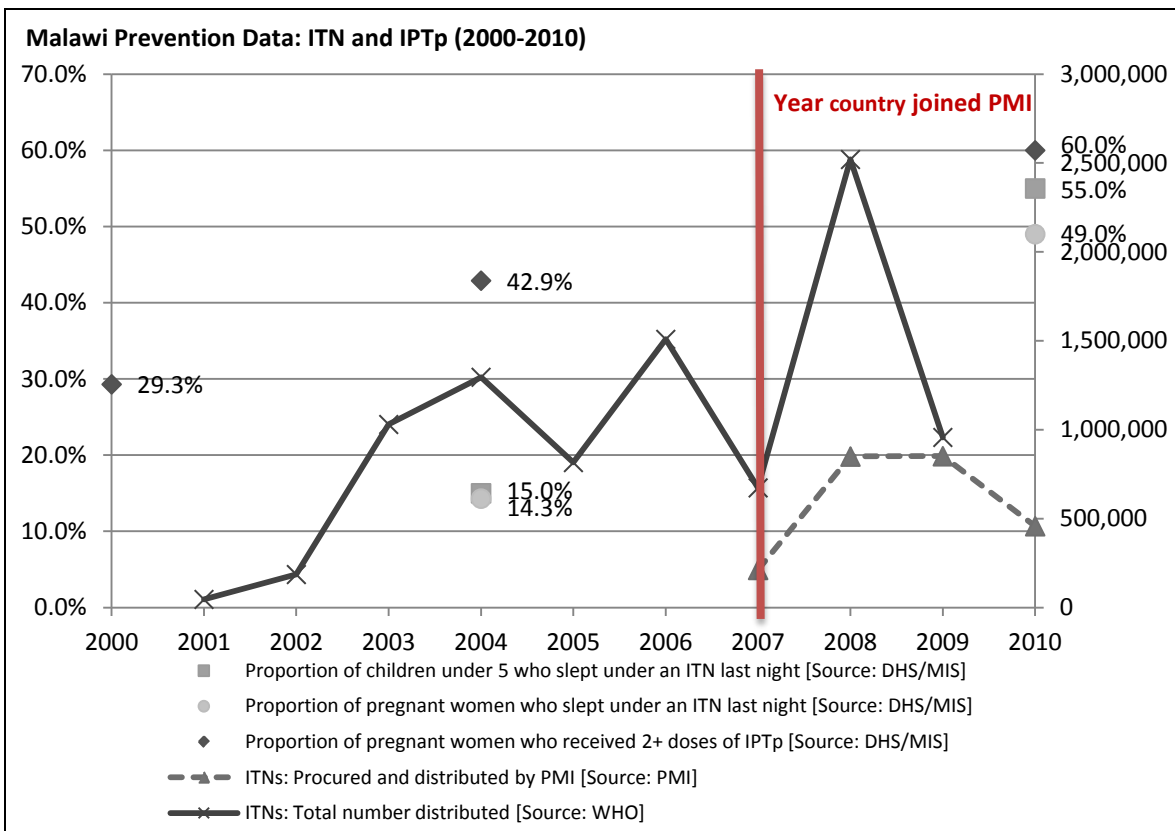
There is possibly slightly less rainfall after the start of PMI. The slight increase in measles immunization coverage could have a slight effect on ACCM.

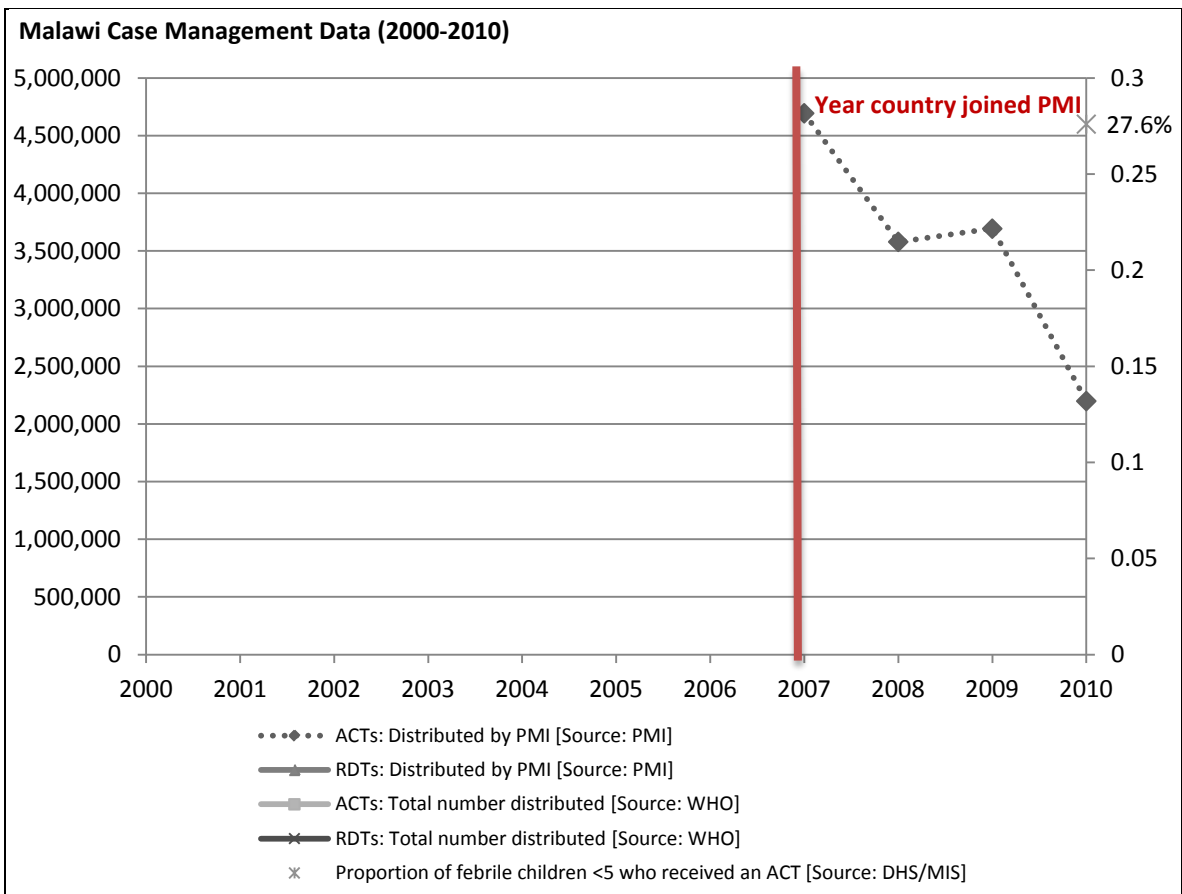
Conclusion

It is plausible that the reduction in ACCM is related to the scale-up of prevention, especially ITN and IPTp. More data would be required for a firm conclusion.









9. Mali

PMI started in Mali in FY 2008 (Round 3). Mali has 14.1 million inhabitants in 2011, all at risk of malaria. Malaria transmission is more intense in the southern part of the country.

Prevention

ITN distribution began in 2006 and has been increasing ever since—as many as 3 million ITNs were distributed in Mali in 2007. Based on surveys from 2006 and 2010, the proportion of children under 5 who slept under an ITN increased from 27% to 70%. A similar trend was also seen among pregnant women, from 29% in 2006 to 63% in 2010. IPTp rates in Mali stood at only 4% in 2006. IRS implementation protected approximately 3% of the population at risk from 2007–2009, with PMI funds supporting a majority of the IRS operations.

Case Management

Distribution of ACTs decreased from 2.84 million treatment courses in 2008 to 440,000 courses in 2009, which is insufficient to treat all the suspected malaria cases reported in the public sector. PMI has contributed to the distribution of 500,000 RDTs and 250,000 ACTs in 2010. Only a third of febrile children received any antimalarial medicine, with only 2% receiving ACT.

Impact

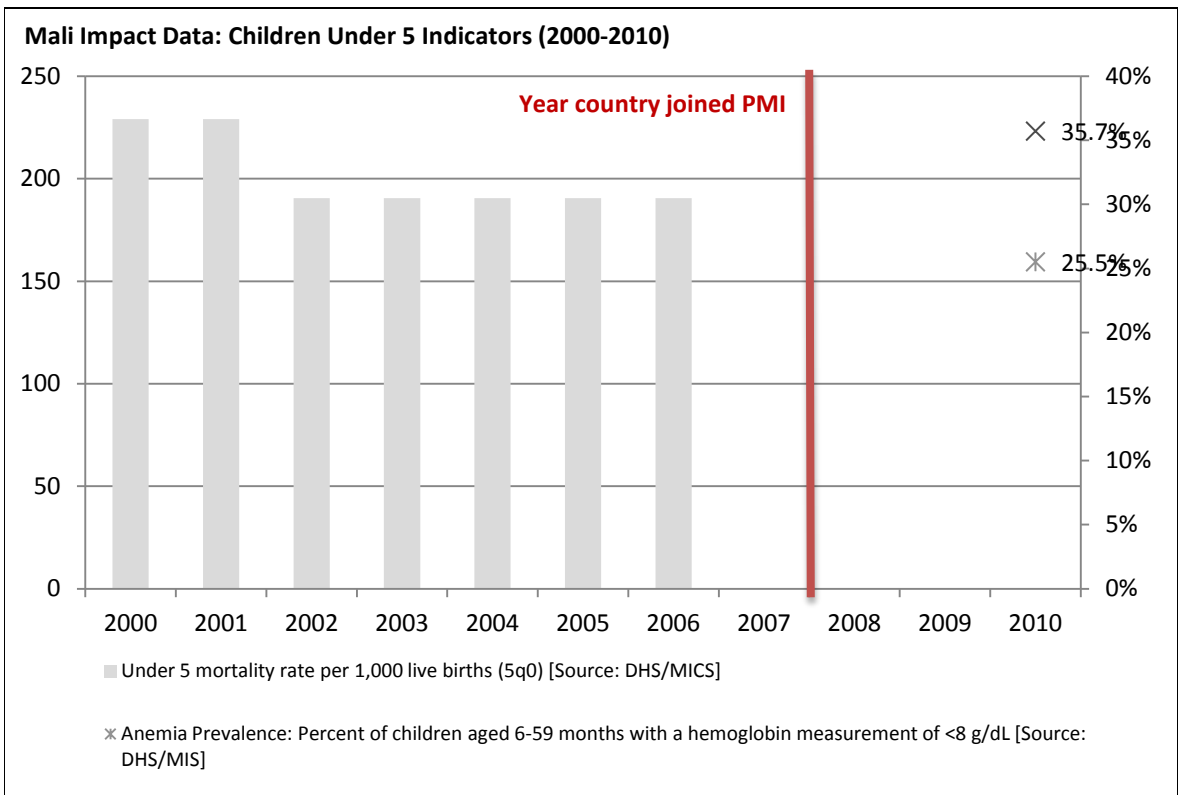
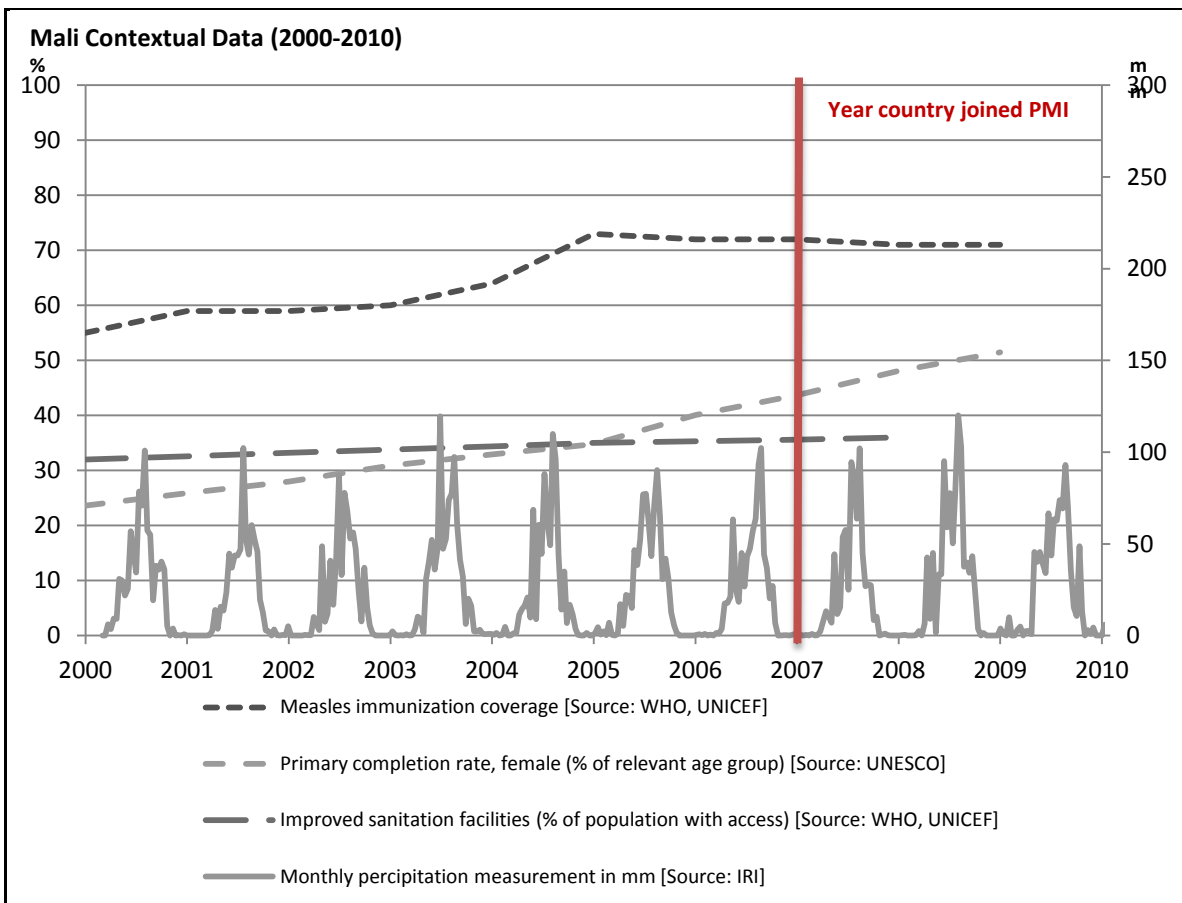
ACCM under 5 in Mali has seen a 23% decrease from 2004–2009. Historical data seems to indicate an increasing trend in malaria cases and deaths; however, it is unknown whether the increase resulted from improved reporting or a real increase in incidence.

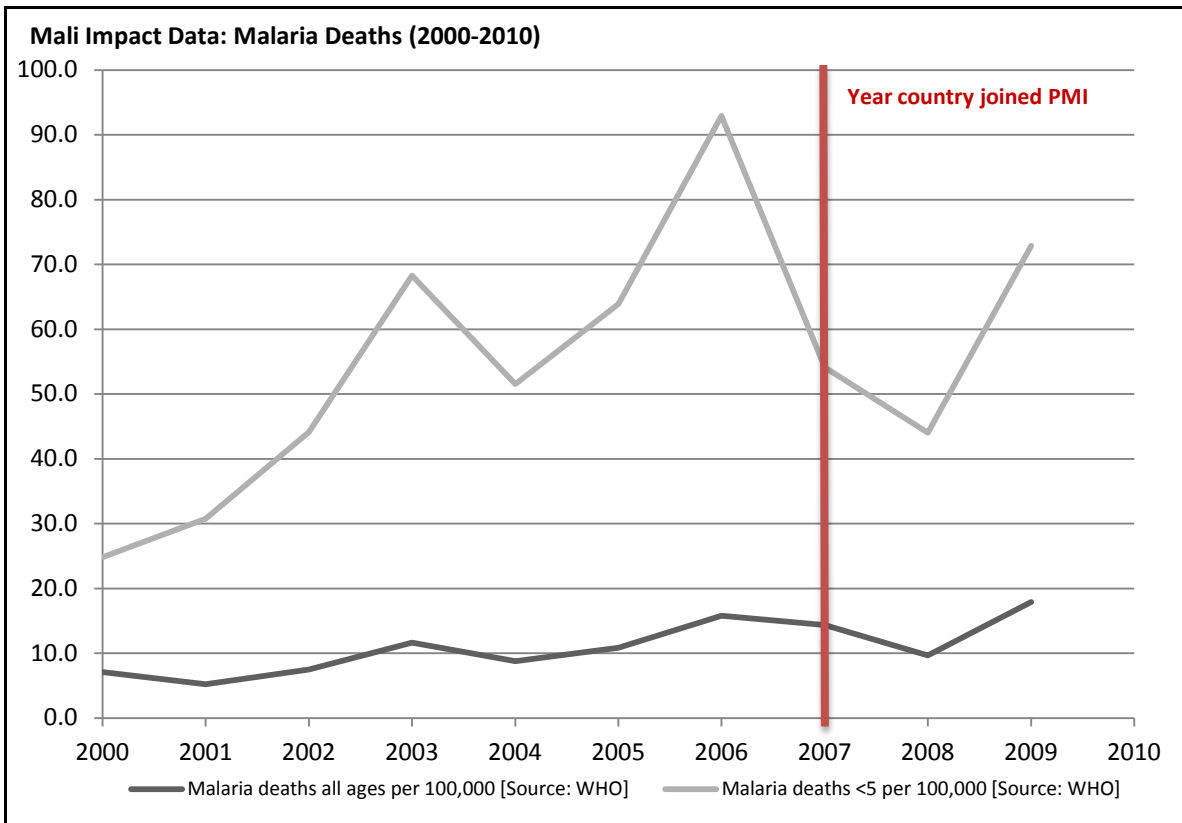
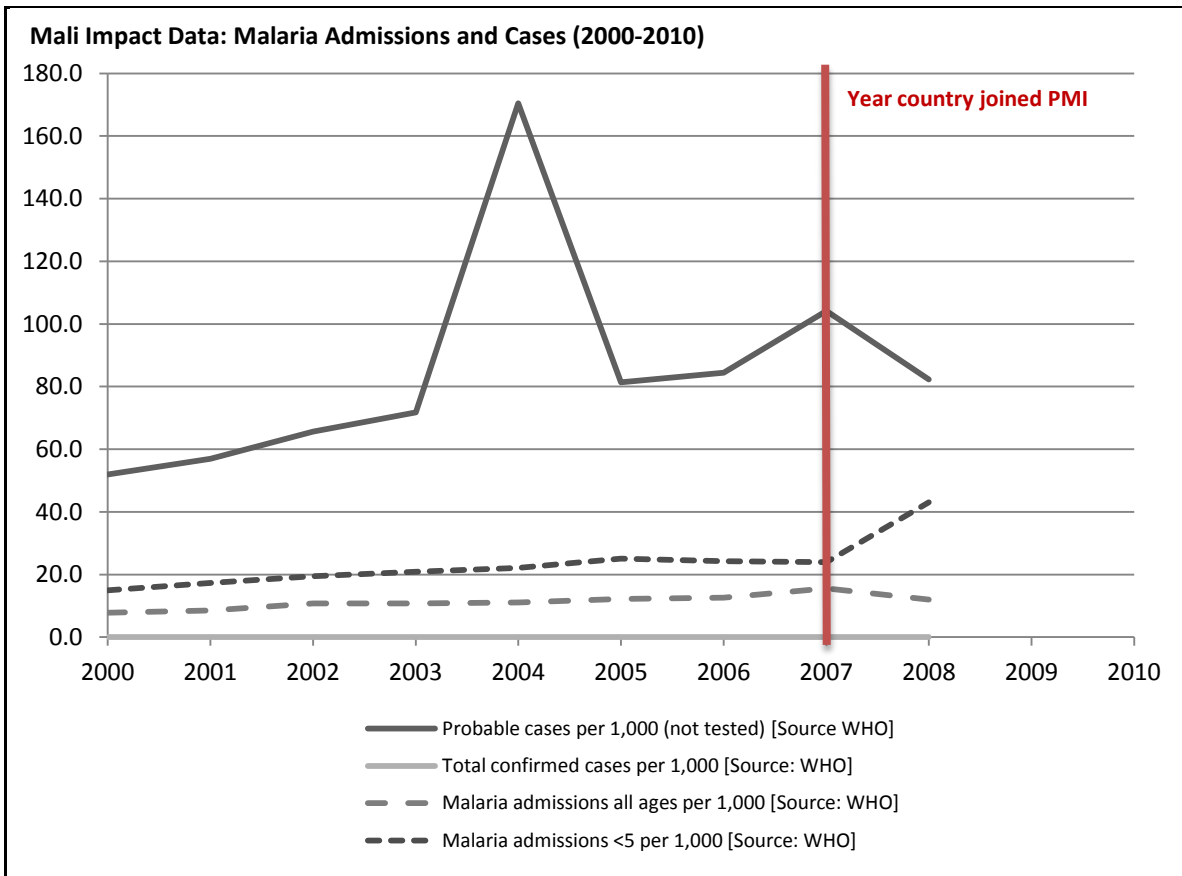
Contextual Factors

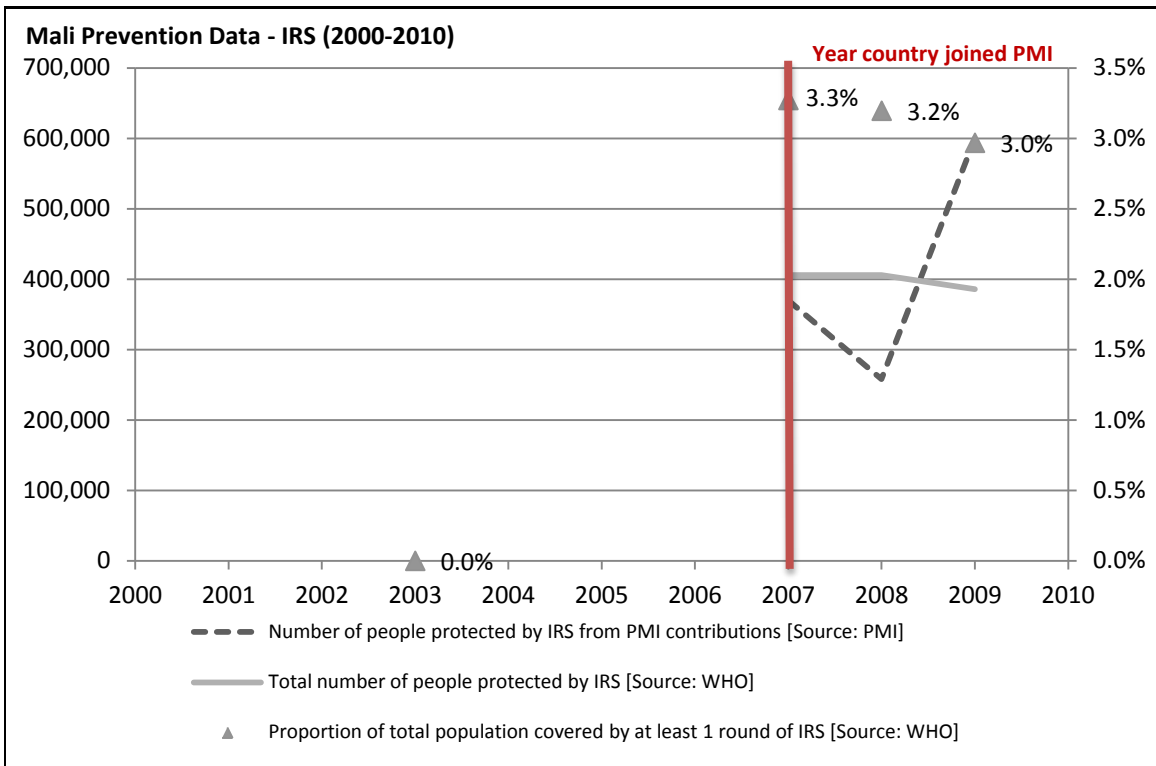
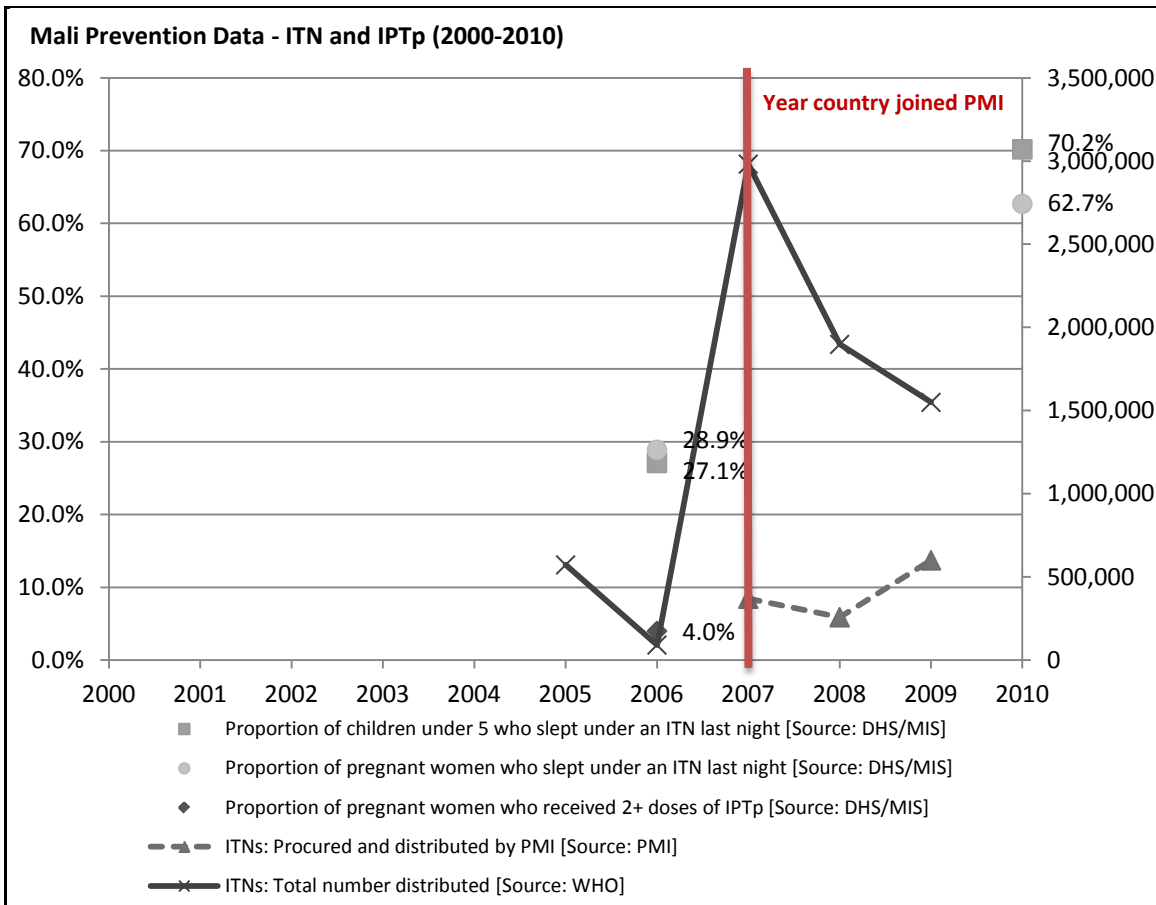
A considerable increase in primary school completion rate among girls between 2000 and 2004 may result in reduction of ACCM in the coming years. Measles immunization coverage has been increasing up until 2005, where it has remained constant at approximately 70%. An overall change in precipitation trend is not apparent.

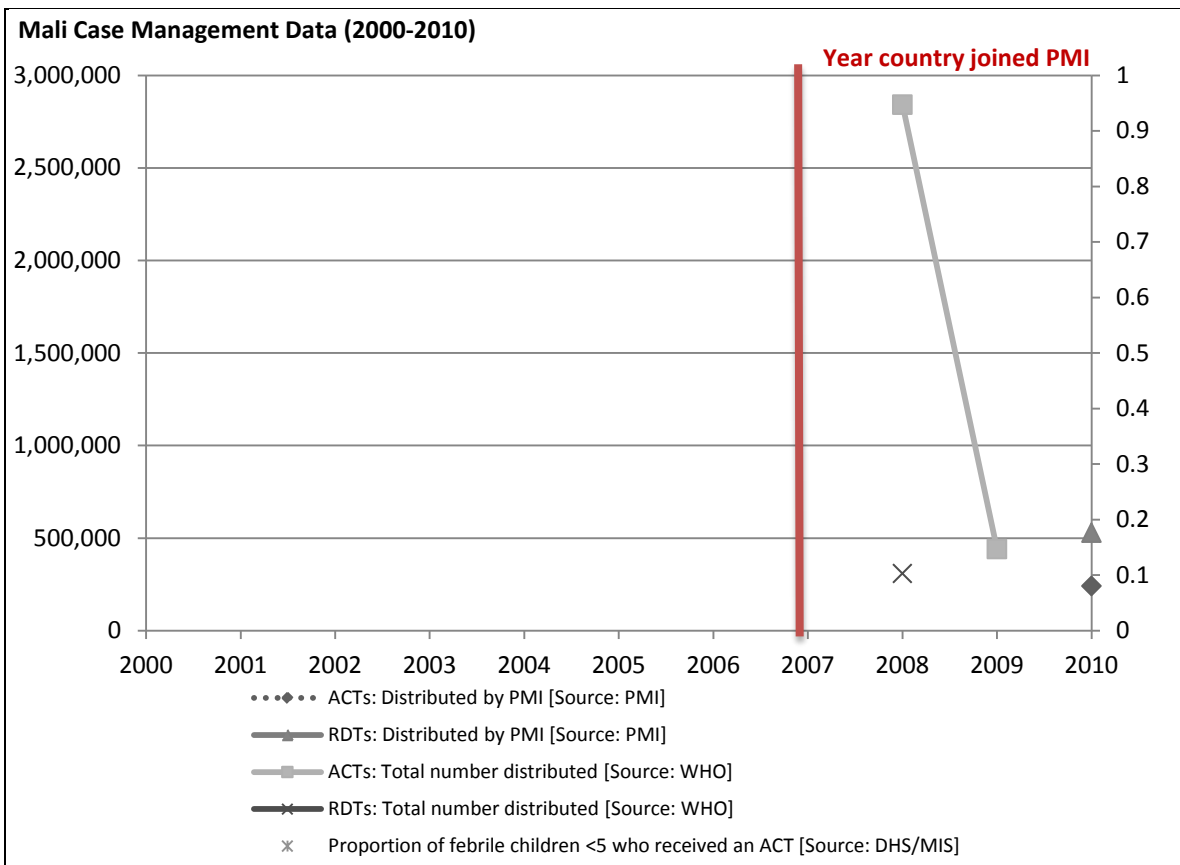
Conclusions

There was excellent progress in ITN coverage from 2006–2010. However, the parasite and anemia prevalence rates were still high in 2010 (single measurements). With that background, it is difficult to assess whether the ACCM reduction, which was observed before ITN coverage had reached very high levels, is related to improvement in malaria control. Apart from ITNs, other components of malaria control have too low coverage rates to have had any significant impact.









10. Mozambique

PMI started in Mozambique in FY 2007 (Round 2). Mozambique has 22.9 million inhabitants in 2011, all at risk of malaria. Malaria transmission is seasonal, especially in the southern half of the country, occurring mainly between December and April.

Prevention

ITN distribution has increased over the last decade with 2 million nets distributed in 2008. Based on MIS data from 2007, the proportion of children under 5 and pregnant women who slept under an ITN last night was only approximately 7%. IPTp stood at 16% in 2007. IRS has been the principal method of vector control, protecting 6.5 million people at risk in 2008 and 8.5 million people in 2009. In this country with high level of IRS use as well as some ITN, it is regrettable that there is no data for the PMI (and RBM) indicator proportion of people protected by ITN or IRS.

Case Management

Distribution of ACTs started in 2007 but has been decreasing over the last few years, from a high of 6 million treatment courses of ACT in 2007 to 1.5 million courses in 2010. Delivery of RDTs has not been recorded in Mozambique. ACT coverage in children under 5 was approximately 23% in 2007.

Impact

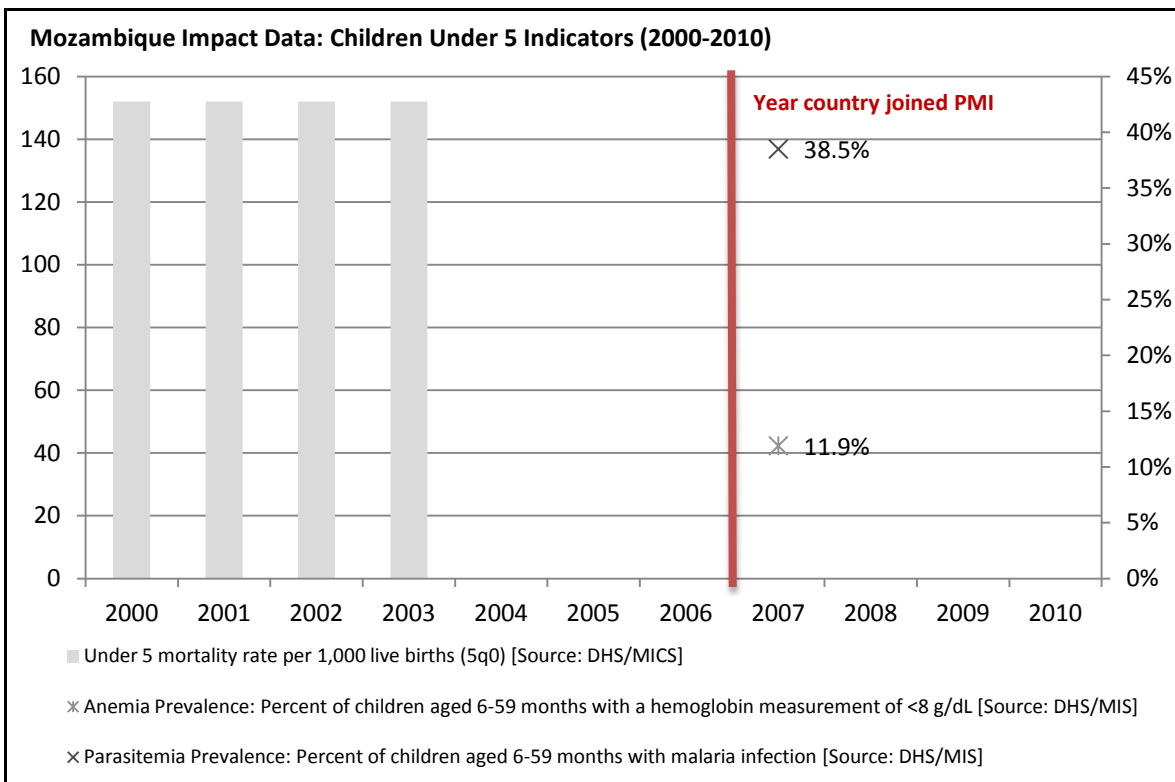
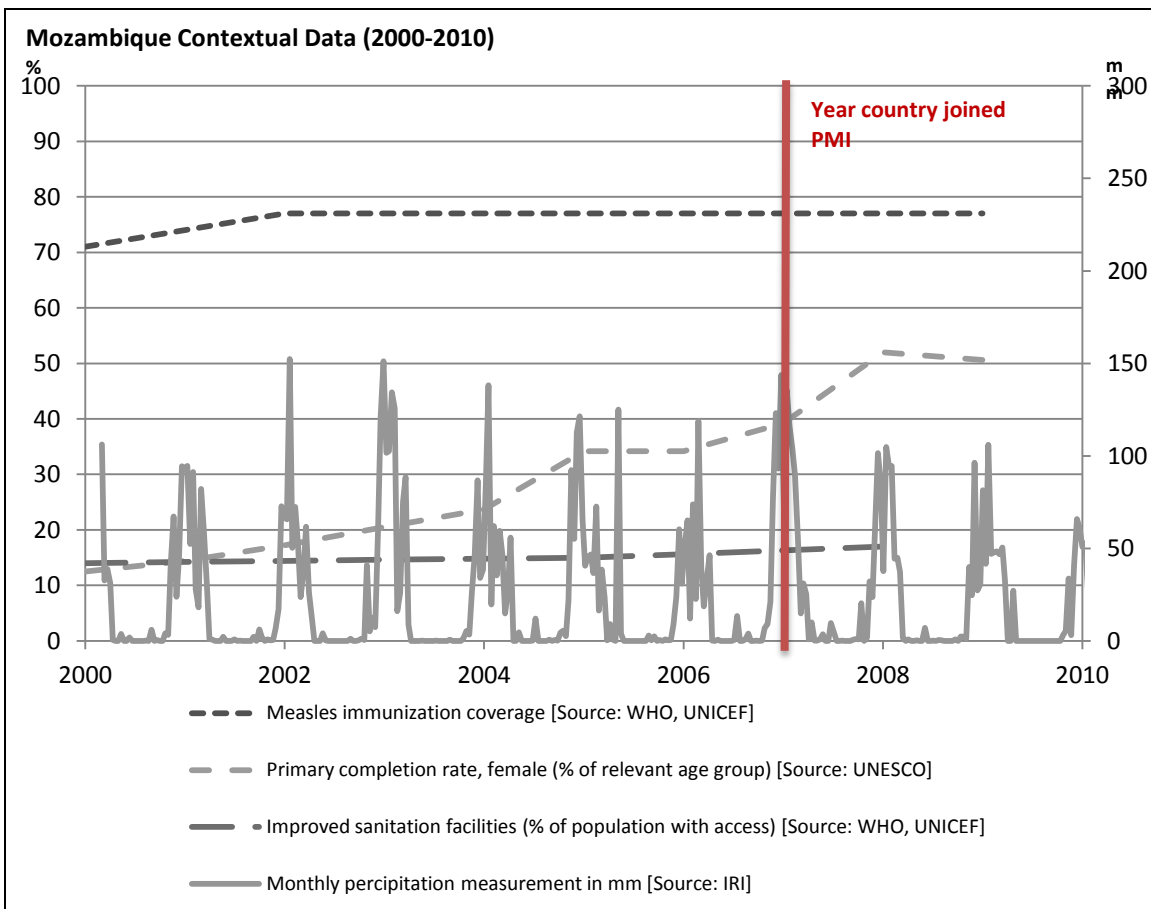
With only one DHS data point, it is not possible to assess the impact on ACCM. Prevalence levels of anemia and parasitemia were still high in 2007. With national malaria surveillance starting in 2007, any assessment trend is constrained. However, there seems to be a reduction in probable malaria cases and deaths from 2007–2009. Of the reported 4.3 million suspected malaria cases in 2009, only 2% were confirmed.

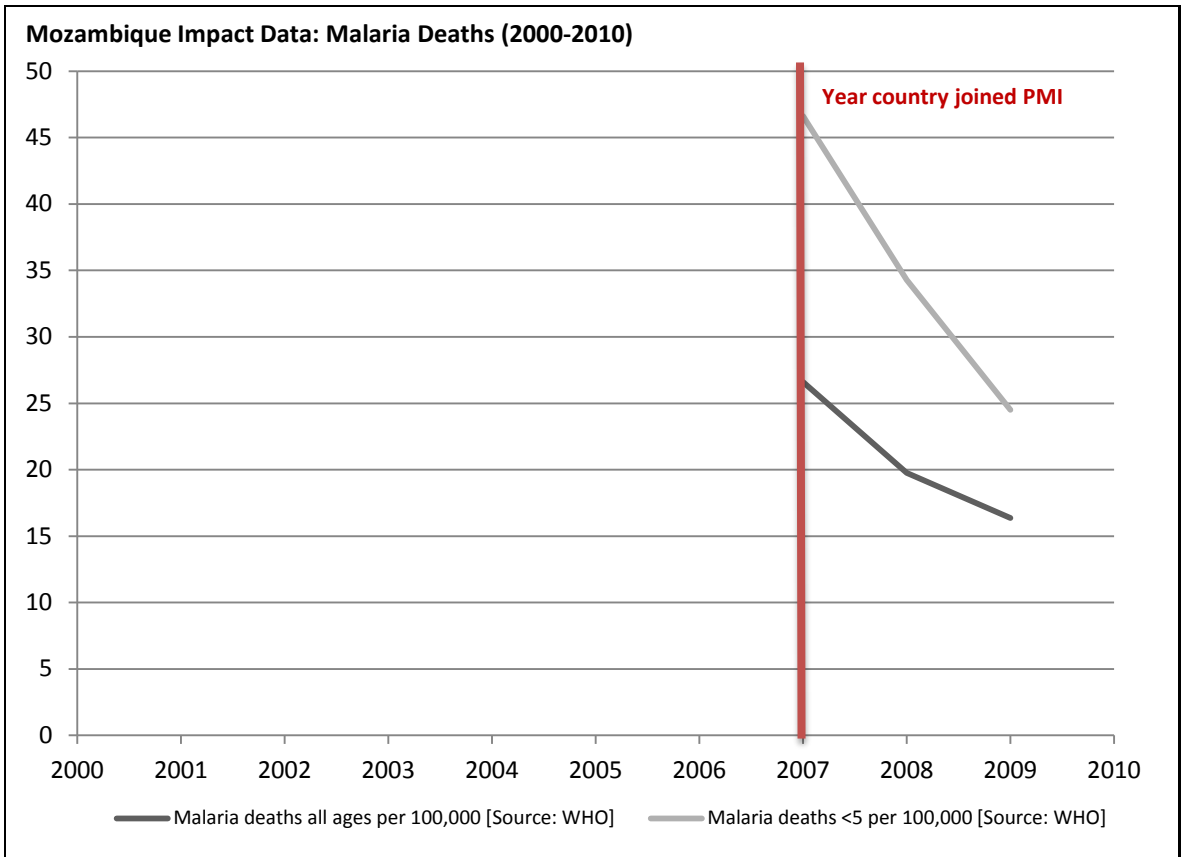
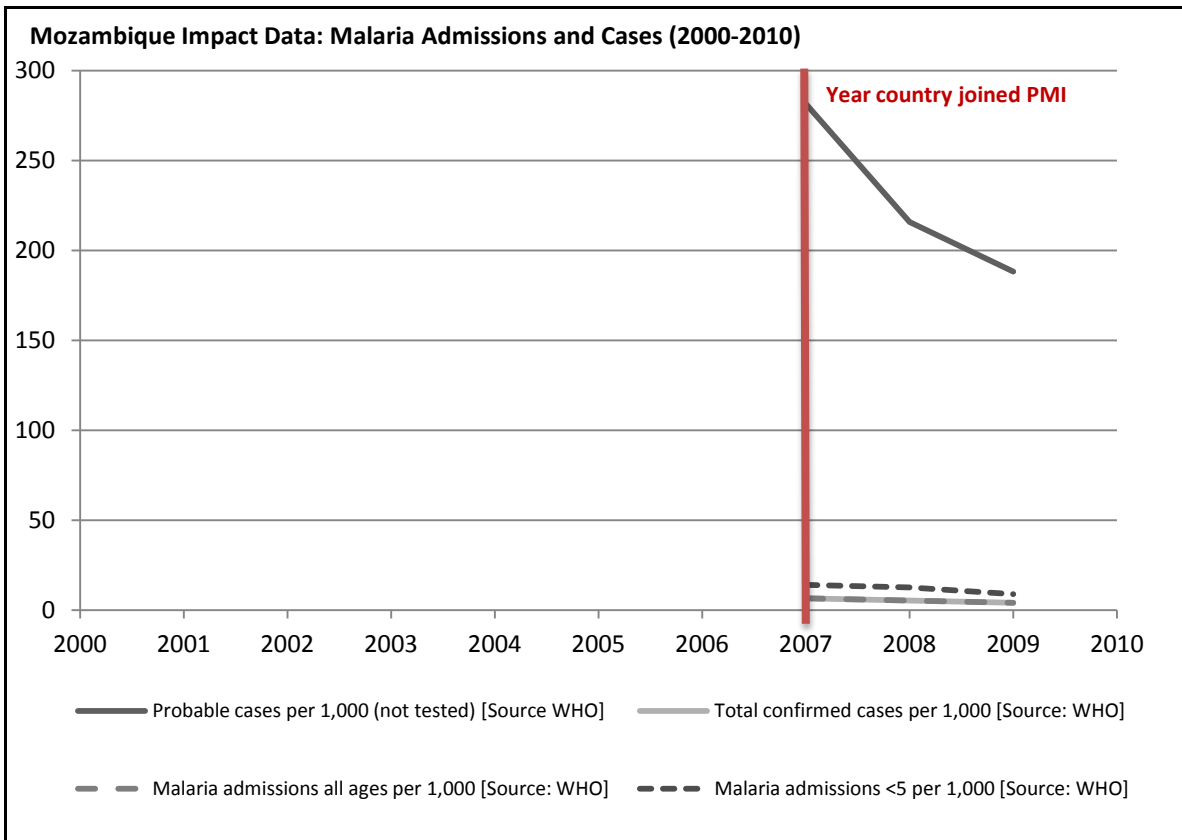
Contextual Factors

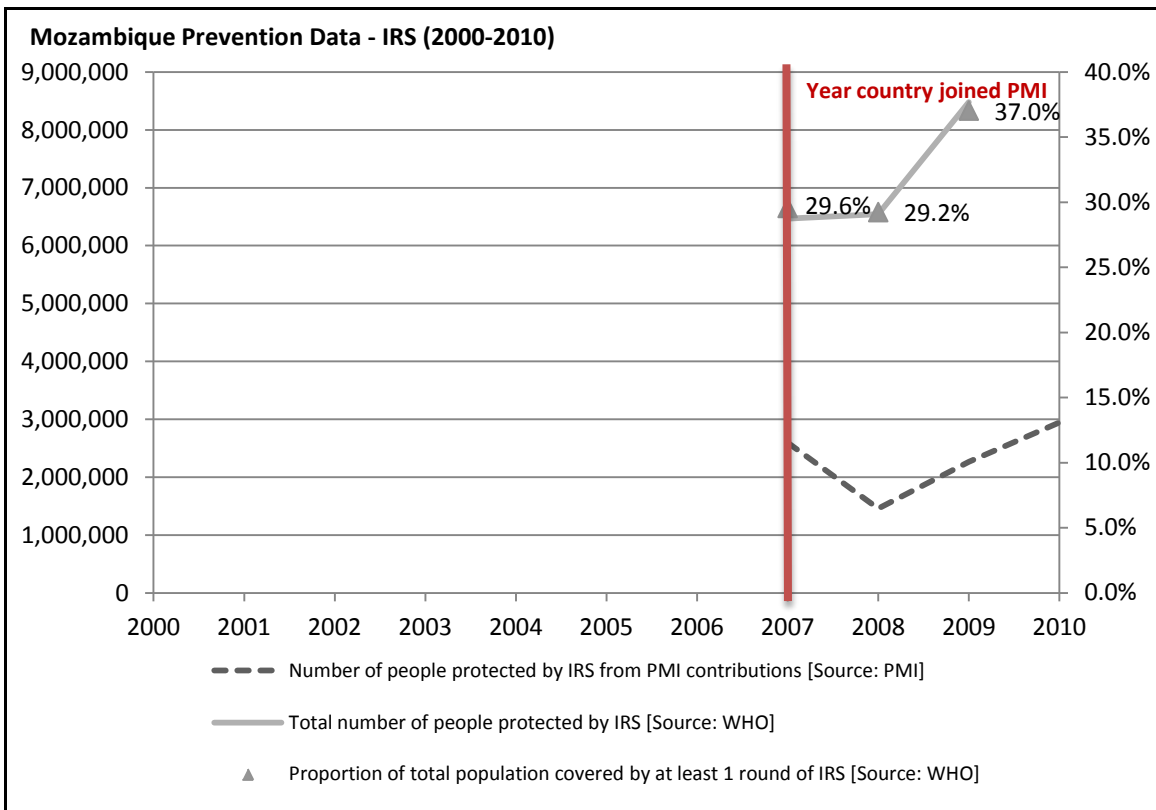
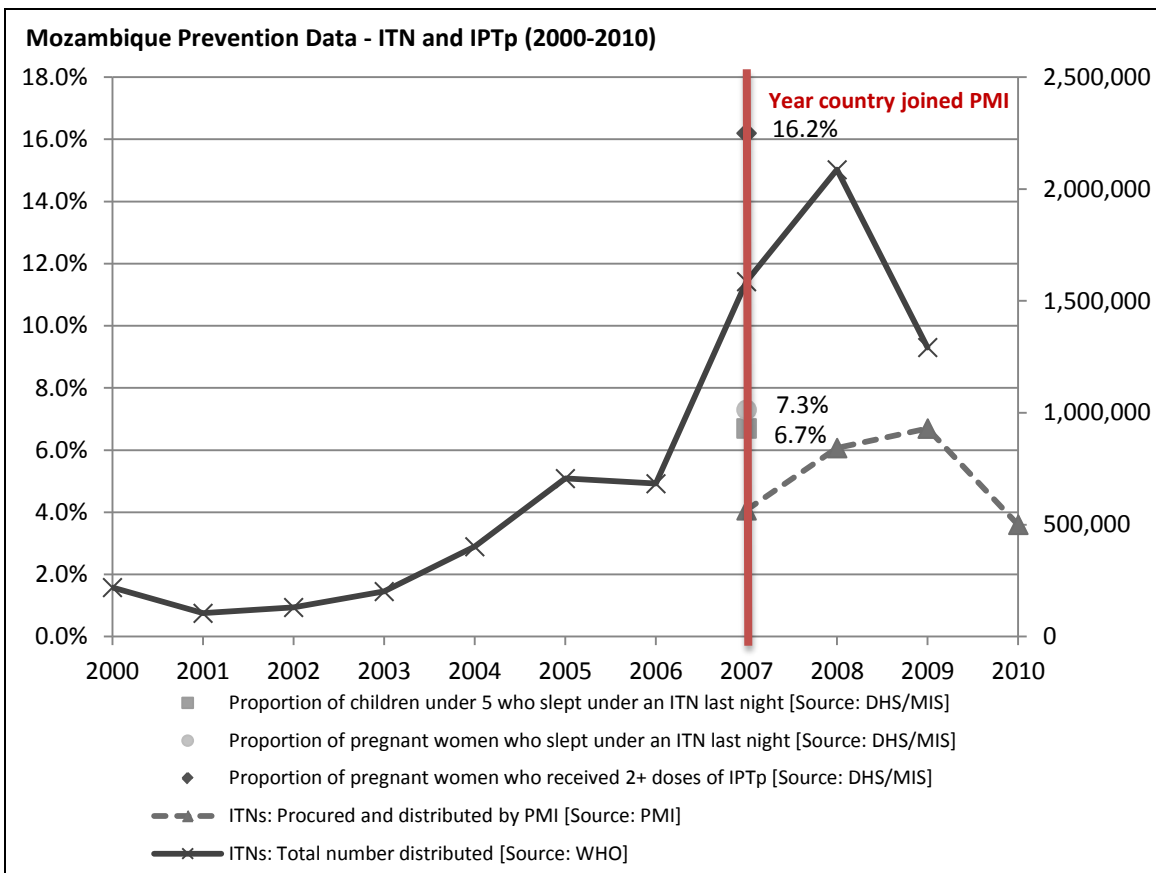
A considerable increase in primary school completion rate among girls may result in reduction of ACCM in the coming years. Measles immunization coverage has remained relatively constant over the last decade. An overall change in precipitation trend is not apparent.

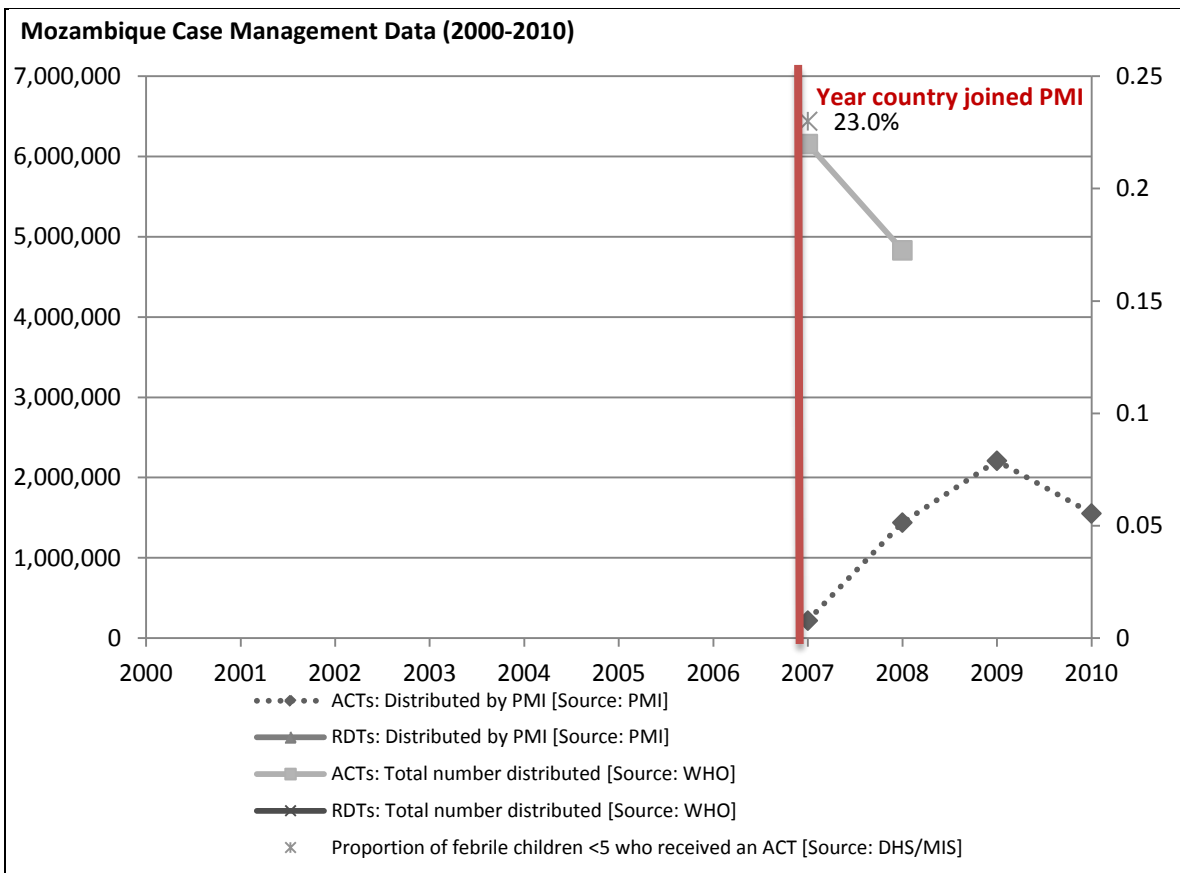
Conclusions

There are some signs from surveillance data that the situation is improving. ACCM will be a highly relevant indicator, and it will be interesting to see what it will show at the next survey.









11. Rwanda

PMI started in Rwanda in FY 2007 (Round 2). Rwanda has approximately 11.4 million inhabitants in 2011, all at risk of malaria. Malaria transmission is most intense in the eastern and southwestern parts of the country, but much lower in the highlands.

Prevention

There has been impressive and steady progress in ITN coverage and use toward levels compatible with PMI standards (use among children under 5 rose from 13% to 70%). IRS also has high coverage (up to 99%) in highly malaria endemic districts.

Case Management

Access to health care has also improved through Rwanda's extensive network of 60,000 community health workers who are implementing an integrated community-based treatment of childhood illness. Laboratory confirmation is mandated (microscopy at health facilities and RDTs in the community). Laboratory confirmation rate of malaria cases was 94% in 2010.

Impact

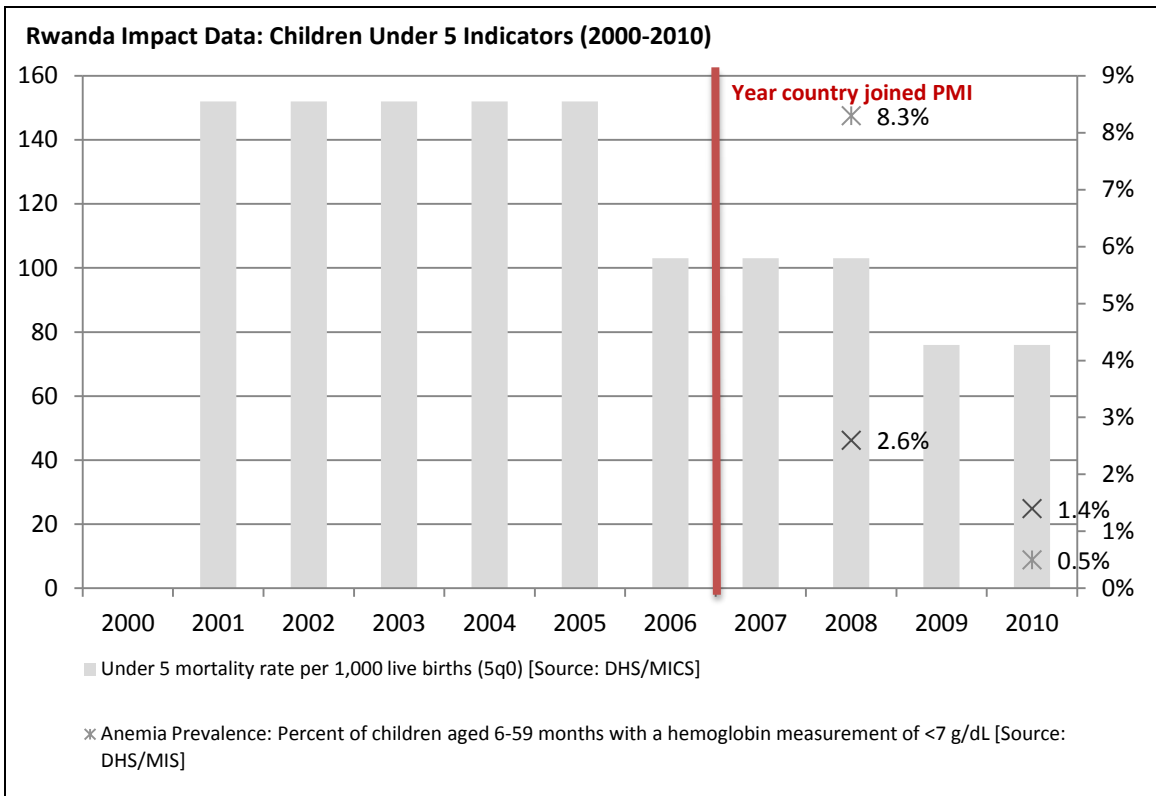
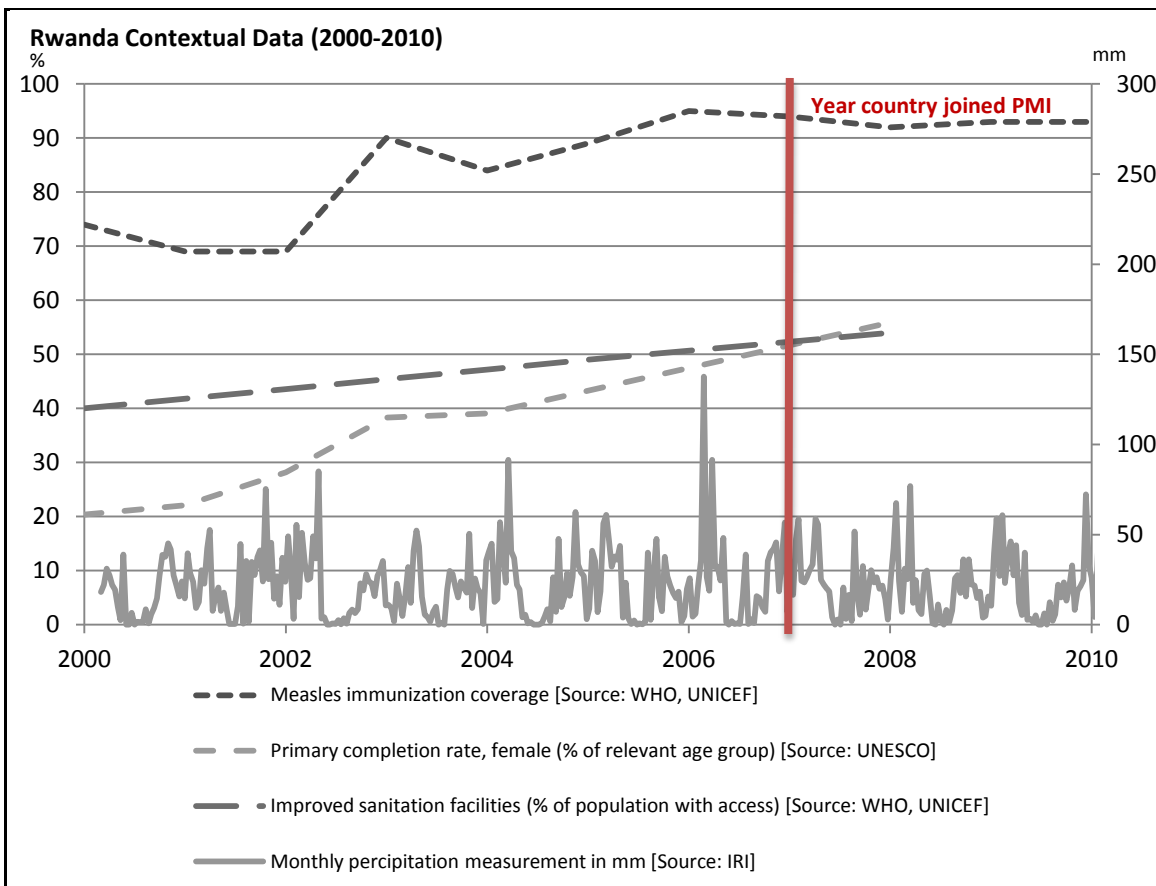
According to DHS data, ACCM declined by 32% between 2005–2008 and by 26% between 2008–2010 (total 50% decline 2005–2010). Over the same time period, reported malaria incidence fell sharply, most likely due to the interventions. In 2009, an increase in the number of confirmed malaria cases was reported. The cause of this increase is unclear, but it may have been caused by a decline in ITN coverage due to procurement delays.

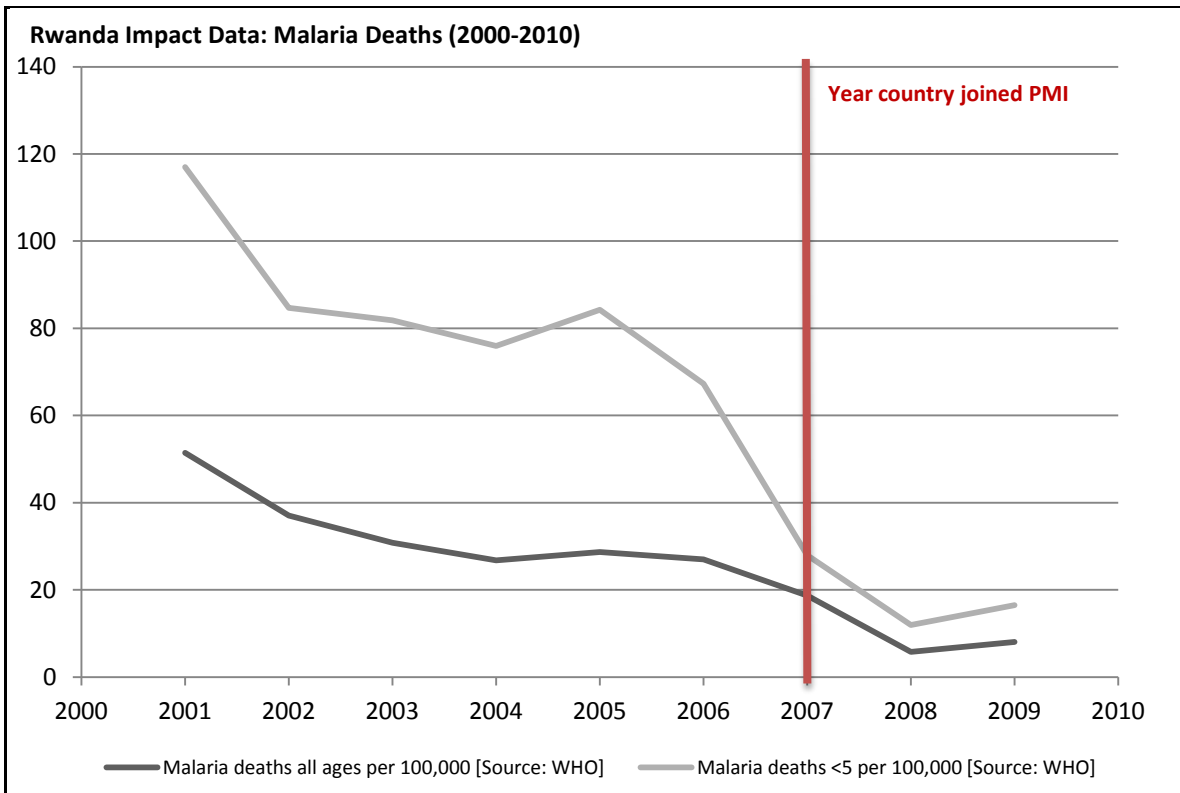
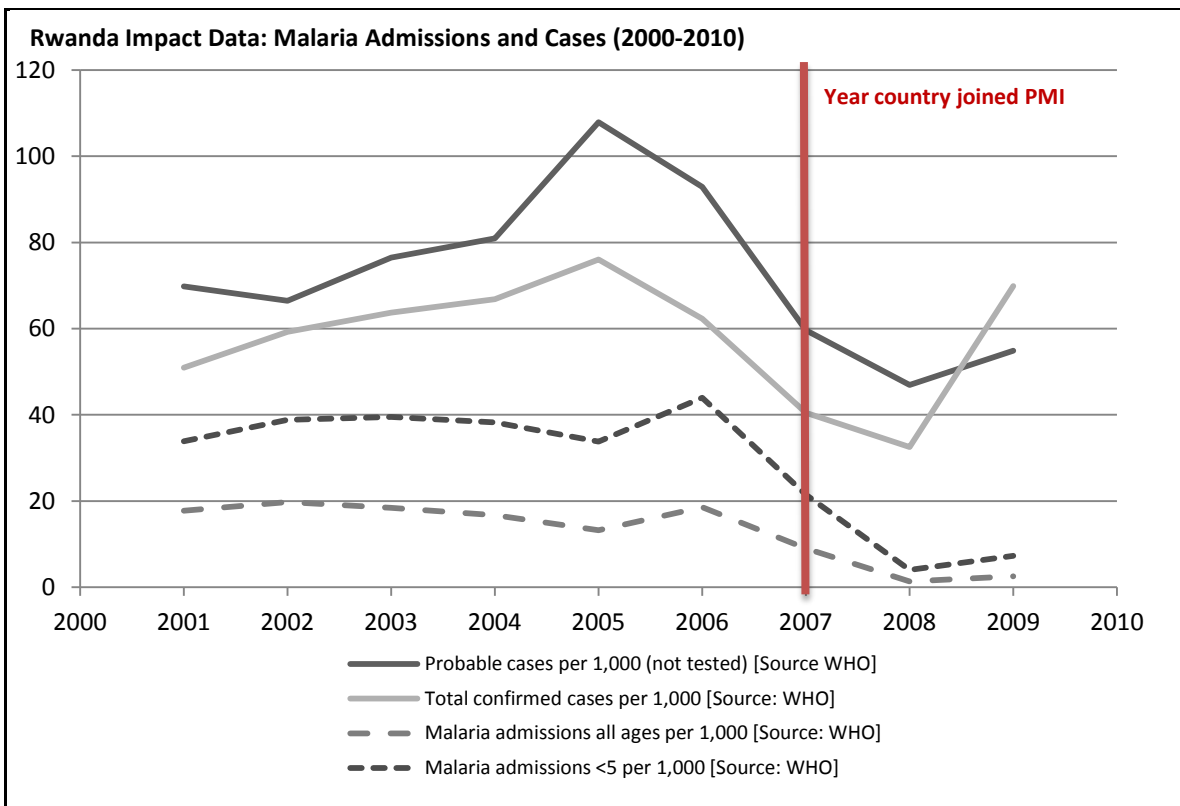
Contextual Factors

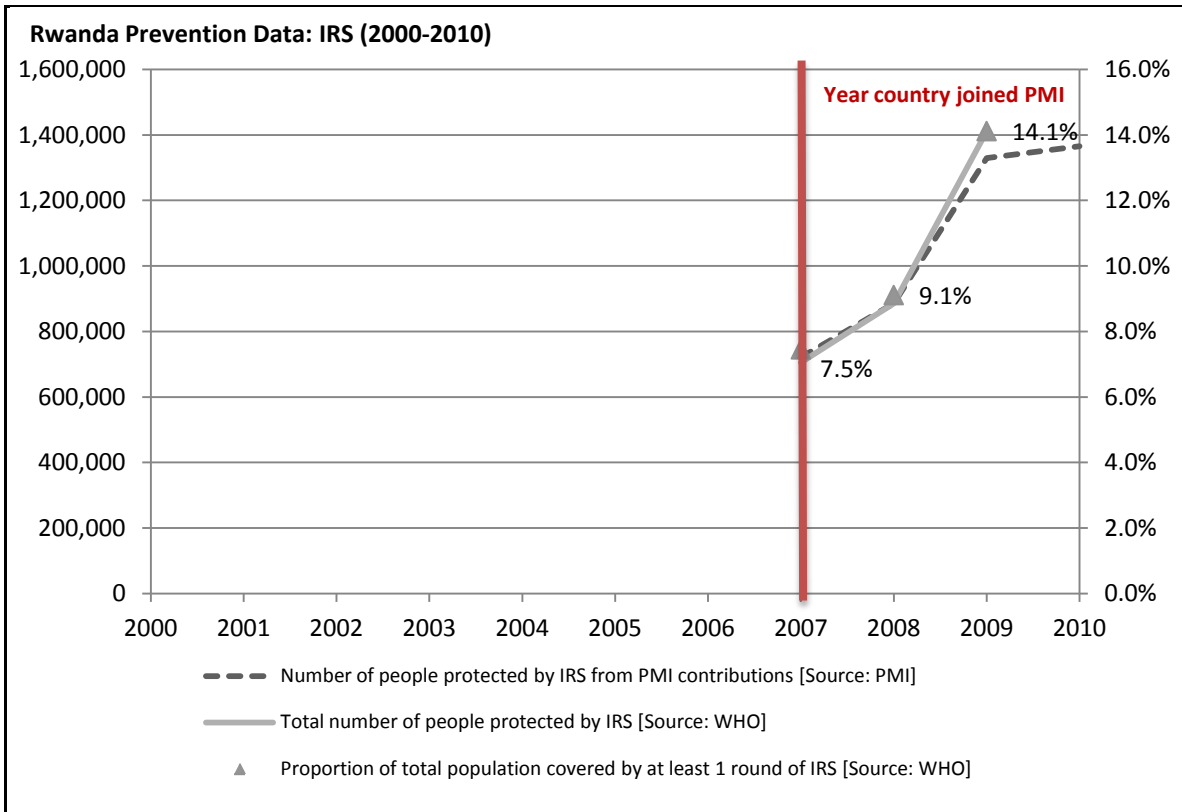
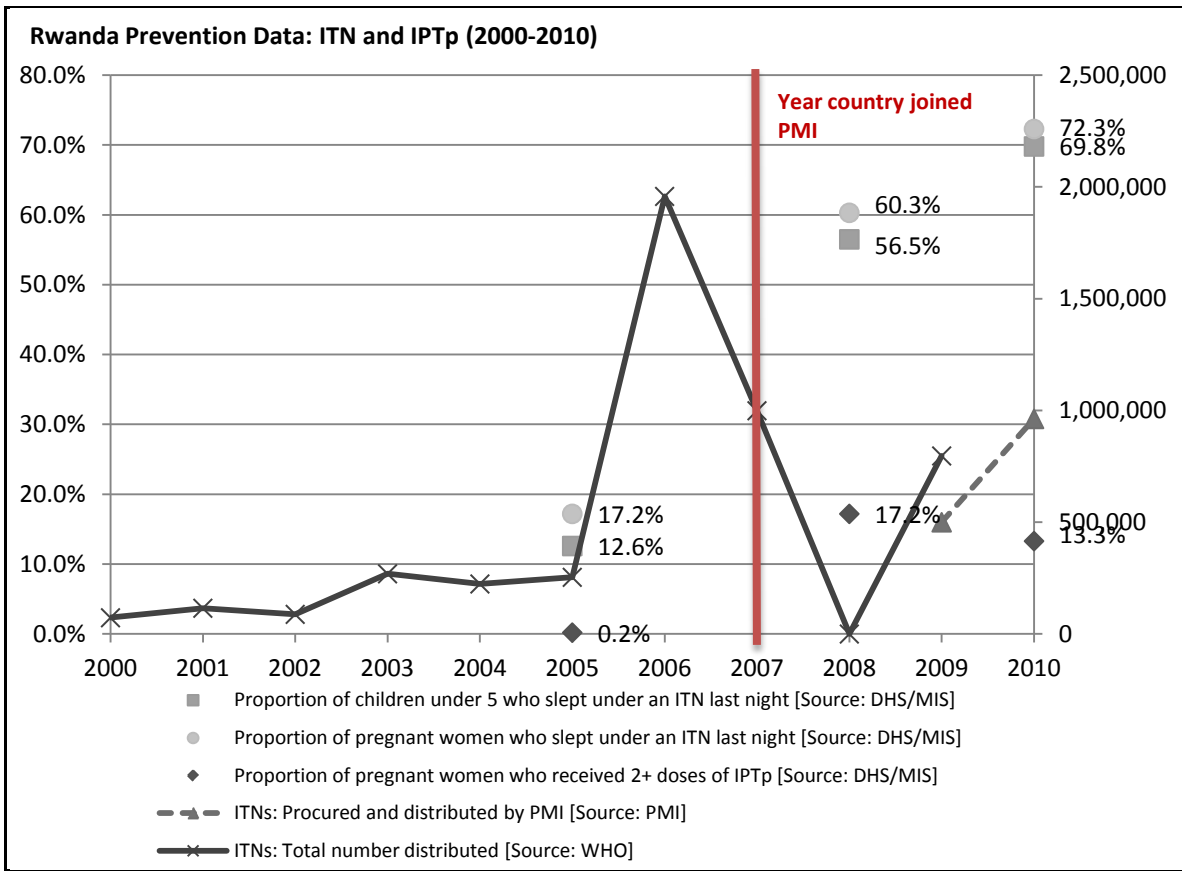
Several factors could have contributed significantly to a reduction of ACCM through the decade. However, there is no indication that malaria would have decreased for reasons other than improved malaria control.

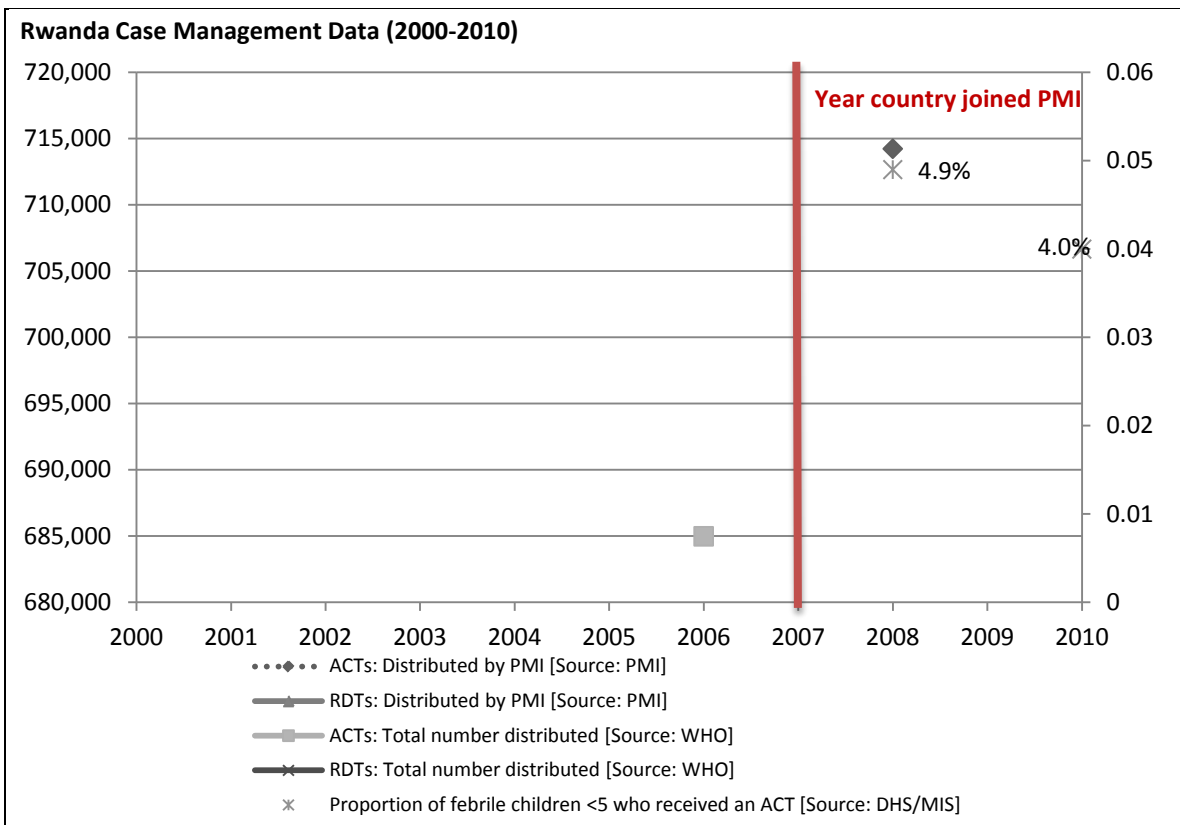
Conclusion

It is likely that the reduction in ACCM is related to the scale-up of prevention and better case management. The good surveillance system and survey data should be used for research on M&E.









12. Senegal

PMI started in Senegal in FY 2007 (Round 2). Senegal has 12.5 million inhabitants; nearly all are at risk of malaria, but that risk is extremely low in the northernmost part of the country.

Prevention

There was a marked increase in ITN use from 2005, when 7%–9% of young children and pregnant women were protected, to 2009 when utilization rates reached 40%–50%. IPTp coverage increased over the same period from 12% to 52%, but from operational data, it is known that it declined again in 2010–2011 because of non-availability of SP. IRS was introduced by PMI. From 2007–2009, 600,000 to 700,000 people were protected by a single annual round. In 2010, over 900,000 (5.7% of the national population) were covered.

Case Management

After the start of PMI, there was a rapid scale-up in the distribution of RDTs, funded by GFATM, and a concomitant decrease in ACT distribution. From 2006–2008, there was a modest increase in the proportion of children with fever treated with ACT from 4.3% to 4.6%, but it is difficult to interpret this in view of the introduction of RDTs (i.e., many children with fever do not test positive for malaria). A closer examination of HIS data concluded that the introduction of RDTs had indeed led to a rapid reduction in antimalarial drug consumption in the public health services.⁵² Since 2008, there has been a major effort to scale up community-based management of malaria cases in villages with poor access to health facilities; this service is greatly appreciated by public health officials and villagers concerned.

Contextual Factors

A greatly improved measles immunization rate is likely to explain an important part of the reduction in ACCM. A change in precipitation is not apparent; however, in one rural area of Senegal, annual rainfall was found to be a very important determinant of malaria risk (as would be expected in desert fringe malaria); therefore, attention to this determinant must be paid in any analysis.⁵³

Impact

The apparent reduction in the number of malaria cases is probably in large part due to the introduction of RDTs and more rigorous diagnostic criteria. It is uncertain to what extent this also explains the reductions in malaria mortality and admission rates of more than 50% from 2007–2009. These reductions occurred during the period when ITNs were scaled up, and this is likely to be at least part of the explanation. A decline in malaria incidence is confirmed by some studies. In Dielmo, a village in southwestern Senegal, the number of confirmed malaria cases has steadily declined since 2000. This was paralleled by changes in the age profile of malaria patients so that the risk of malaria is now almost uniformly distributed throughout life.⁵⁴ In one district, the introduction of ITNs was associated with a marked decrease of malaria attacks, but it took less than two years before malaria attacks almost returned to previous levels. One possible explanation for this was pyrethroid resistance.⁵⁵

⁵² Thiam, S., et al. “Major Reduction in Anti-Malarial Drug Consumption in Senegal after Nation-wide Introduction of Malaria Rapid Diagnostic Tests.” *PLoS One*, 6(4):e18419, 2011.

⁵³ Munier, A., et al. “Evolution of malaria mortality and morbidity after the emergence of chloroquine resistance in Niakhar, Senegal.” *Malaria Journal*, 8:270, 2009.

⁵⁴ Brasseur, P., et al. “Changing patterns of malaria during 1996–2010 in an area of moderate transmission in Southern Senegal.” *Malaria Journal*, 10:203, 2011.

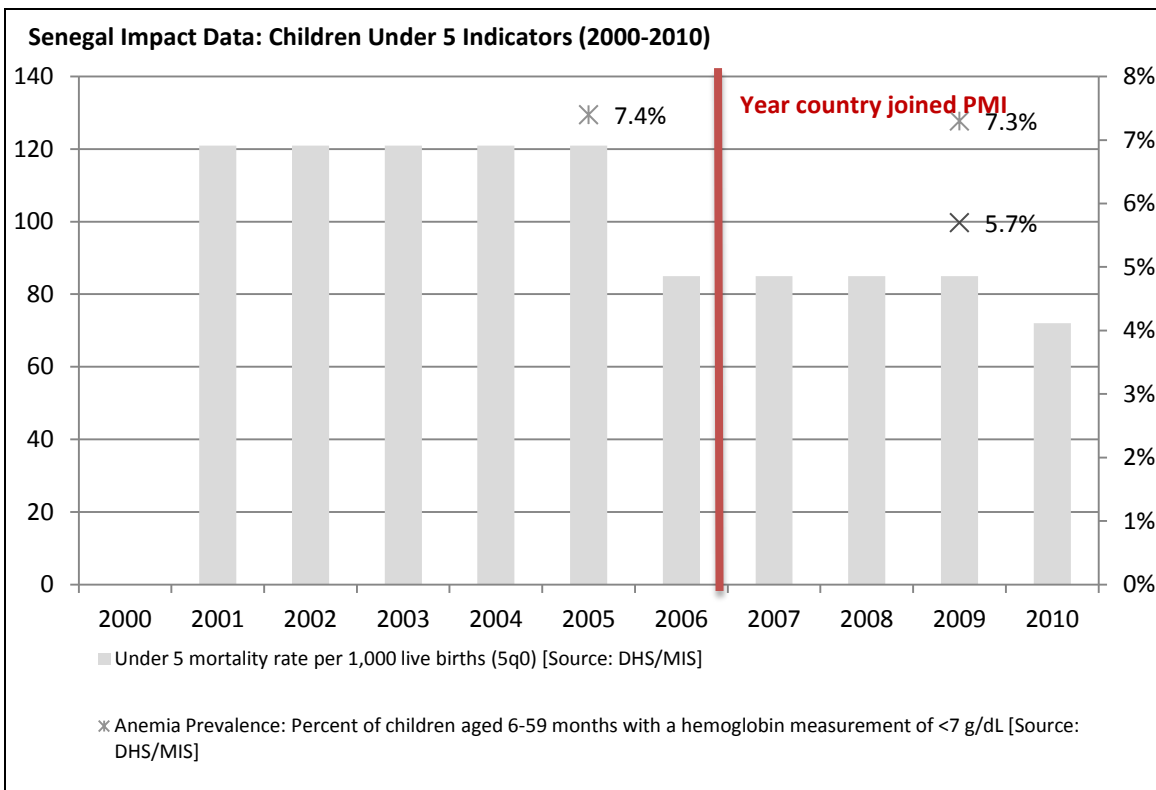
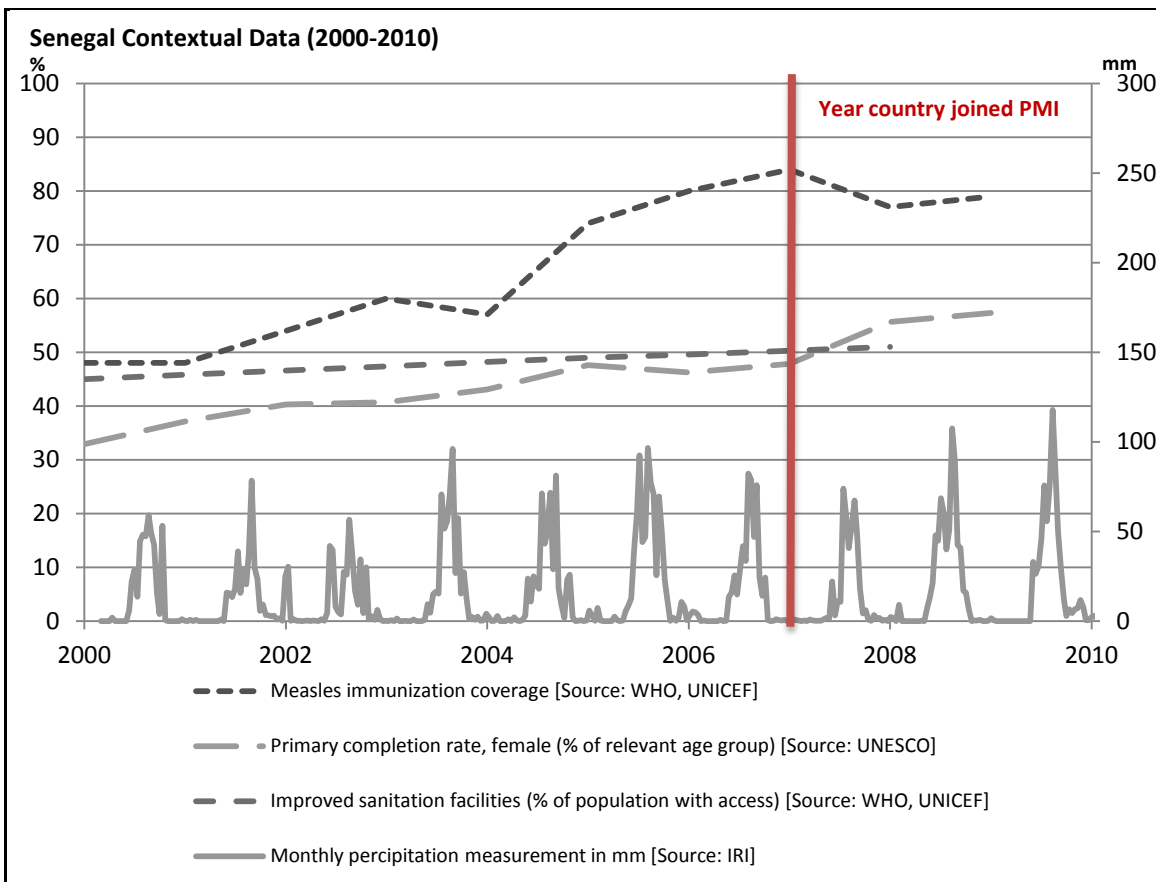
⁵⁵ Trape, J.F., et al. “Malaria morbidity and pyrethroid resistance after the introduction of insecticide-treated bednets and artemisinin-based combination therapies: A longitudinal study.” *The Lancet Infectious Diseases*, 11(12):925–932, 2011. DOI:10.1016/S1473-3099(11)70194-3.

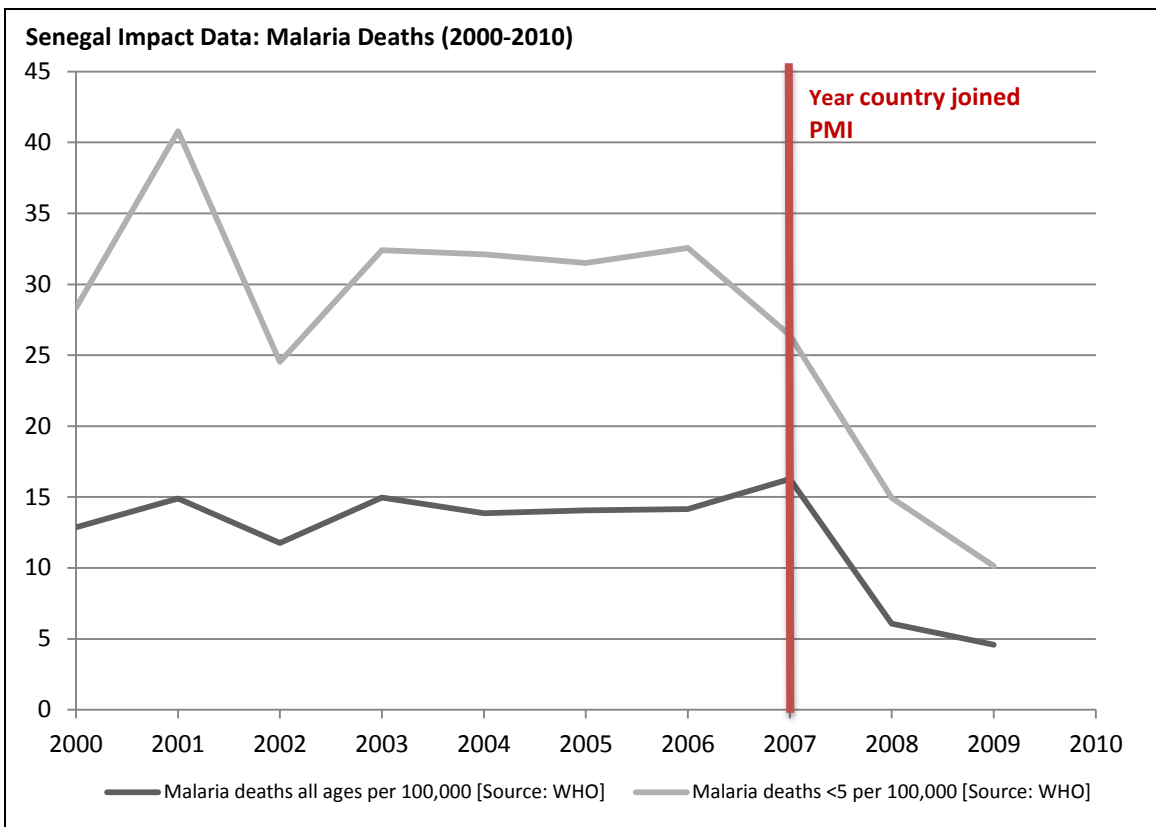
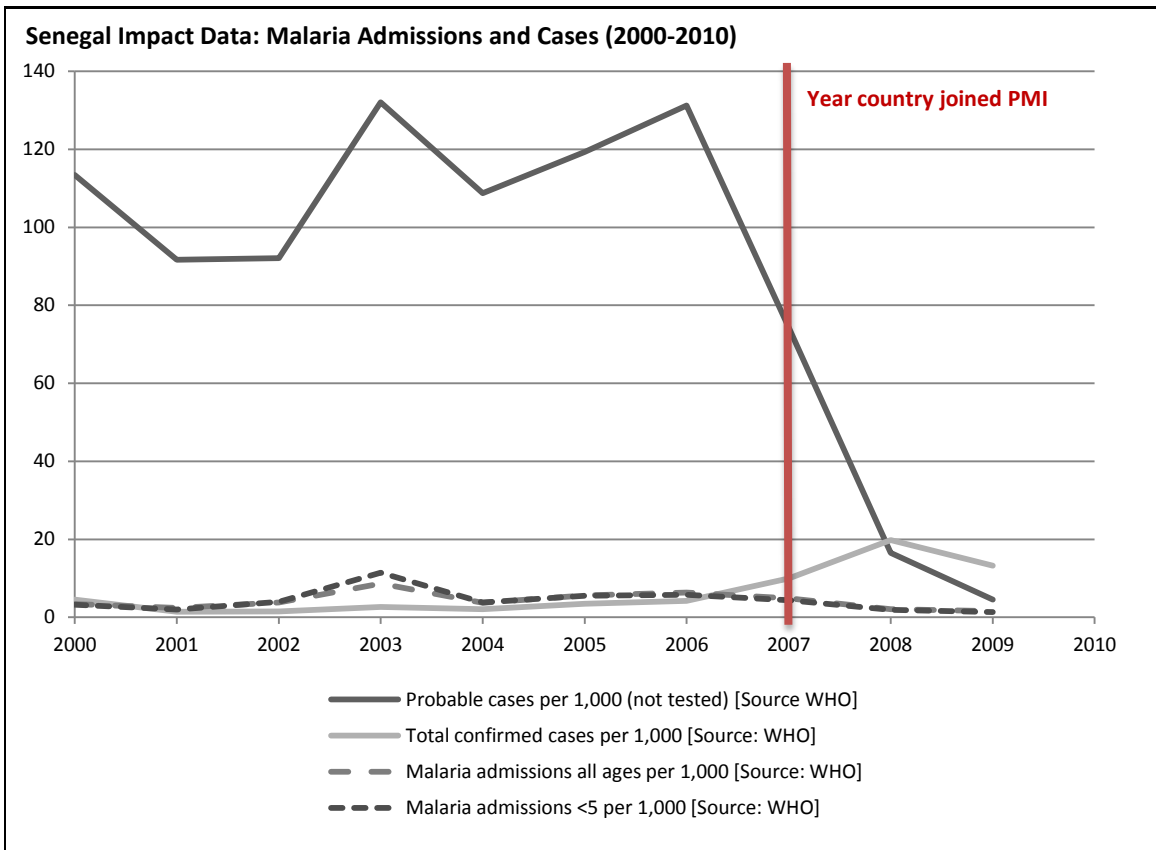
Public health service providers who met during the external evaluation mission in September 2011 also reported a marked reduction in malaria admissions, some saying that severe malaria had “nearly disappeared.” Given the various indications that malaria is improving, it is a little surprising that childhood anemia did not decrease from 2005–2009.

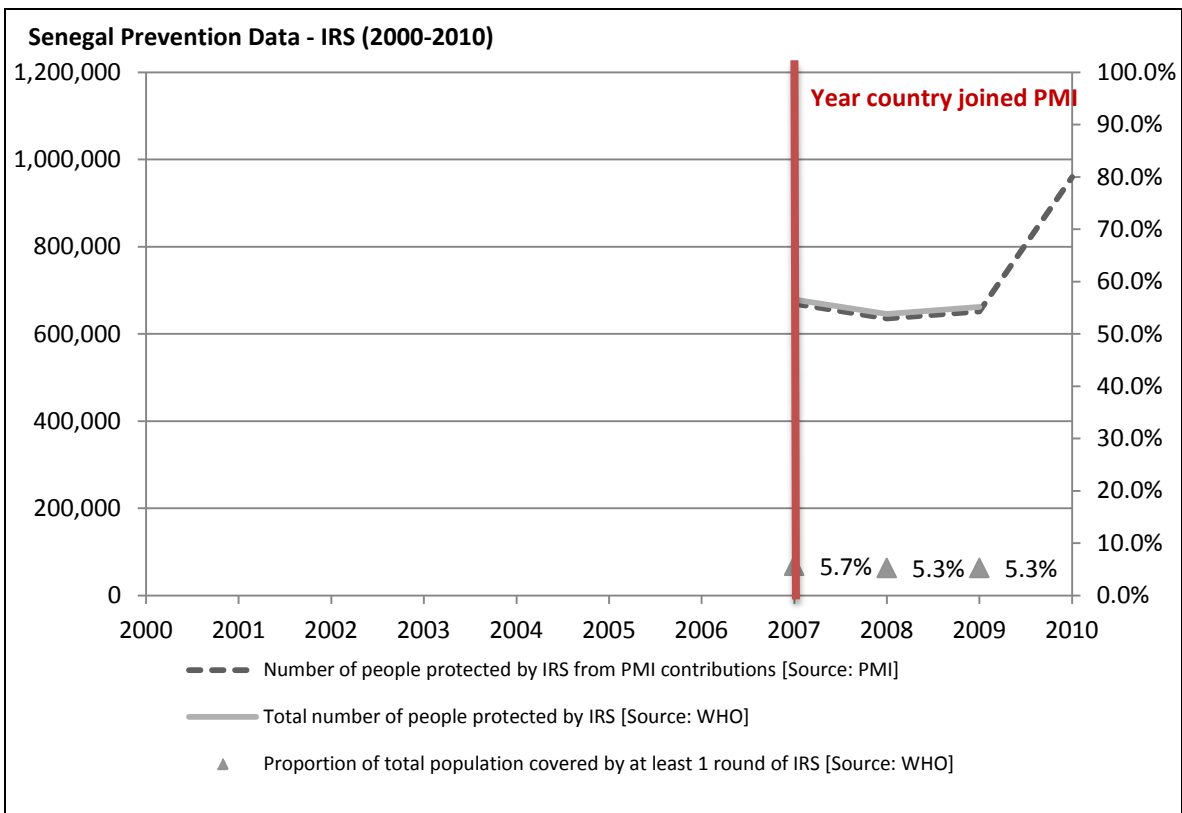
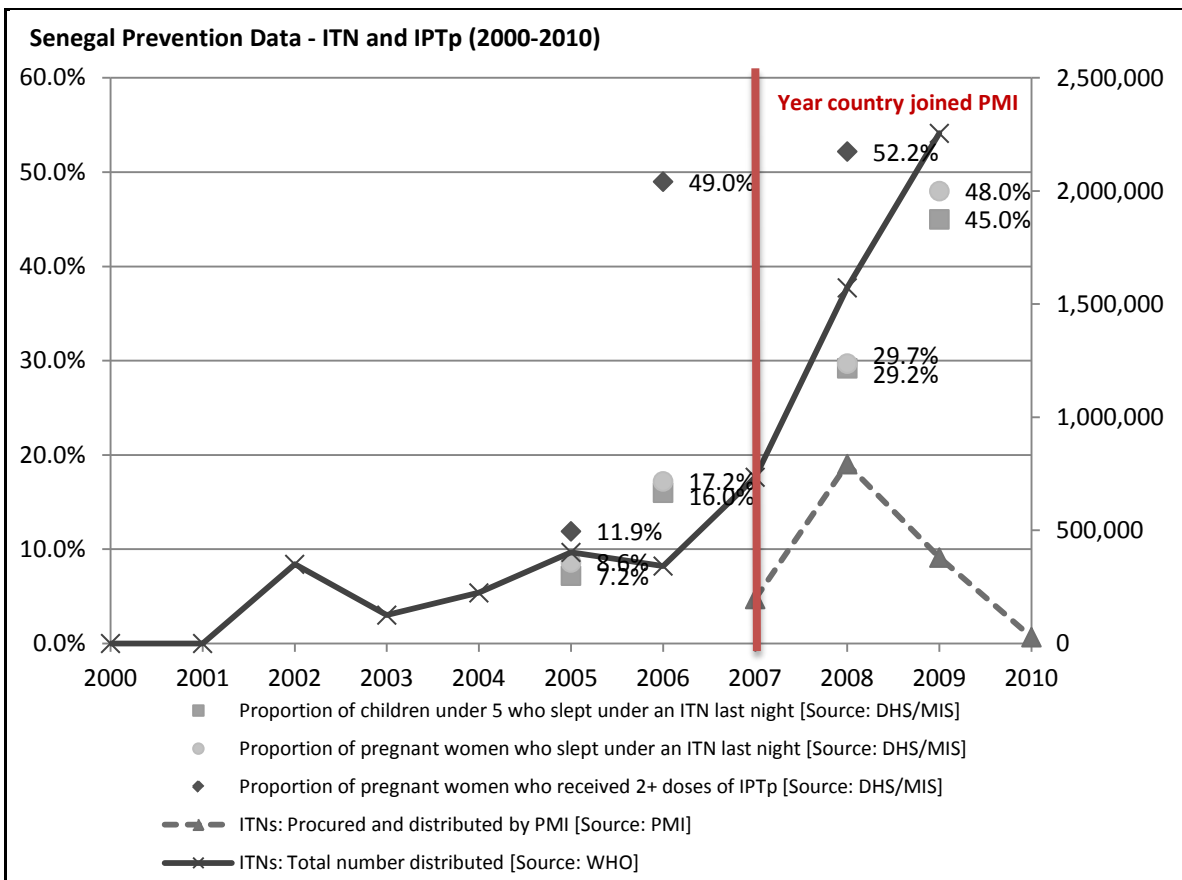
The DHS data show a marked decline in ACCM from 121 to 85 per 1,000 live births (30%) from 2005–2009. A further reduction to 72 deaths per 1,000 live births was seen in the 2010–2011 DHS data, creating a 40% reduction in under-5 mortality rate from 2005–2011.

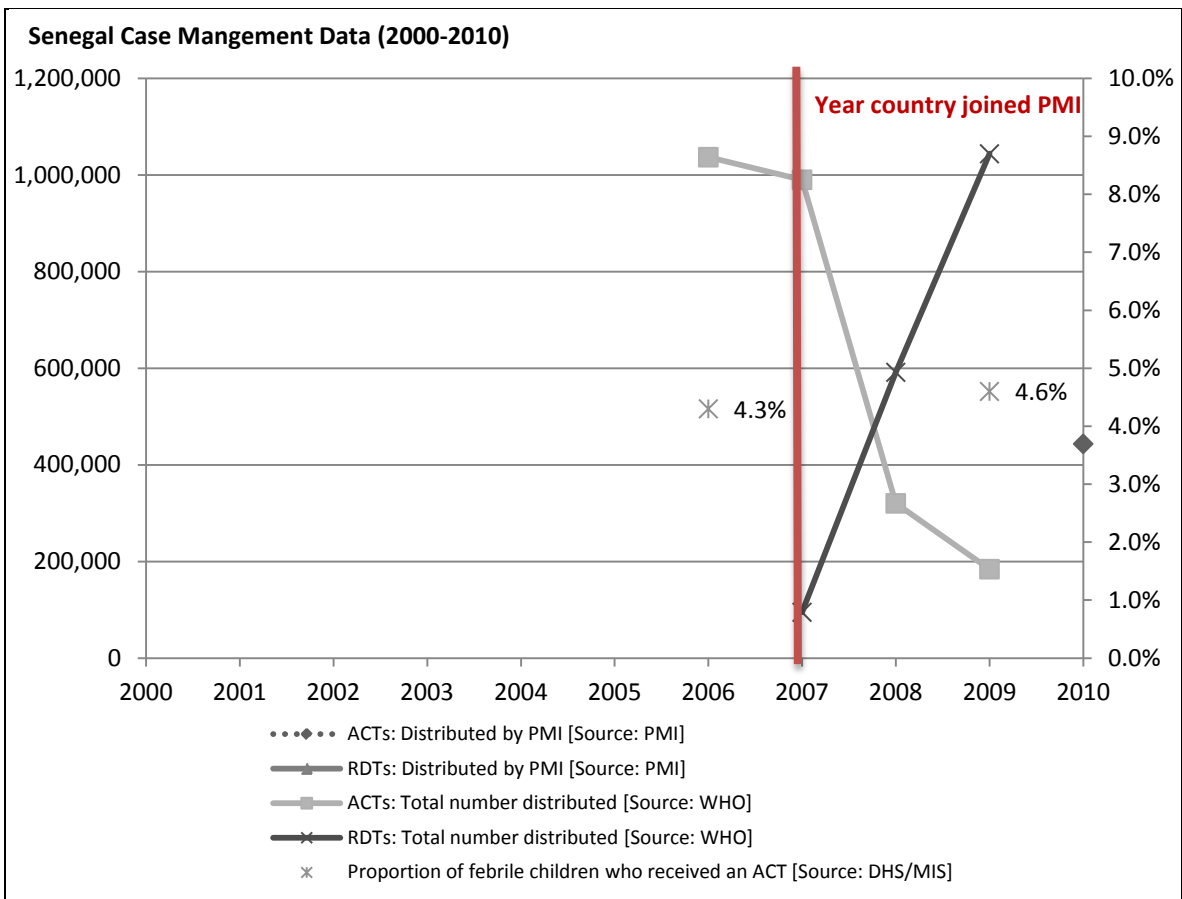
Conclusions

Scale-up of ITNs began in 2007 and coincided with a malaria mortality reduction seen in HIS and a malaria incidence decline seen in several research studies. Furthermore, ACCM was reduced by about 40% over the decade. ACTs were scaled up and services improved by the introduction of RDTs, and this may have helped in the reduction of mortality. IRS, which covered a small proportion of the population (in combination with ITNs), may have added to the impact in the target population. Part of the ACCM reduction may be explained by increased measles immunization coverage and other factors, which we have not examined. However, there is no doubt that the program has reduced malaria and thus also ACCM. The finding of pyrethroid resistance and associated malaria resurgence in Dielmo village is alarming. If this emerges in other areas, which is likely to happen sooner or later, there may be no other choice, with current technologies, than to institute widespread IRS with non-pyrethroids, which will be very costly. This problem is likely not limited to Senegal. Close monitoring of insecticide resistance is warranted. Senegal has switched from pyrethroids to carbamates for IRS, but this will not retard the development of resistance in the areas (the great majority) where there is no spraying.









13. Tanzania

PMI started in Tanzania in FY 2006 (Round I). Tanzania has 42.7 million inhabitants in 2011, with a majority at risk of malaria. Malaria transmission is highest in the north of the country around Lake Victoria and on the coast of the Indian Ocean. In Zanzibar, malaria control efforts over the past five years have dramatically reduced malaria.

Contextual Factors

A considerable increase in primary school completion rate among girls may result in reduction of ACCM in the coming years. Measles immunization coverage has remained relatively constant over the last half of the decade. An overall change in precipitation trend is not apparent.

Prevention

ITN distribution has increased over the last decade with as many as 3 million ITNs distributed in Tanzania in 2006. Between 2005 and 2010, household ownership of at least one ITN increased from 23% to 64%, and ITN use among children under 5 and pregnant women increased from 16% (in both groups) to 64% and 57%, respectively. PMI has made considerable investment in implementation of IRS in Tanzania, protecting almost 5 million people by the end of 2010.

Case Management

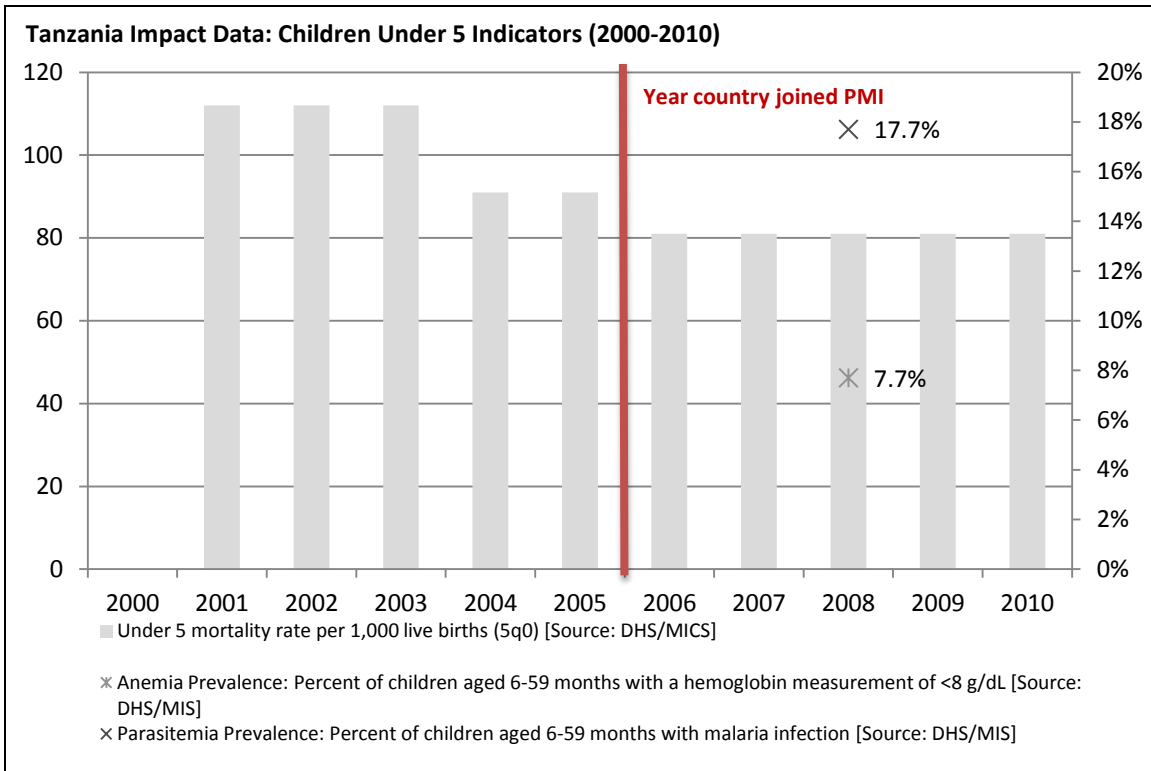
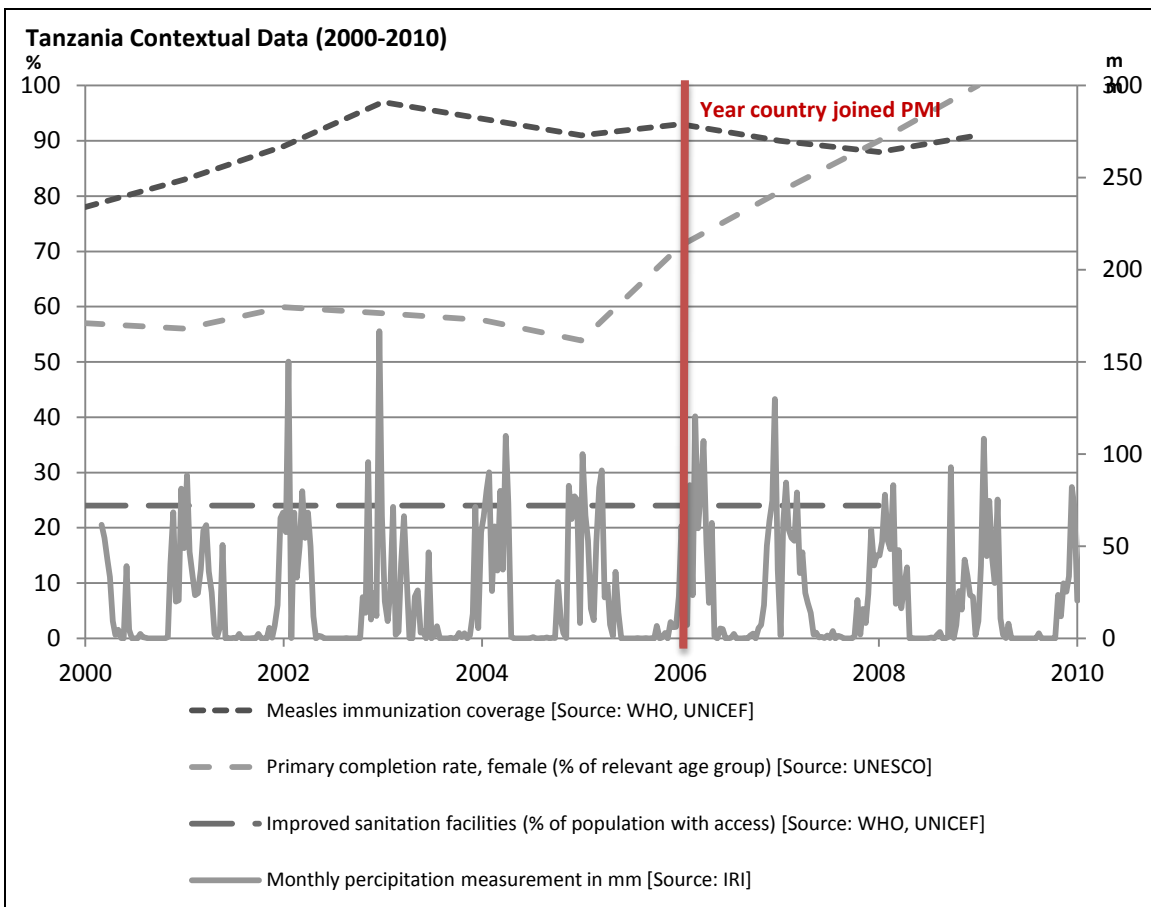
Distribution of ACTs and RDTs in Tanzania started with implementation of PMI in 2006. At the end of 2010, 0.7 million RDTs and 4.9 million ACTs were distributed in Tanzania. ACT coverage of febrile episodes in children under 5 was approximately 21% in 2008.

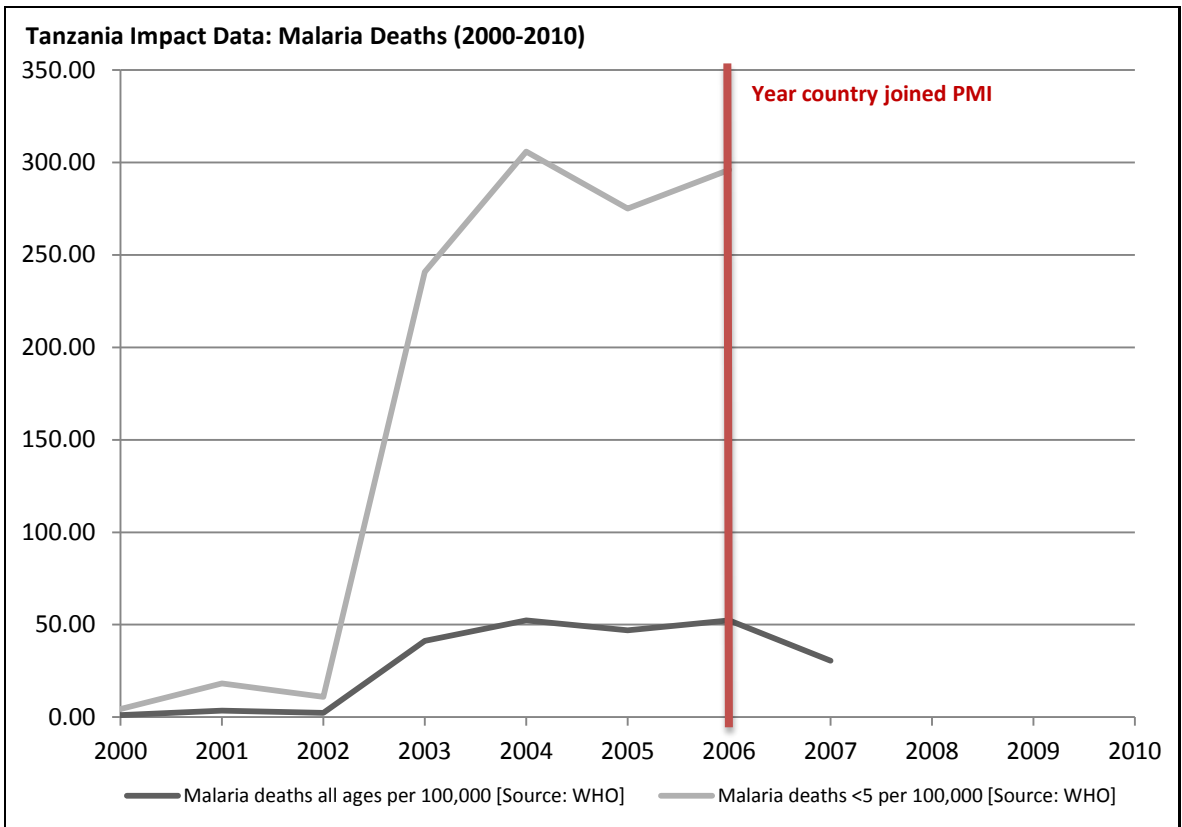
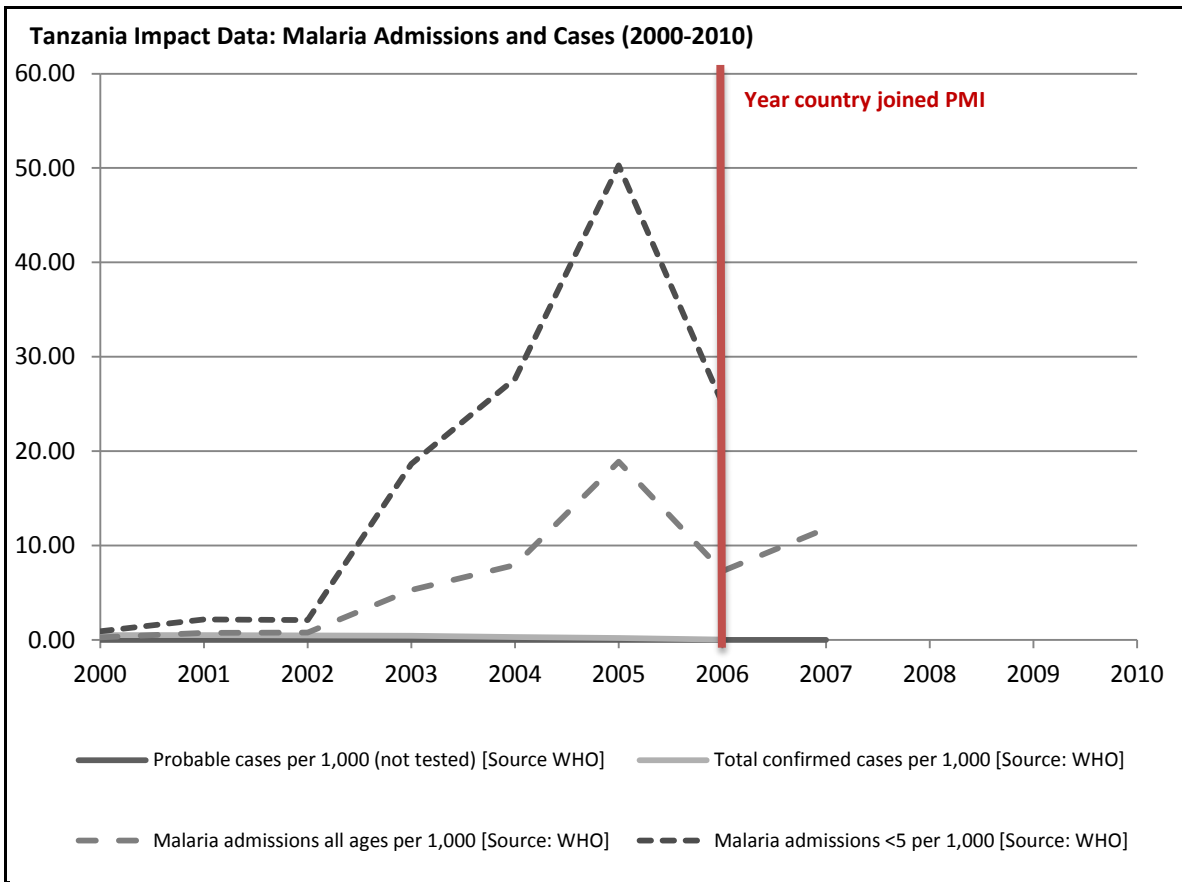
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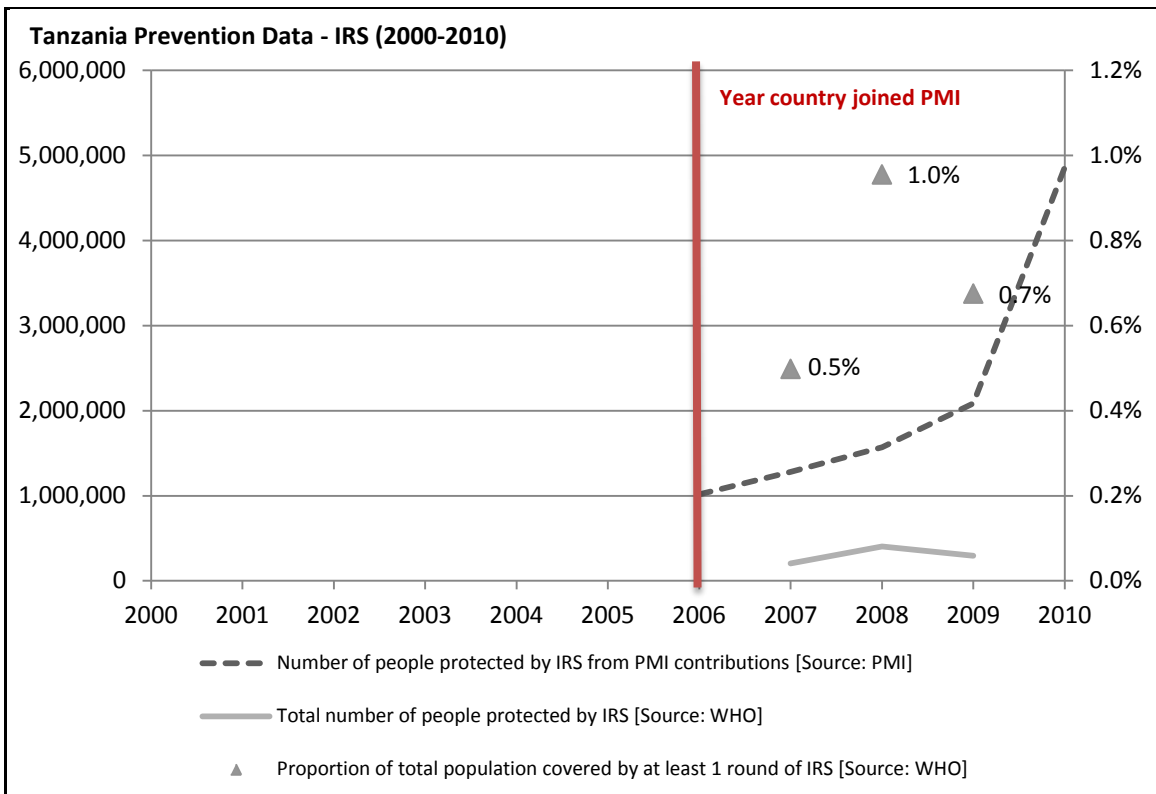
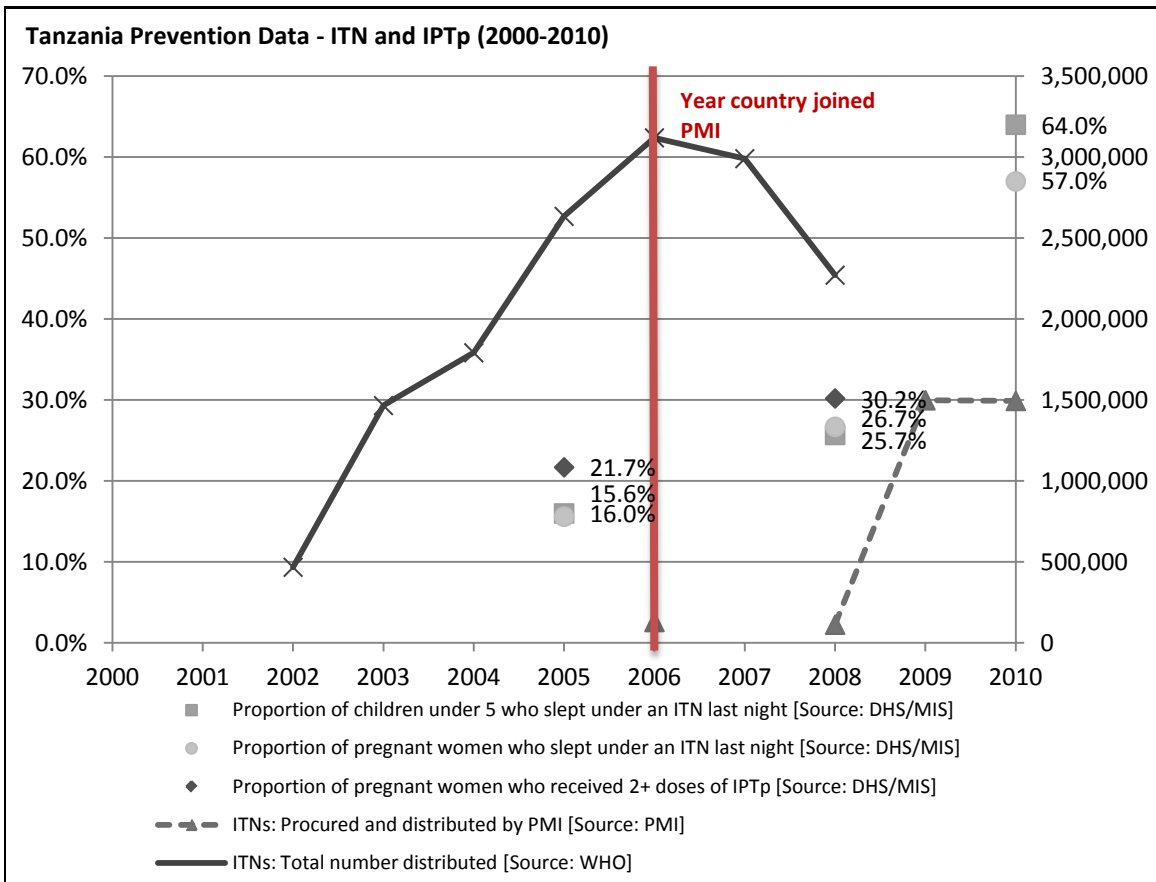
In Tanzania, ACCM fell by 28% between measurements in 2005 and 2010. The frequency of severe anemia in children fell by 50% between 2005 and 2010. Malaria control efforts have been very successful on the island of Zanzibar, where in 2010 less than 2% of blood smears taken from patients at health facility surveillance sites were positive for malaria parasites.

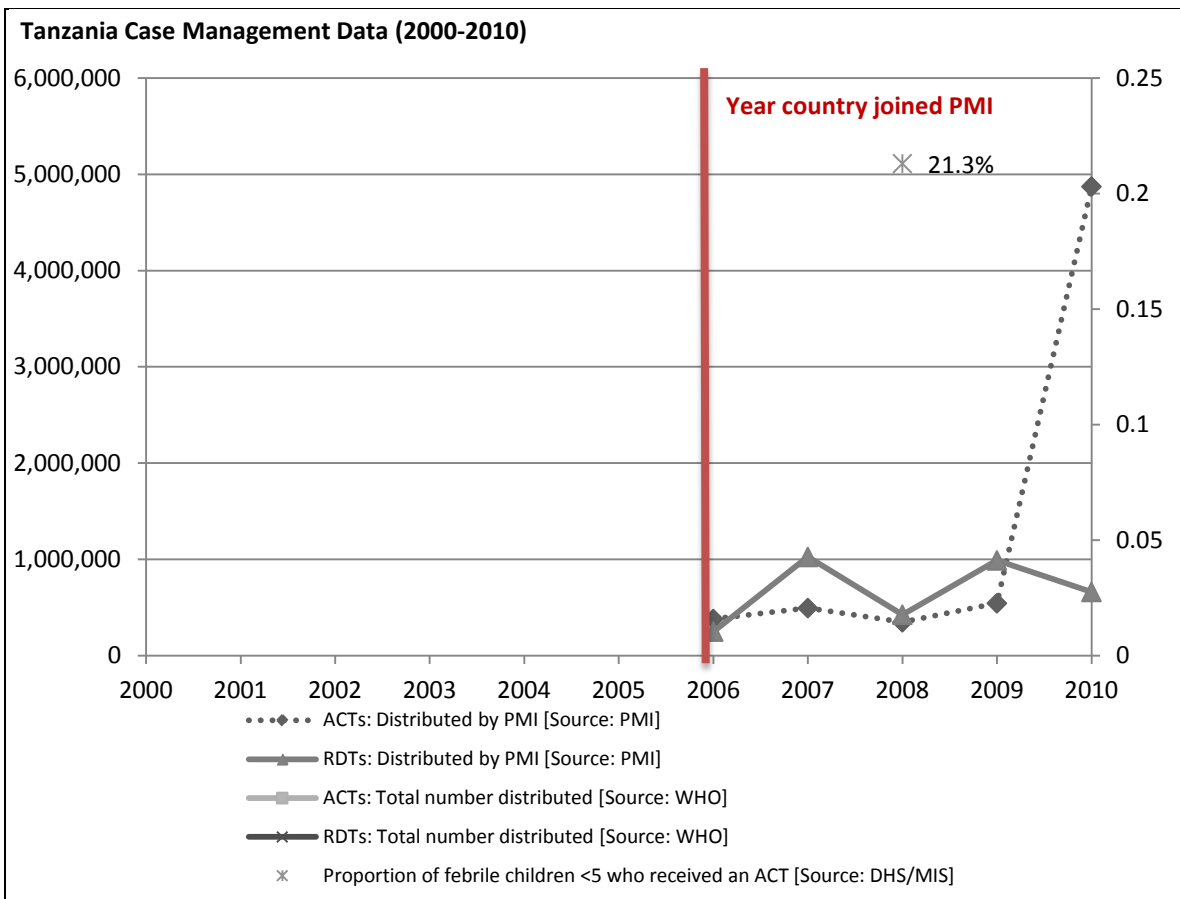
Conclusions

See main report (Chapter 4: Monitoring and Evaluation).









14. Uganda

PMI started in Uganda in FY 2006 (Round 1). Uganda has 35.6 million inhabitants in 2011, all at risk of malaria. Malaria transmission occurs year-round in most parts of Uganda.

Contextual Factors

Measles immunization coverage, primary school completion rates among females, and improved sanitation facilities have remained relatively constant for the majority of the decade. An overall change in precipitation trend is not apparent.

Prevention

ITN distribution started in 2005 and has increased over the latter half of the decade, with 2.3 million distributed in Uganda in 2008. Between 2006 and 2009, ITN use among children under 5 and pregnant women increased from 10% (in both groups) to 44% and 33%, respectively. IPTp use has also increased during the same time period from 16% to 32%. PMI has made considerable investment in implementation of IRS in Uganda, protecting on average 1.8 million people at risk per year during 2007–2009 and almost 2.7 million people by the end of 2010.

Case Management

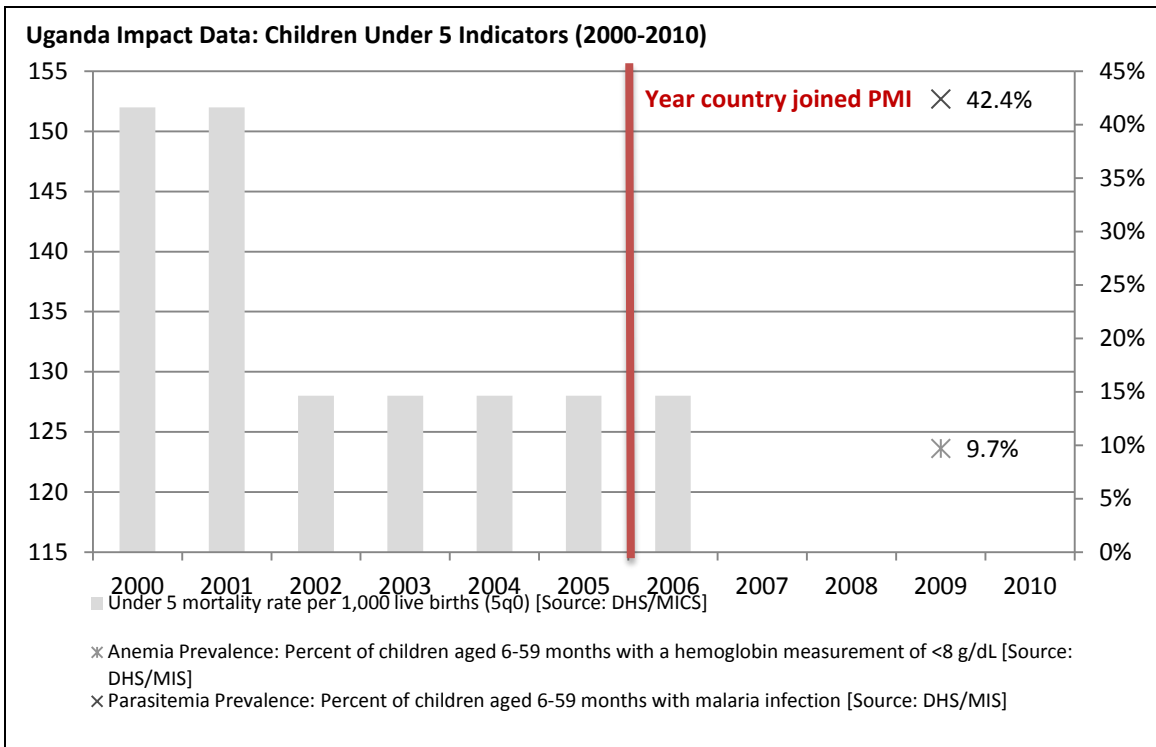
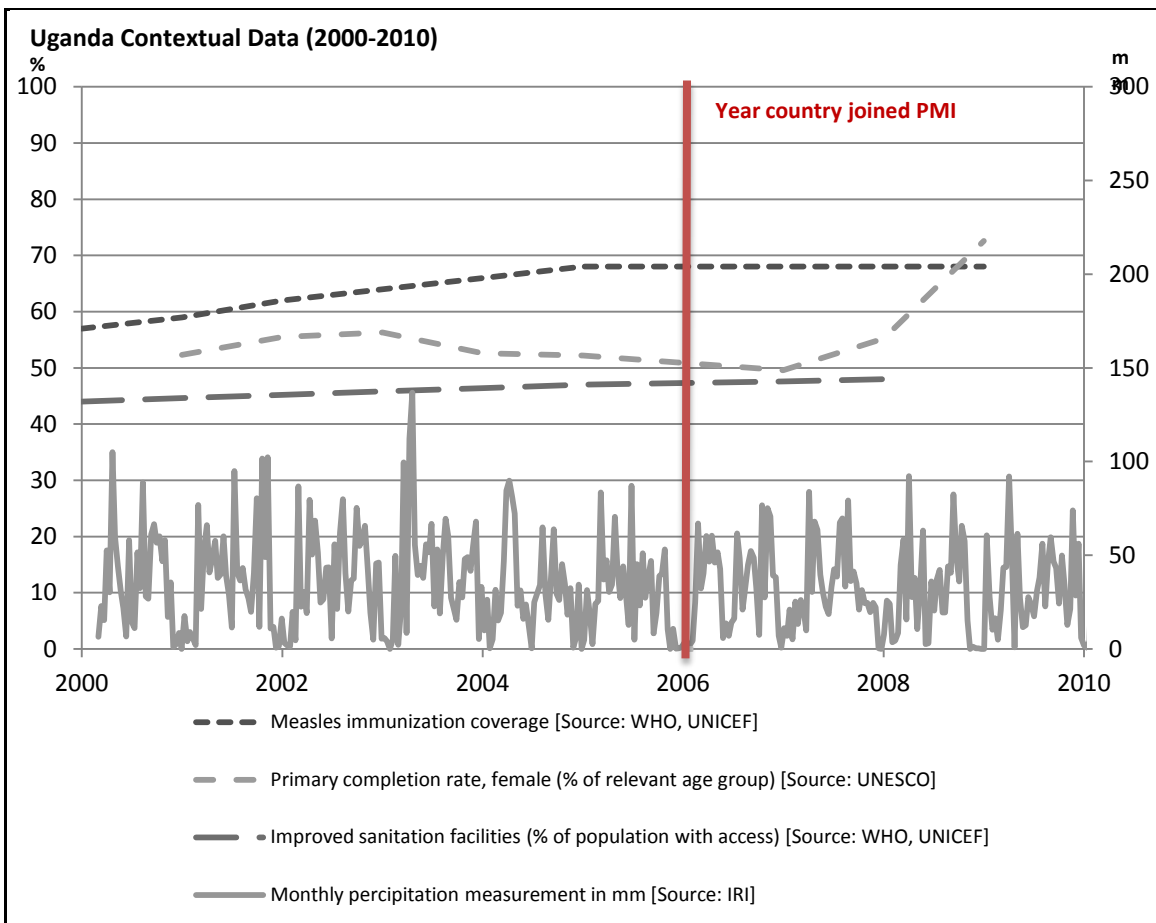
Distribution of ACTs and RDTs in Uganda started in 2006. Almost 11.3 million treatment courses of ACT were delivered in 2009, nearly double the quantity for 2008—sufficient to treat all suspected malaria cases in Uganda that year. ACT coverage rate for children under 5 stood at 23% in 2009. RDT distribution is very low in Uganda with only 34,000 RDTs distributed in 2010. About 30% of the suspected cases were tested parasitologically in 2009, a slight improvement from previous years.

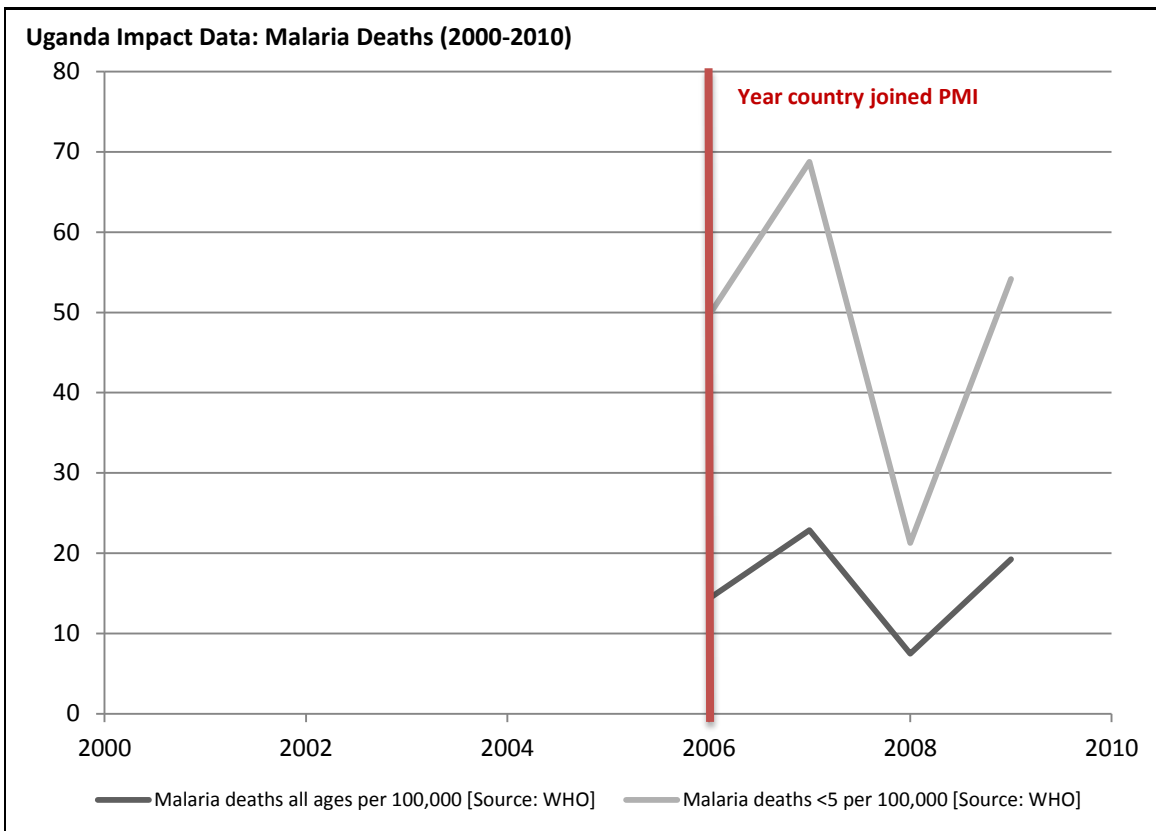
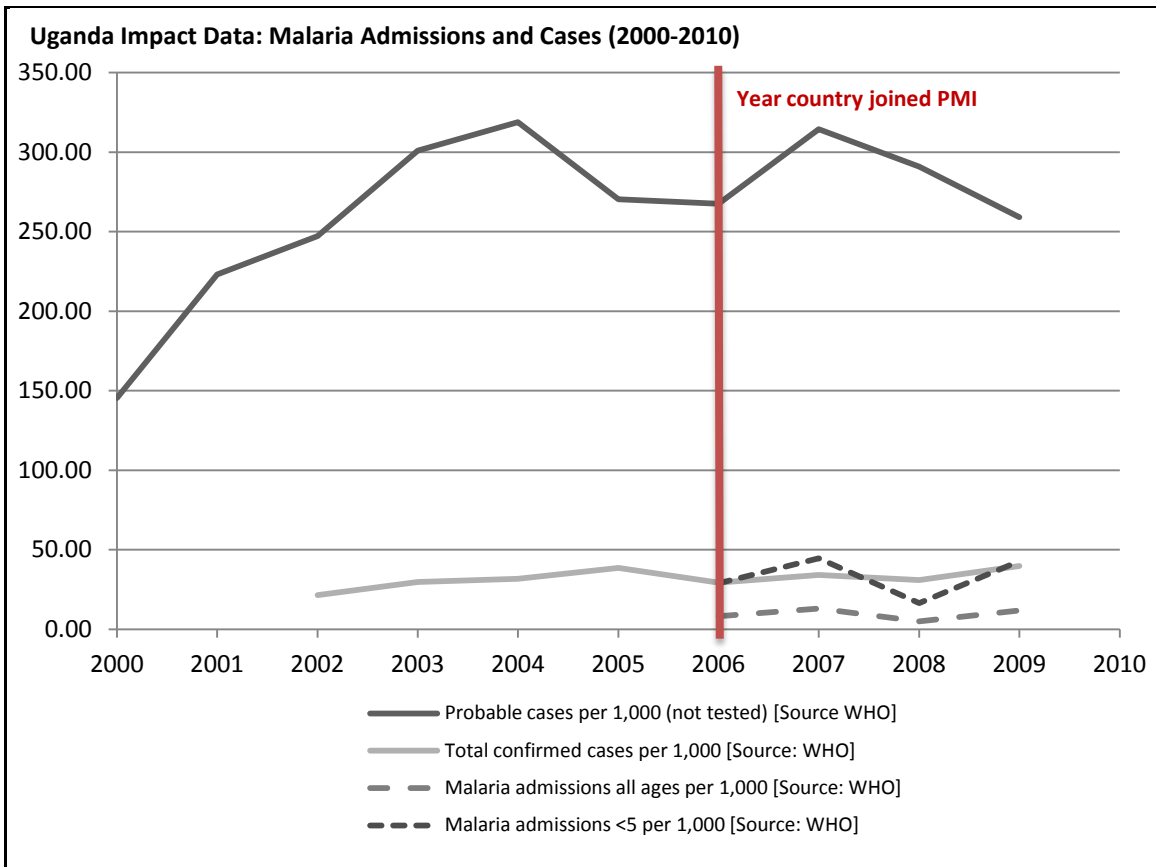
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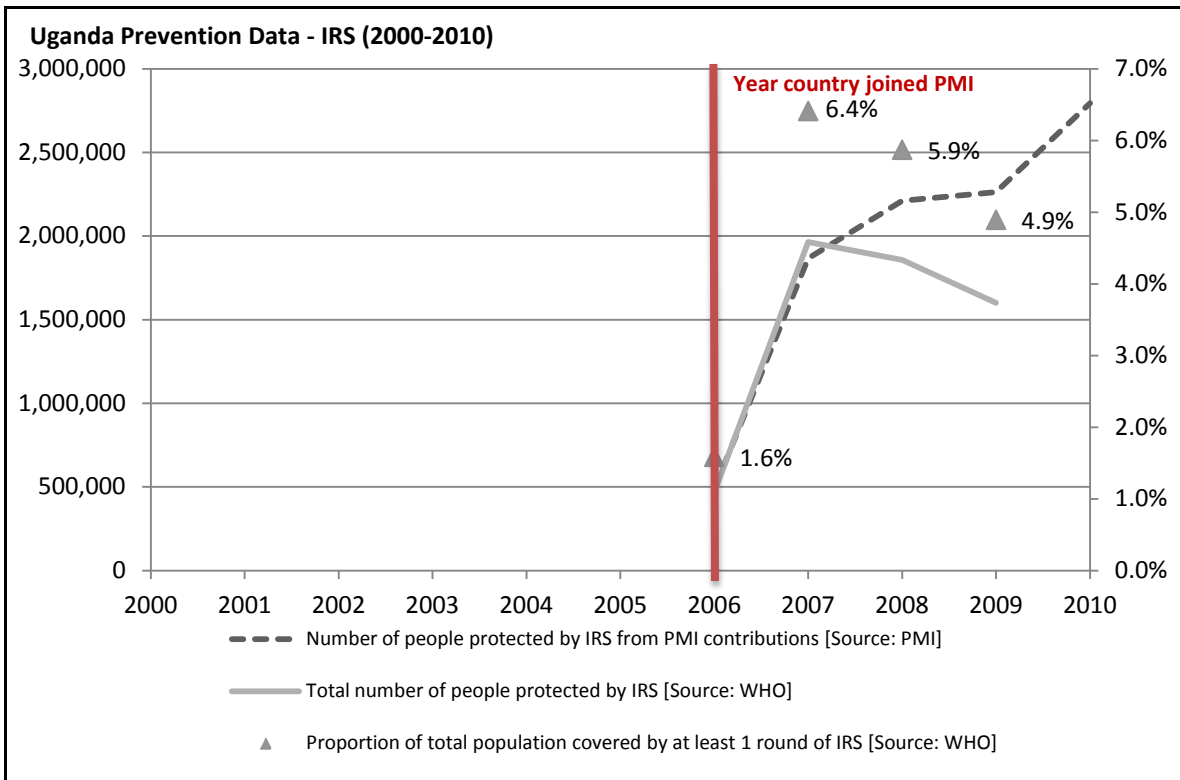
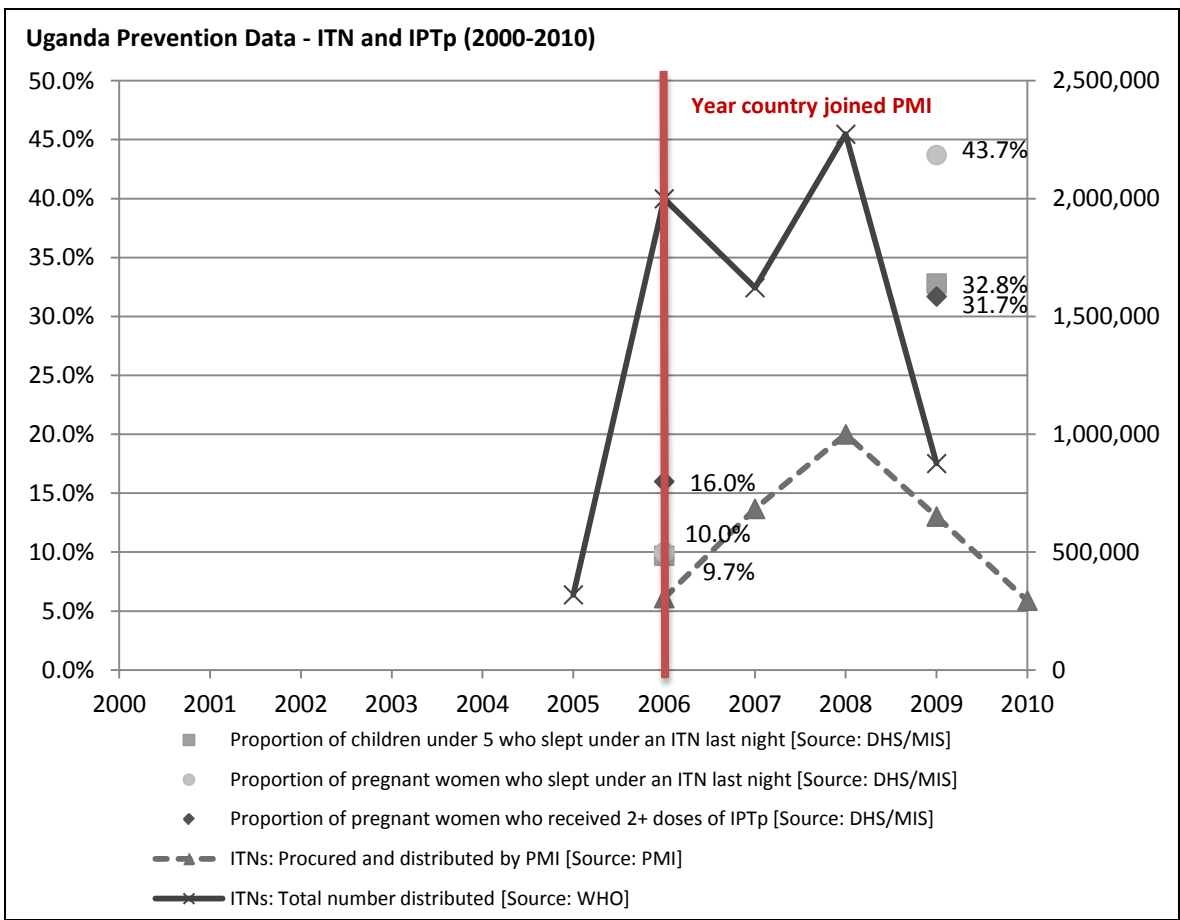
In Uganda, ACCM fell by 18% between 2001 and 2006. The latest DHS data will provide the critical data point to help assess the impact of PMI. Prevalence rates of parasitemia and anemia were still high in 2009. The fluctuating numbers of inpatient malaria cases and deaths reported in 2006–2009 do not provide a basis for evaluation of trends.

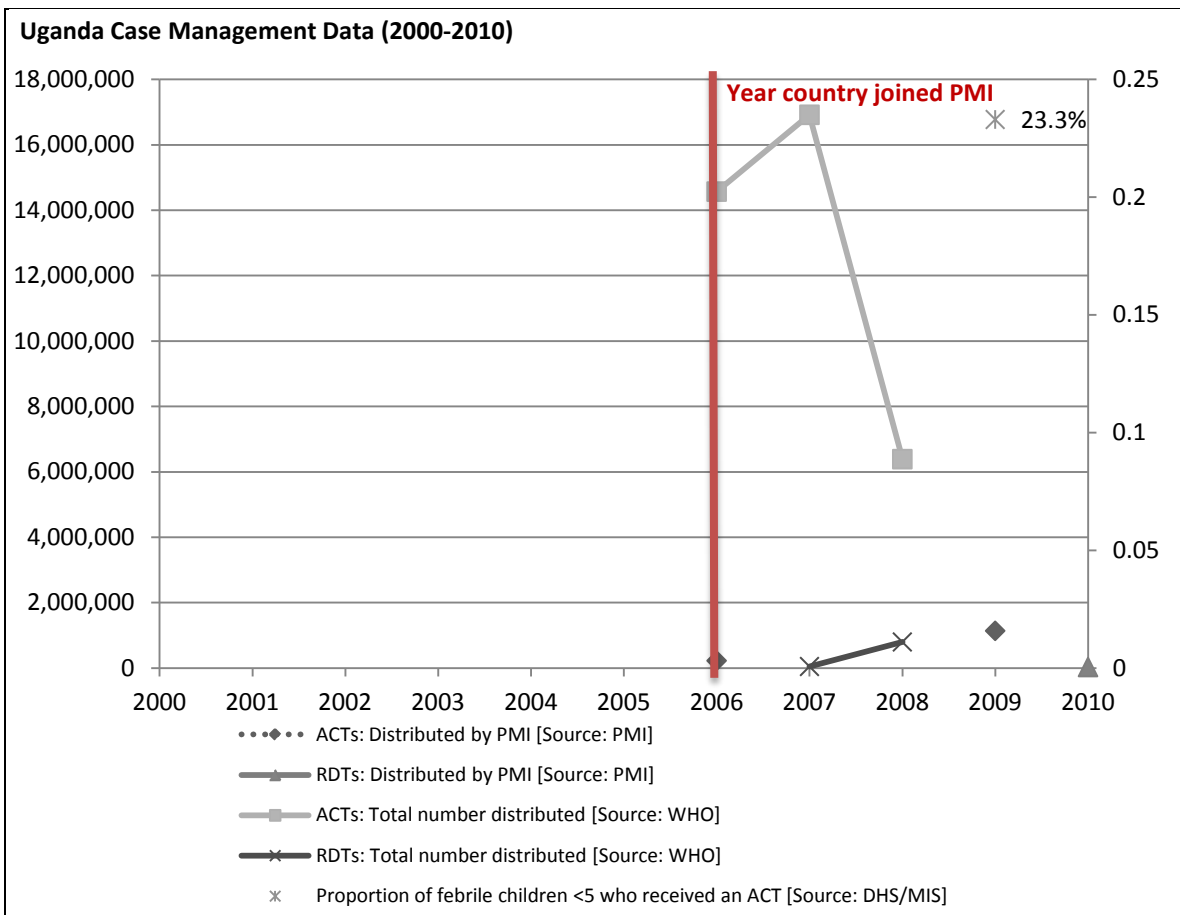
Conclusions

The relatively high coverage rates of different interventions give reason for optimism that it will be possible to document impact in a few years' time.









15. Zambia

PMI started in Zambia in FY 2008 (Round 3). Zambia has 13.9 million inhabitants in 2011, all at risk of malaria.

Prevention

ITNs have been steadily scaled up to high levels of coverage. Zambia and Mozambique are the only countries without unstable highland malaria, where IRS has been scaled to relatively high coverage.

Case Management

Based on the data, ACT has also been scaled up steadily. The 25% coverage rate for febrile episodes in children may be adequate, as the malaria risk is probably now low, although there are still some provinces with high parasitemia rates.

Impact

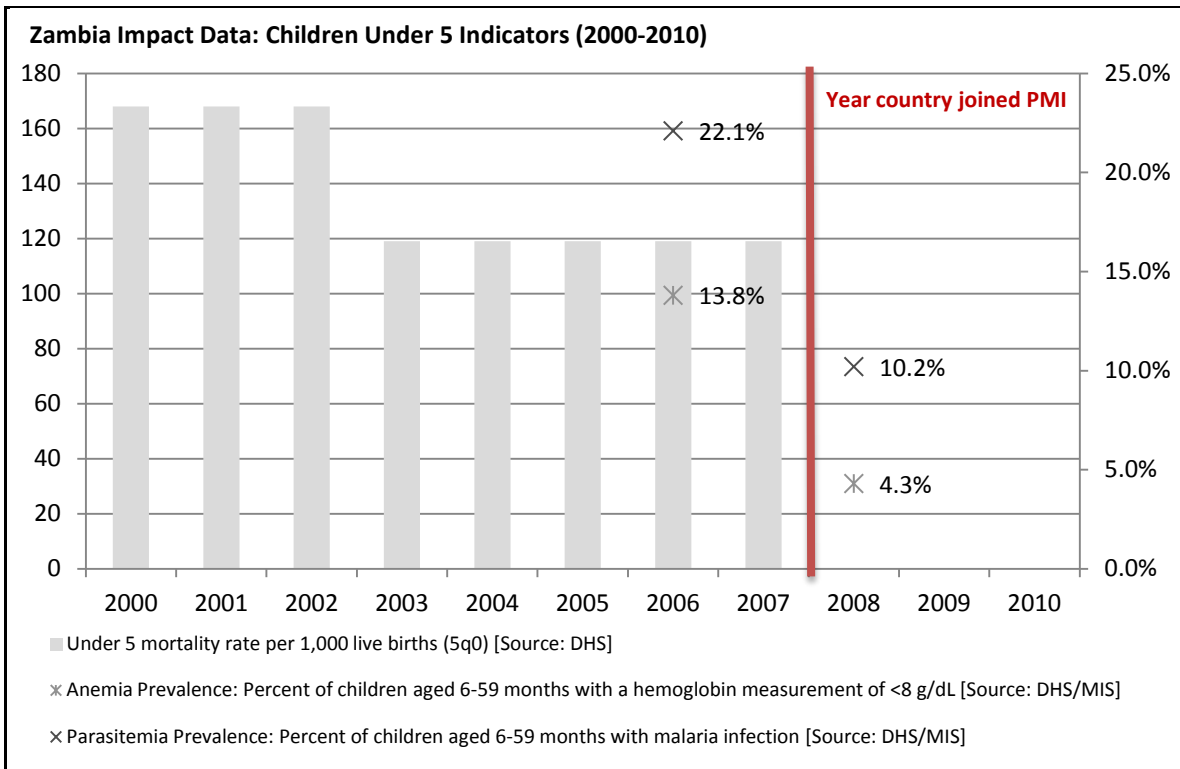
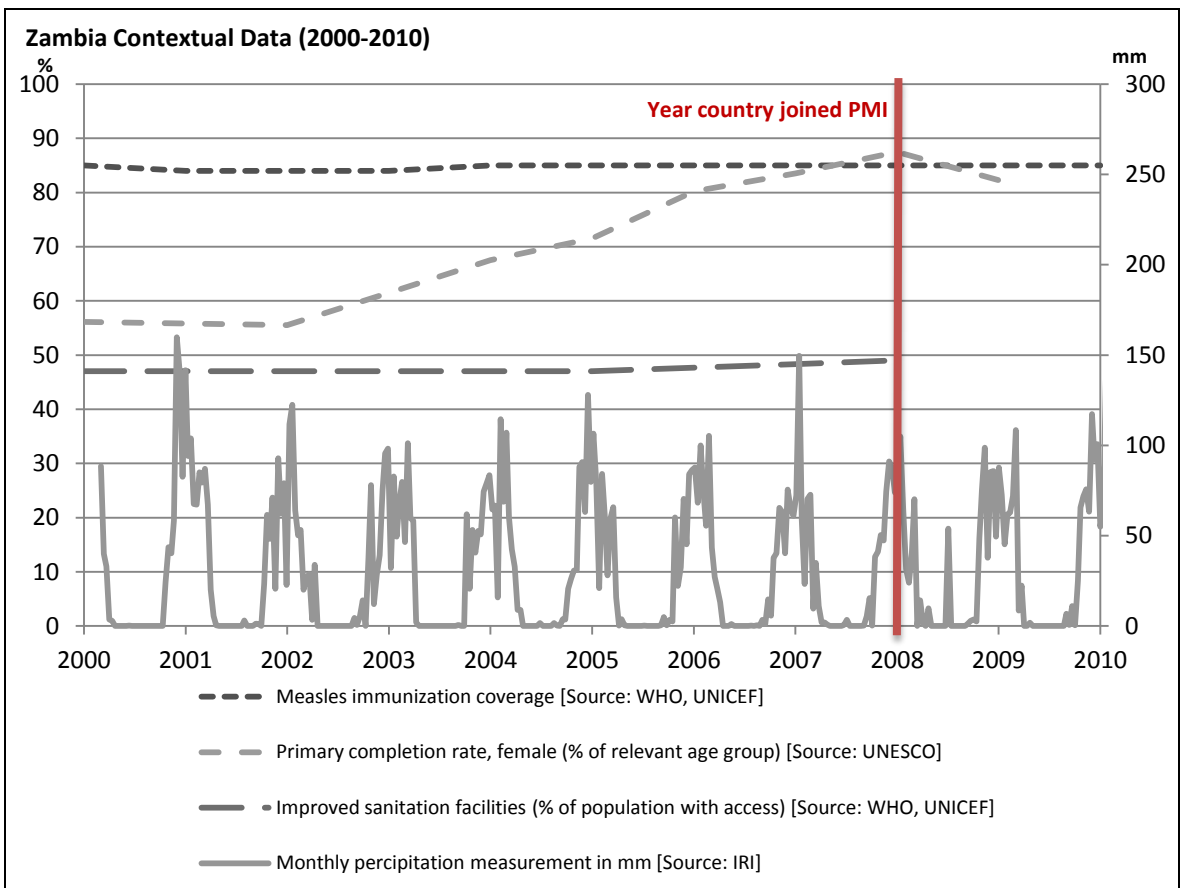
While ACCM data cannot yet be used to assess impact, the decline of prevalence of anemia as well as parasitemia in children provides clear evidence of progress in malaria control. The HMIS data show a clear trend of decreasing malaria burden.

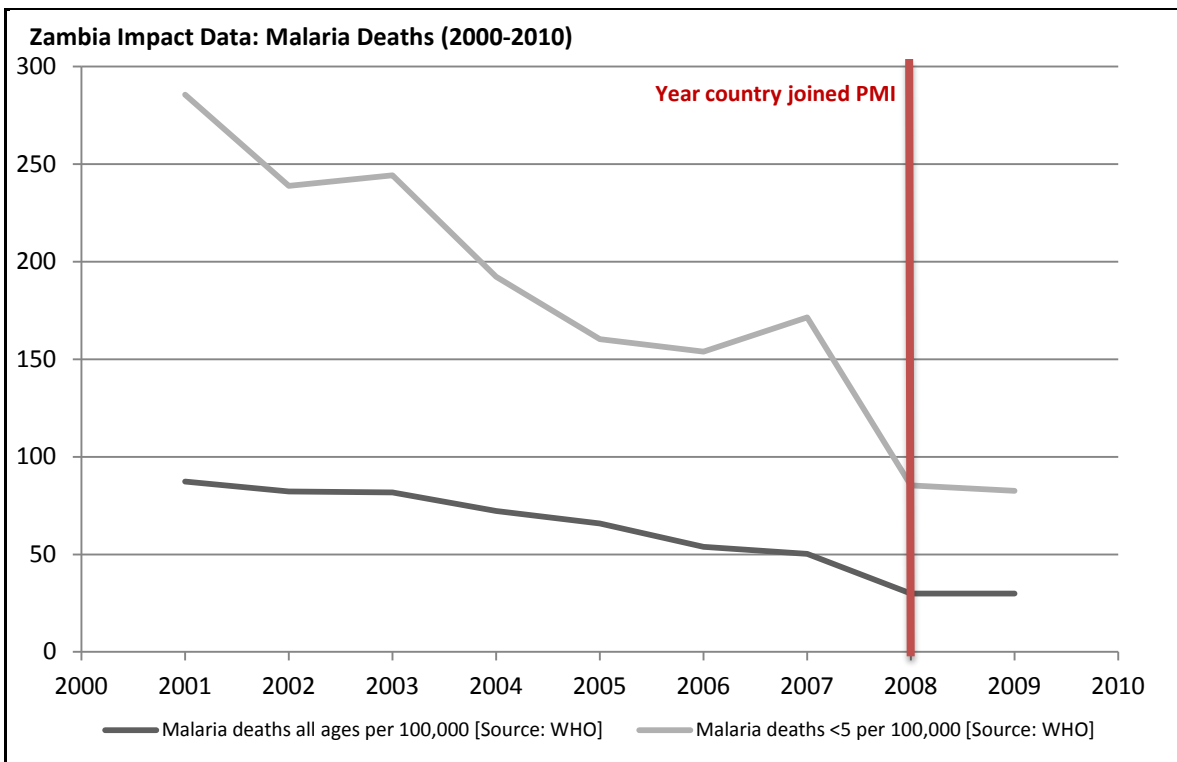
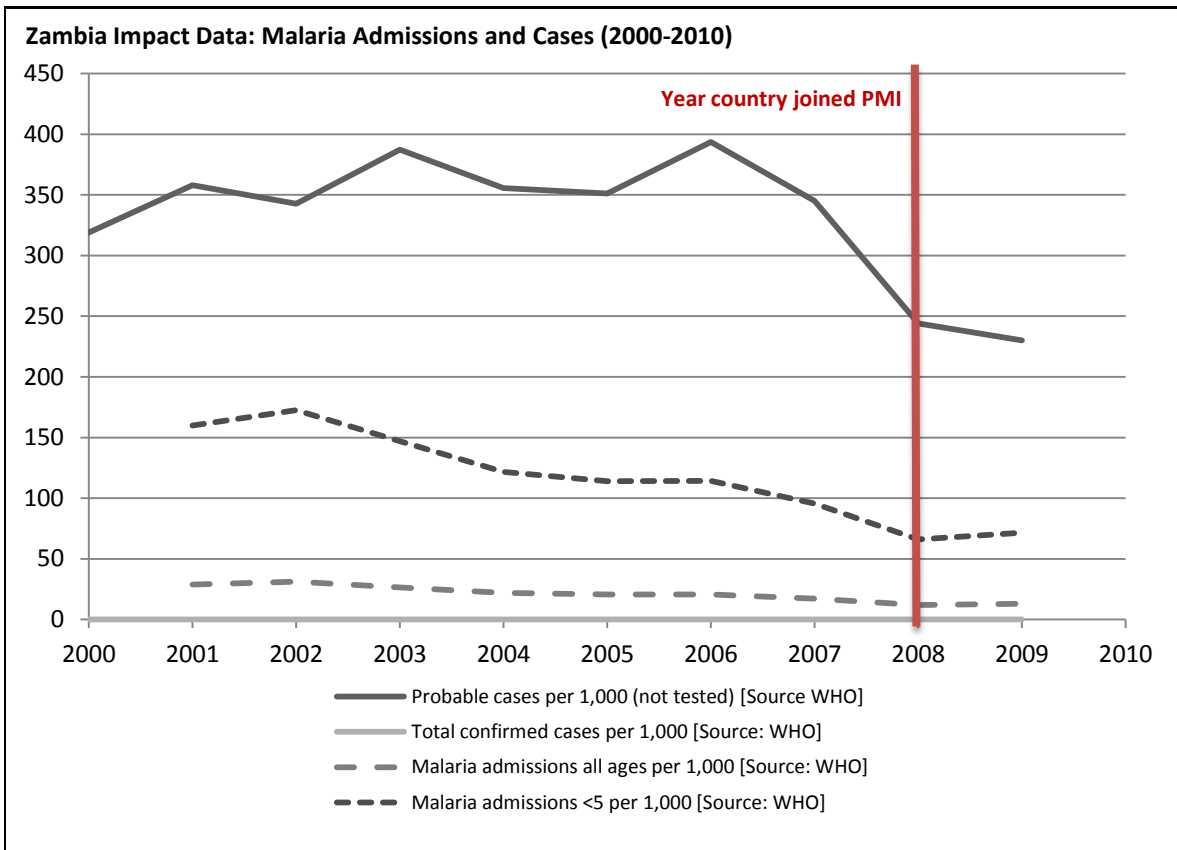
Contextual Factors

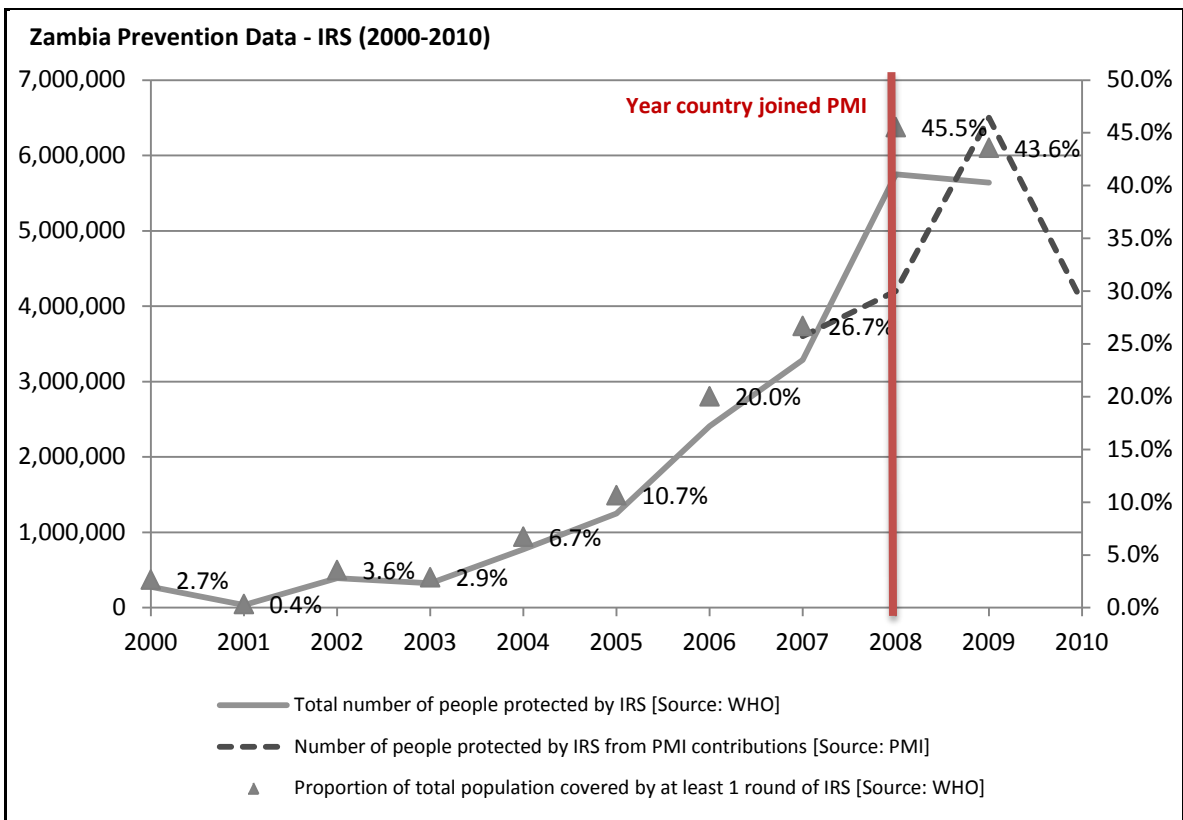
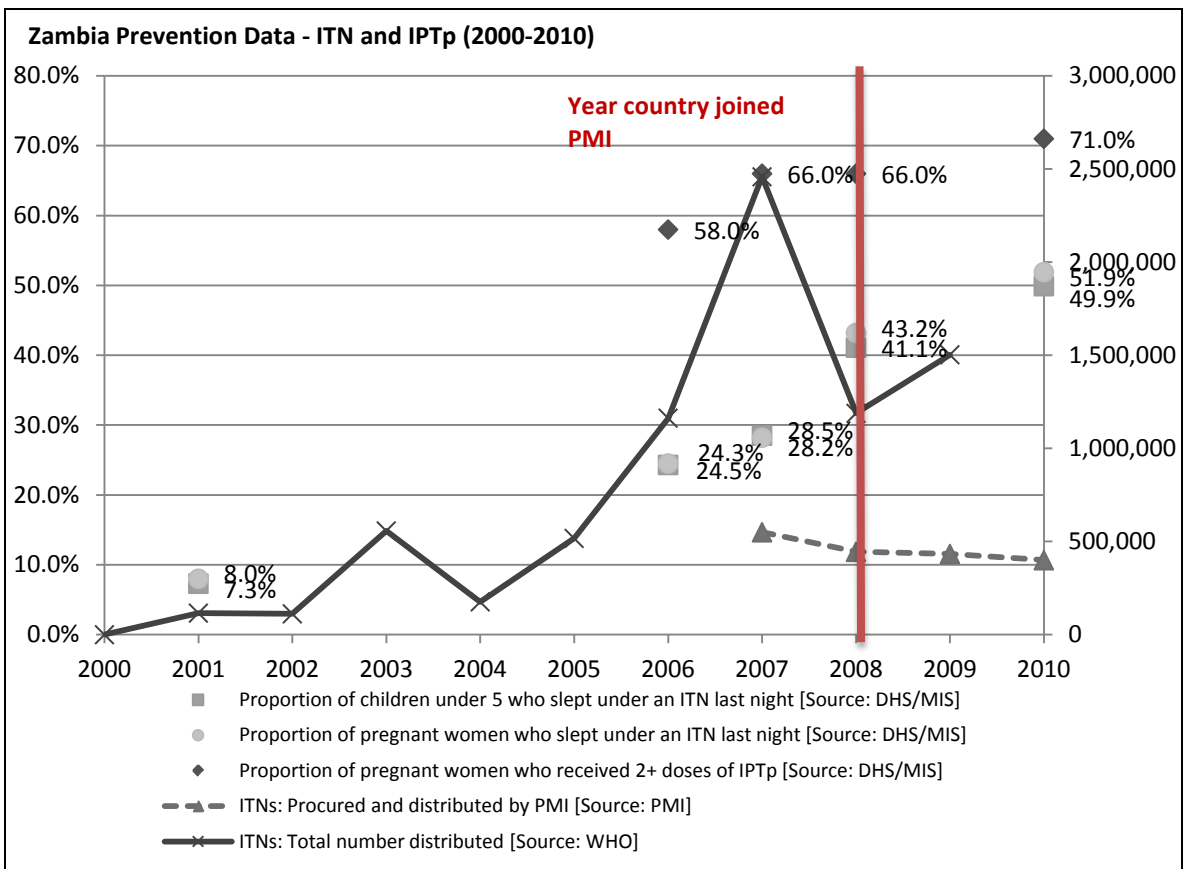
There are no signs of changes in precipitation. The increased school enrollment of girls in recent years will probably have an effect on ACCM in coming years.

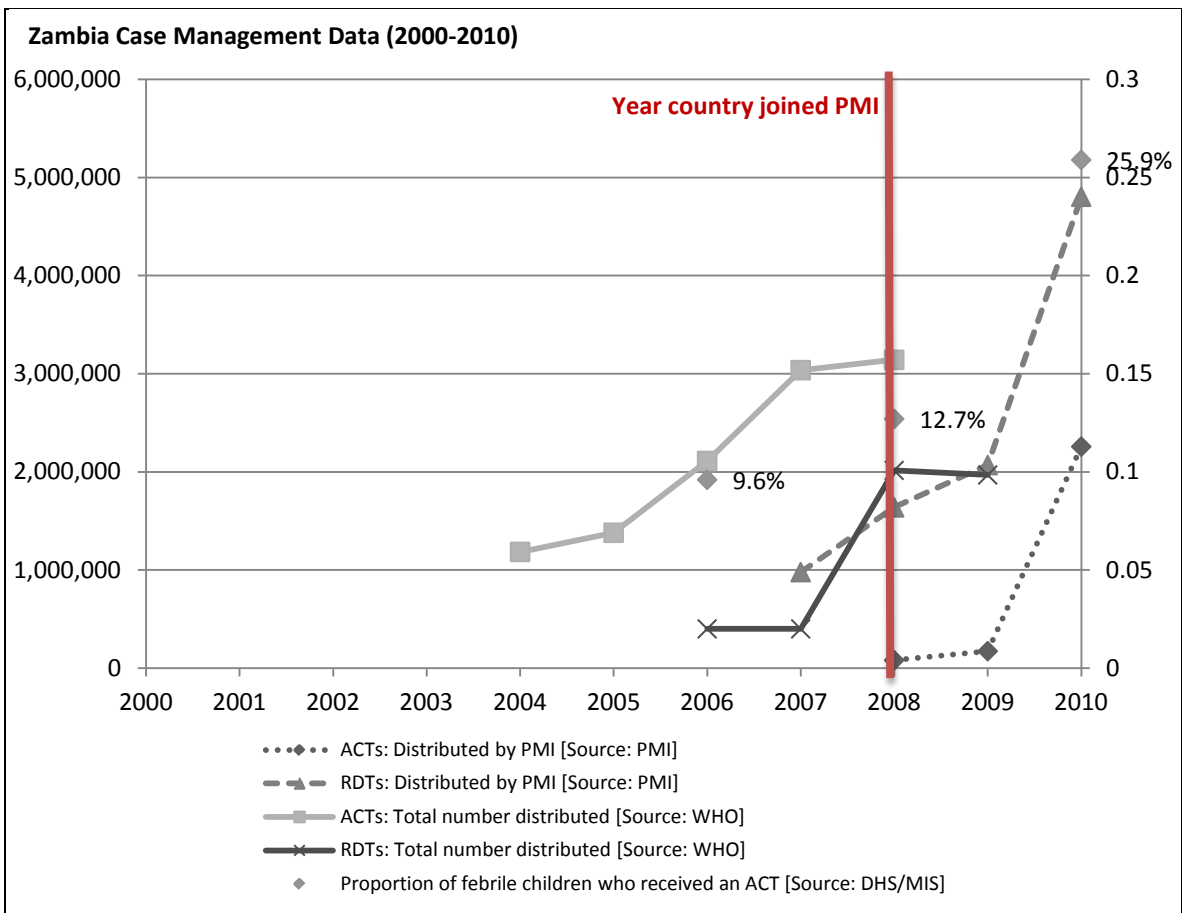
Conclusion

Based on the available data there is no doubt that malaria control has led to a substantial reduction in malaria burden over the last decade.









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