

# President's Malaria Initiative Strategic Guidance for Operational Research February 2014



PRESIDENT'S MALARIA INITIATIVE



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## **List of Abbreviations**

ACT – artemisinin combination therapy  
AOR/COR – agreement officer representative/contracting officer representative  
BMGF – Bill and Melinda Gates Foundation  
CDC – Centers for Disease Control and Prevention  
DFID – Department for International Development  
DOD – Department of Defense  
DRC – Democratic Republic of Congo  
EDCTP – European and Developing Countries Clinical Trials Partnership  
FY – fiscal year  
IAA – interagency agreement  
IPTp – intermittent preventive treatment during pregnancy  
IRS – indoor residual spraying  
LLIN – long lasting insecticide-treated net  
MOP – malaria operational plan  
NIH – National Institutes of Health  
NMCP – National Malaria Control Program  
OR – operational research  
PMI – President’s Malaria Initiative  
USAID – United States Agency for International Development  
USG – United States Government

**President's Malaria Initiative**  
**Strategic Guidance for Operational Research**

**Introduction**

The President's Malaria Initiative (PMI) was launched in June 2005 to scale up malaria prevention and treatment interventions and to reduce malaria morbidity and mortality in 15 sub-Saharan African countries. The original 2005 PMI Strategic Plan listed "targeted studies and evaluations to improve program effectiveness" as one of the approaches PMI would use to achieve its goal of a 50% reduction in malaria-related deaths. In 2008, the Lantos-Hyde United States Leadership against HIV/AIDS, Tuberculosis, and Malaria Act authorized continued funding for PMI until 2014, leading to an expansion of PMI to 19 countries in Africa and a sub-regional program in the Greater Mekong Sub-Region. The Lantos-Hyde Act also included more specific language about operational research (OR), stating that "CDC should advise the Malaria Coordinator on priorities for operation(al) and implementation research and should be a key implementer of this research."<sup>1</sup> A guiding principle of the U.S. Government Malaria Strategy, developed in response to the Lantos-Hyde Act, is to "conduct OR 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 in different malaria transmission settings."<sup>2</sup> The PMI External Evaluation Report pointed out that the language of the Lantos-Hyde Act forms a suitable basis for clarifying the technical boundaries of PMI's research agenda, and stated that PMI research should focus on program needs and "the delivery of efficient, effective and sustainable malaria control program services."<sup>3</sup>

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<sup>1</sup> Lantos-Hyde Global Leadership against HIV/AIDS, Tuberculosis, and Malaria Act, 2008

<sup>2</sup> United States Government Malaria Strategy, 2009-2014

<sup>3</sup> External Evaluation of the President's Malaria Initiative Final Report, December 2011

PMI-supported malaria control efforts currently rely on four proven and effective prevention and treatment measures: long lasting insecticide-treated nets (LLINs), indoor residual spraying (IRS), intermittent preventive treatment of malaria during pregnancy (IPTp), and prompt diagnosis and effective treatment of malaria with an artemisinin-based combination therapy (ACT). The wide-scale implementation of these control measures in African countries over the past 5-10 years has been correlated with substantial reductions in malaria morbidity and all-cause child mortality in many countries. Since 2006, PMI has supported numerous OR studies addressing a range of programmatically-relevant topics. A list of PMI-supported OR from FY06 through FY12 can be found in Annex 1.

Questions remain, however, about how to improve scale-up of the four interventions, how to implement combinations of these interventions in sequence or in parallel, and how the interventions should be tailored to different epidemiological settings. Additional important questions include how to implement interventions in the most cost-effective manner, how to preserve the effectiveness of proven interventions that are threatened by resistance or other risks, and how best to incorporate promising new interventions and innovations that have the potential to further reduce malaria morbidity and mortality, including in areas where some of the four proven interventions currently available are either not sufficiently effective or where implementation is not feasible.

### **Purpose of the Strategic Guidance for OR**

Operational Research plays an important role in improving upon the successful implementation of PMI malaria control strategies and in achieving the PMI goal. As PMI's involvement in OR expanded during its early years, it became clear that formal strategic guidance for the OR portfolio was needed. This guidance for OR has been developed to facilitate the identification

and prioritization of OR activities required to achieve PMI's objectives, to sustain PMI-supported activities and to aid decision-making related to research studies that should be prioritized for PMI funding. The guidance will be revised as necessary to reflect updates to the USG Malaria Control Strategy.

PMI will initiate and engage in an ongoing dialogue with both USG and non-USG research partners (e.g. NIH, BMGF, DFID, and others) to share the PMI perspective on priority research areas that require funding, and will encourage those partners to fund and/or conduct research in areas where they have a comparative advantage. This dialogue will ensure that PMI research funds are targeted appropriately, taking into account the investments of other research organizations and development agencies.

**PMI Goal:**

Work with partners to halve the burden of malaria (morbidity and mortality) in 70% of the at-risk populations of sub-Saharan Africa, thereby removing malaria as a major public health problem and promoting development throughout the African region.

**PMI Objectives, 2009-2014:<sup>4</sup>**

- ***In sub-Saharan Africa***, with full funding over the next five years, the USG will work with National Malaria Control Programs (NMCPs) and partners to accomplish the following:
  - By 2015, achieve a 70 percent reduction in malaria burden (morbidity and mortality) in the original 15 PMI focus countries, when compared with the PMI baseline established in 2006-2007; and

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<sup>4</sup> United States Government Malaria Strategy, 2009-2014

- Expand malaria control efforts to reach large areas of the Democratic Republic of the Congo (DRC) and Nigeria and up to seven additional high burden countries, achieving a 50 percent reduction in malaria burden (morbidity and mortality) in at-risk populations when compared with a 2009–2010 baseline. Nigeria and DRC are the two highest burden countries in Africa and account for half of all malaria cases on the continent. The selection of the seven additional countries will be based on population, malaria burden, health infrastructure, and availability of other donor funding.

***In Southeast Asia***, where antimalarial multidrug-resistance is one of the greatest threats to global malaria control, the USG will work with NMCPs and partners to strengthen efforts to contain the spread of multidrug resistant *Plasmodium falciparum* malaria. This will be accomplished by:

- Supporting well-functioning antimalarial drug resistance surveillance networks in each country in the region;
- Establishing national systems to monitor the quality of antimalarial drugs as a means of preventing the introduction and dissemination of sub-standard or counterfeit drugs, which contribute to increased drug resistance; and
- Contributing to a further reduction in the level of transmission of *P. falciparum* malaria and the number of reported cases in the Greater Mekong Region, with a goal of elimination of malaria in these areas by 2020.

### **PMI OR Objectives:**

To achieve its goal, PMI will support program- and policy-relevant OR that will:

- Improve existing interventions and their scale-up, including assessing combined interventions (e.g. LLINs and IRS);

- Evaluate ways to mitigate insecticide and drug resistance;
- Identify and assess improved and cost-effective approaches to monitoring changes in malaria burden;
- Identify and assess approaches to improve the capacity of health systems to better deliver malaria interventions;
- Assess new interventions that offer the potential for use by PMI-supported programs in the near future;
- Assist in optimizing program efficiency by addressing bottlenecks in malaria prevention and control.

### **Definition of Operational Research**

Operational research is defined in the Lantos/Hyde Act as the “application of social science research methods, statistical analysis, and other appropriate scientific methods to judge, compare, and improve policies and program outcomes from the earliest stages of defining and designing programs through their development and implementation with the objective of the rapid dissemination of conclusions and concrete impact on programming.”<sup>5</sup>

The U.S. Government Malaria Strategy, developed in response to the Lantos-Hyde Act, focuses malaria research on answering operational questions of importance to the implementation of PMI’s malaria prevention and control activities. Many of these questions are related to the use and cost-effectiveness of malaria control measures independently and in combination and

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<sup>5</sup> Lantos-Hyde Global Leadership against HIV/AIDS, Tuberculosis, and Malaria Act, 2008

include efforts to establish the best mix and timing of interventions at different levels of malaria transmission.

As new or improved malaria interventions are developed and efficacy is demonstrated, OR will be required to see how best to incorporate those new interventions into malaria activities, including understanding how well and under what conditions these tools work, the best and most cost-effective combination of tools, and whether certain interventions can be tailored to specific epidemiological settings. Currently, malaria control program managers and their donor partners aim for high-level coverage of all interventions, but as that is attained, OR can help guide decisions about how to optimize interventions for highest impact.

In PMI, OR is distinguished from monitoring and evaluation. Evaluations can be considered OR depending on the purpose. Parameters for determining whether an evaluation is research or non-research are included in Annex 2. Those evaluations that are considered OR, or those for which investigators are unclear whether or not they are OR, are subject to review by the OR Working Group.

### **Use of PMI Intervention Areas and Opportunities for Other Investigators**

PMI-supported activities and programs may provide a useful platform for other non-PMI funded OR activities related to implementation of malaria prevention and control. In particular, PMI-supported programs offer an excellent opportunity for comparative studies across two or more countries. Provided the proposed OR activities fit within the country's NMCP strategy and plans and the PMI Malaria Operational Plan (MOP) for that country, PMI is open to working with researchers from other institutions, either national or international. Additionally, PMI tries to accommodate requests from other investigators with non-PMI funding to conduct studies related

to PMI-supported interventions and activities. Such requests will be reviewed by the OR Working Group and PMI leadership. National malaria control programs ultimately have the final decision as to accommodating the needs of such research proposals.

## **Funding Channels for PMI Operational Research**

Funding for PMI OR activities may come from several places within the PMI budget:

1. PMI country/Malaria Operational Plan (MOP) budgets: These studies are generally conceived and designed by the PMI Country Team in consultation with NMCPs and local partners and are frequently implemented by local research groups. They tend to be shorter-term studies (duration of 12-15 months) and typically have had budgets below \$150,000, although they are not restricted to this time frame or funding limit. The amount of country funding proposed for country-specific OR activities varies by country and by year.
2. PMI core funds allocated for OR: These studies generally address broader issues applicable across the Initiative and tend to be larger with higher budgets than country-generated OR activities. They may involve two or more PMI countries and/or require several years to complete. Studies supported with PMI core funds have up to this point been conceived by PMI headquarters staff at CDC and USAID. The activities that are allocated core funding are determined by PMI research priorities and the available core funding. The amount of core funding available for priority OR activities varies from year to year depending on the overall PMI budget and the incremental funding needs for larger studies that were funded in previous years.
3. PMI core funds within a PMI implementing partner's budget: Some centrally funded USAID/PMI projects (e.g. Health Systems 20/20; Networks) have scopes of work that

include OR. Within the context of developing their annual work plans, these partners and/or PMI headquarters staff may propose OR studies as part of the proposed work plan. The OR component of an implementing partner's final work plan will be approved by the designated Agreement Officer's Representative or Contracting Officer's Representative (AOR/COR), following input and approval from the OR Working Group. Such activities will be programmed and monitored in consultation with PMI headquarters' staff.

Whether PMI-supported OR is core- or country- (MOP) funded, experience has shown that the use of multiple funding channels provides increased flexibility, allowing funds to be more rapidly allocated to specific research studies. These channels include, but are not limited to, USAID country bilateral and central implementing partner mechanisms, USAID direct funding of local research institutions, funding through the CDC IAA with direct implementation by CDC staff and/or implementation together with local partners, or a combination of the above. For this reason, it is expected that PMI will continue to make use of multiple funding channels in the future. Co-funding of activities with other institutions and organizations also occurs, such as the multi-center study on SP efficacy in pregnancy that was co-funded with CDC, European and Developing Countries Clinical Trials Partnership (EDCTP) and others. This type of cooperative effort is encouraged during the review process, especially for studies whose results are applicable to a new global policy recommendation or one that is under revision where a larger body of evidence will be desired.

### **Sustainability and Strengthening National Research Capacity**

An important component of PMI's OR portfolio is collaboration with in-country institutions and research partners to strengthen the host country's capabilities to design and conduct

operational research. Many PMI OR studies rely on long-standing relationships with national institutions, such as the Kenya Medical Research Institute, Cheikh Anta Diop University in Senegal, the National Institute for Medical Research in Tanzania, and the Center for Entomologic Research of Cotonou in Benin. PMI will continue to work with local partners utilizing local researchers and building capacity of new researchers through such programs as the Field Epidemiology Training Program. PMI supports the alignment of research studies with the priorities of national malaria control programs and remains committed to developing and strengthening local capacity to conduct high-quality operational research.

### **PMI OR Priorities**

PMI staff have developed a priority listing of OR activities for sub-Saharan Africa organized by programmatic areas (Annex 3). Consistent with recommendations from the external evaluation of PMI, this listing was reviewed by external partners, including donors, USG agencies, and malaria researchers. Operational research activities for the Mekong Sub-Region will be discussed and proposed at the annual meeting to develop the regional MOP. Because PMI core and country-level OR funding is limited, it is important to set priorities for funding and to avoid unnecessary duplication with studies supported by other malaria research initiatives. For that reason, the list of PMI OR priorities will be reviewed annually for re-prioritization as new research findings and issues in malaria control emerge and to ensure that it remains flexible and responsive to changes in malaria epidemiology and health systems. Although PMI funding is authorized until FY 2014, it is expected that USG support for global malaria control will continue beyond that point. Thus, multi-year studies that extend beyond calendar year 2015 will be considered for PMI OR funding.

While basic research questions and exploratory research studies should continue to be part of the larger USG malaria research portfolio, PMI will not provide financial support for these types of studies, which are primarily funded by other agencies such as the NIH and DOD. Rather, PMI will advocate for investments by other agencies and donors supporting basic and applied malaria research to consider funding activities that complement PMI's programmatic and OR activities.

Individual countries may have different priorities than those found on the priority OR listing. Country-specific OR activities are eligible for MOP funding, even if they are not included on the that list, assuming they are consistent with the Guidelines for Selection of OR Activities for PMI Funding.

### **Guidelines for Selection of OR Activities for PMI Funding**

The following guiding principles were developed to assist the OR Working Group when considering which OR activities should be prioritized for funding. These guidelines apply to all PMI-funded OR activities.

In general, OR research funded with PMI country-specific MOP funding responds to country-specific priorities and needs while core-funded OR typically addresses broader issues that are relevant across PMI's programs. Core-funded OR may be conducted across multiple countries and may address fundamental questions to achieve optimal impact from proven interventions.

1. The OR study should be aligned with one of the PMI OR objectives. In addition, in the case of MOP-funded OR activities, the OR activity must focus on a country-specific priority.
2. Priority should be given to studies that improve the implementation of existing PMI-supported interventions and are likely to produce information that will have the greatest impact in reducing malaria burden and, in some areas, eliminating transmission.
3. When considering whether to prioritize a study for funding, the OR Committee should take into account the number of studies that PMI is already funding on the same subject, whether another donor is funding similar research, and the number of ongoing PMI-supported OR activities in a given country and the capability of the PMI team to oversee those studies given their other responsibilities.
4. In the case of core-funded OR, priority should be given to OR proposals that take advantage of PMI's capacity to conduct research across multiple PMI countries. Lower priority for core-funding will be given to OR proposals that can be conducted through smaller country-specific studies.

It is recognized that some high priority OR activities may take several years to complete.

Therefore, PMI does not impose restrictions on study length nor likely time from study start to intervention implementation for PMI OR studies. However, when considering which of several high priority studies to fund, the time from study start to likely time of intervention implementation will be considered, recognizing that research itself can accelerate the timeframe to policy adoption and intervention implementation.

All PMI-supported OR studies, regardless of the implementing partner or funding channel, will be reviewed and monitored by an interagency OR Working Group to ensure efforts are

coordinated and support PMI's goal. It is expected that CDC will be a key implementer of PMI-supported OR, as specified in the Lantos-Hyde Act, when CDC has a comparative advantage over other institutions and organizations for conducting that research.

## ANNEX 1 – PMI Operational Research Studies 2006-2012 (FY)

### Long-lasting Insecticide-treated Nets

Outdoor Sleeping Rapid Assessment	Ghana
Insecticide-treated net effectiveness in a setting of significant pyrethroid resistance: an observational cohort study of malaria incidence in children in Malawi	Malawi
Cluster randomized trial of the impact of dual-insecticide treated nets vs. traditional LLINs on malaria vectors and malaria epidemiology in 2 districts of Mali	Mali
Durability and Insecticide Persistence in Long-Lasting Insecticide-treated Nets in Zambia	Zambia
Net Care and Repair Behaviors: Formative Research in Uganda	Uganda & Nigeria
Continuous Distribution Pilot Assessments	Nigeria
Linking holes to parasitemia: an exploratory, matched, health facility-based case-control study in Kinshasa	DRC
Effectiveness of post-campaign door-to-door hang-up and communication interventions to increase LLIN utilization	Uganda
Durability and insecticide persistence in LLINs	Zambia
(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 <i>Anopheles gambiae</i> s.s. has high levels of pyrethroid resistance. (2) A phase II evaluation of ITNs + IRS (non-pyrethroid) to manage <i>An. gambiae</i> s.s. pyrethroid resistance and to promote continued efficacy of ITNs in Benin	Benin
Evaluation of technology for determining when to replace insecticide-treated (mosquito) bed nets (ITNs)	Benin
Phase III field evaluation of long-lasting insecticide treated nets	Kenya, Malawi, Senegal
Focused evaluation of National Net Voucher Program	Tanzania

### Indoor Residual Spraying

Prevalence of <i>Plasmodium falciparum</i> parasitemia and anemia in children under-five years of age at baseline and following annual vs. biannual indoor residual spraying (IRS) in Bunkpurugu-Yunyoo district, northern Ghana	Ghana
The combined use of indoor residual spraying (IRS) and long-lasting insecticidal nets (LLINs) for malaria reduction in endemic rural Tanzania	Tanzania
Evaluation of the Efficacy of Barrier Spraying to Protect Ethiopian Populations from Malaria Epidemics	Ethiopia

Longevity of insecticides used for IRS	Kenya
Evaluation of integrated vector control in high and low transmission areas of western Kenya	Kenya
Development of a Pilot Dry Season Vector Control Strategy in Mali	Mali
Longevity of insecticides used for IRS	Senegal
IRS and LLIN: Integration of methods and insecticide mode of actions for control of African malaria vector mosquitoes	Tanzania
Evaluation of DDT's repellent vs killing effect	Tanzania
Integrated vector management: Interaction of larval control and Indoor Residual Spraying on <i>Anopheles gambiae</i> density and vectorial capacity for human malaria	Mali

## Case Management

Assessing the safety and tolerability of low dose primaquine for transmission blocking in Cambodian patients with acute uncomplicated <i>Plasmodium falciparum</i> malaria	Mekong
Determining the prevalence of glucose-6-phosphate dehydrogenase deficiency in Ethiopia	Ethiopia
Field evaluation of the CareStart™ Glucose-6-Phosphate Dehydrogenase Deficiency Screening Test	Mekong
Evaluation of Severe Malaria Case Management in Malawi	Malawi
A pilot of interventions to improve patient adherence to a treatment regimen of artemether-lumefantrine in Malawi	Malawi
Assessment of diagnostic and treatment algorithm	Senegal
Adherence to artemether-lumefantrine (AL) for routine treatment of uncomplicated malaria in Ethiopia	Ethiopia
Zambia Integrated Management of Malaria and Pneumonia Study (ZIMMAPS)	Zambia
Evaluation of home-based management of malaria in 5 districts	Rwanda
Evaluation of treatment of severe malaria	Tanzania
Home-based management of fever	Uganda
Field Testing of Dried Malaria Positive Blood as Quality Control Samples for malaria RDTs.	Liberia, Ethiopia and Benin
A project to develop and evaluate an adaptation of routine disease reporting to include malaria diagnoses by RDT result in Tanzania	Tanzania

## Malaria in Pregnancy

Knowledge and Adherence to Malaria Treatment Guidelines for Pregnant Patients in Rural Western Kenya	Kenya
Intermittent Screening and Treatment (IST) or Intermittent Preventive Treatment (IPT) with Dihydroartemisinin-Piperaquine, versus IPT with Sulphadoxine-Pyrimethamine for the control of malaria in pregnancy in Kenya: Assessment of Acceptability, Feasibility and Cost-effectiveness within a randomized controlled trial	Kenya
A Study to determine the current prevalence of malaria detectable among pregnant women registering for ANC in 6 districts in Rwanda: Evidence for developing and implementing a new malaria in pregnancy strategy in the context of reducing malaria prevalence.	Rwanda
Placental parasitemia among women who have not had intermittent preventive treatment (IPTp) for malaria in Zanzibar	Tanzania
A comparative assessment of sulfadoxine-pyrimethamine for treatment of uncomplicated malaria illness in small children and prevention of malaria in pregnancy	Zambia
SP efficacy study	Malawi

## Monitoring & Evaluation

Pregnant women and infants as sentinel groups for monitoring impact of interventions to reduce malaria transmission in the general population	Tanzania
Validation and comparison of physician panel and candidate algorithm coding methods for verbal autopsy data using international ICD procedures	Tanzania
A Mixed-Methods Evaluation of the EPI Contact Method as both Monitoring Tool and Intervention for Malaria Control and Prevention in Mali	Mali
Validation of verbal autopsies	Uganda

## Economics of Malaria

HS 20/20 - Scale up of malaria control interventions and the effect on the health system	Zambia
HS 20/20 - The financial implications of removing user fees for Malaria treatment for under five (U5) children in Mali	Mali

## Other focus areas

Evaluation of intermittent mass screening and treatment to reduce malaria transmission in western Kenya	Kenya
Evaluation of durable insecticide treated wall liners as a replacement for indoor residual spraying	Tanzania

PECADOM Plus: An Active Version of the PECADOM Model in the Context of SMC	Senegal
Evaluation of Seasonal Malaria Chemoprevention (SMC) pilot in Kita District, Mali	Mali
School based surveillance of malaria – Investigation of approaches for outbreak detection and response	Ethiopia
Epidemiologic survey of malaria in Luanda	Angola
Anemia/parasitemia survey in 6 districts	Malawi
Health facility assessment	Malawi

## **ANNEX 2 – Definition of Monitoring and Evaluation to determine a study’s research or non-research designation**

In PMI, OR is distinguished from monitoring and evaluation. Monitoring is defined as a continuous process used to track, understand, and correct activities and programs as they are implemented. Evaluation is defined as a periodic activity to assess whether specific activities or interventions, or an entire operational program have reached their intended goals and have resulted in the desired outcome and/or impact.

Evaluations can be non-research or research, depending on the intent of the activity. An evaluation is considered non-research when the purpose is to assess the success and challenges of an established program. An evaluation is considered research when the purpose is to test a new, modified, or previously untested intervention, service, or program, or when the purpose of the evaluation is to develop generalizable information that is applicable beyond the specific program being evaluated. Those evaluations that are considered OR, or those for which investigators are unclear whether or not they are OR, are subject to review by the OR Working Group.

### ANNEX 3 – PMI Priority List of OR Activities

Programmatic Area	Categories	No.	Priority OR Activities
Prevention	ITNs/IRS/Innovative Vector Control	1	Use field trials, modeling and economic assessment to investigate combinations of “continuous” distribution approaches with the goal of identifying optimal combination of strategies for maintaining equitable LLIN coverage; possible channels for delivery should include ANC and EPI clinics, commercial sector, social marketing, schools, health days, community-based workers and others
		2	Measure how best to achieve and maintain LLIN ownership and use, particularly in groups with poor access to LLINs and in those areas or among groups (e.g. school-age children) with widespread underutilization. Given recent analysis of data from numerous national population-based surveys, the primary focus in most areas should be on addressing inadequate access/ownership
		3	Continue and expand field studies on physical integrity and durability of LLINs and refine the definition of a failed net; identify laboratory tests that are strongly predictive of field durability
		4	Determine whether strategies to promote “care and repair” of ITNs can improve the physical integrity and extend the life of nets
		5	Evaluate combination nets (i.e. insecticide-synergist nets or dual insecticide nets)
		6	Measure the effectiveness and cost-effectiveness of targeting hot spots for IRS (geographically and based on population) with or without optimizing ITN coverage
		7	Evaluate whether ITNs or other interventions can effectively provide an “exit strategy” for IRS in areas that are to stop routine IRS (high and low transmission settings)
		8	Evaluate whether there is/is not added benefit (effectiveness) to using non-pyrethroid IRS and pyrethroid ITNs in the same area concurrently
		9	Evaluate strategies to reduce transmission from outdoor/early or late biting vectors. Outdoor biting could, but does not have to, include biting those sleeping outdoors. Specifically, test in combination or separately: a.) attractive targeted sugar baits b.) spatial repellants c.) treated clothing d) treated hammocks: e) other new, emerging strategies as appropriate
		10	Evaluate non-pyrethroid insecticide-treated durable wall liners
		11	Develop approaches to better measure human exposure to outdoor transmission and test control measure to reduce exposure
		Insecticide Resistance	12

Prevention, <i>con't</i>	Insecticide Resistance, <i>con't</i>	13	Conduct laboratory, experimental hut and field evaluations of potential new insecticides or formats for malaria vector control (including new insecticides, insecticide combinations, incorporation of inhibitors)
		14	Determine the degree of insecticide resistance that results in a loss of effectiveness of ITNs or IRS, using entomological outcomes such as mosquito density and/or sporozoite rate
		15	Determine how best to monitor the effectiveness of insecticides
		16	Determine what is driving resistance, such as LLINs, IRS, or agriculture
		17	Develop and test methods to determine when a previously used insecticide to which the local vector is resistant can be re-implemented
	Transmission Reduction	18	Evaluate new interventions or strategies for reducing malaria in areas with persistently high malaria burden despite efforts to scale up proven interventions, such as focused or mass screening and treatment
		19	Evaluate different approaches for identifying and targeting “hot spots” for vector control and active case detection/treatment in areas with moderate, seasonal or low transmission. Determine whether these hotspots are generated by differences in human-mosquito contact, or treatment or prevention activities
		20	Measure the impact of case management with ACTs on transmission reduction
	Chemoprevention of Malaria in Children and Malaria Vaccine	21	Evaluate the effectiveness of seasonal malaria chemoprevention where recommended by WHO
		22	Evaluate impact of IPTi in areas with sufficient SP efficacy
		23	Evaluate impact of IPTsc on burden of malaria, anemia, and other outcomes measures in school age children
		24	Evaluate IPT provided post discharge (IPTpd) for children hospitalized with severe malarial anemia in areas of moderate to high malaria transmission
	Case Management	25	Evaluate and improve clinician adherence to diagnostic testing; specifically, identify factors associated with clinicians' non-adherence with diagnostic testing and test methods to increase clinicians adherence in public and private sectors
26		Evaluate and improve referral for severe disease: a.) Assess the ability of clinicians/health workers at outpatient departments, peripheral health facilities, and in the community to identify severe febrile illness, provide appropriate pre-referral management, and facilitate referral; implement strategies to improve as needed b.) Determine outcomes of children with severe febrile illness who do not complete referral, and identify risk factors for better/poorer outcomes	
27		Evaluate and improve provider practices in the private retail sector: a.) Identify current practices for diagnosis and treatment of malaria by private sector providers. Determine facilitating factors and bottlenecks to scaling up diagnostic testing and effective treatment b.) Test methods to scale-up quality-assured diagnostic testing and appropriate, high-quality treatment in the retail private and public sector c.) Identify and test innovative methods and a minimum support package for monitoring the quality and accuracy of malaria diagnosis and treatment in the retail private sector	

Case Management, <i>con't</i>		28	Identify and test methods to improve patient adherence to updated malaria case management procedures (including adherence to diagnostic testing and to recommended treatments)
		29	Identify reasons for and test means to improve delayed or non-care seeking by caretakers of children with fever within 24 hours in countries where DHS/MIS or other data indicate that prompt care seeking is low
		30	Determine the impact of the introduction of iCCM on early care seeking by caretakers of children with fever.
		31	Assess adherence to iCCM algorithm and determine factors that improve adherence
		32	Determine the relative frequency of causes of fevers in patients without malaria (i.e. in patients with a negative RDT result)
		33	Assess the safety and feasibility of the introduction of a 48 hour follow-up visit to the current iCCM algorithm for patients with simple fever and no diagnosis (i.e., a negative RDT, no diagnosis of pneumonia or diarrhea, and no danger signs)
Malaria in Pregnancy*		34	Assess the operational and behavioral barriers to improving uptake of malaria in pregnancy interventions, including early pregnancy care-seeking and IPTp2/IPTp3+
		35	Determine whether there is a transmission threshold below which IPTp provides no benefit
Elimination and Epidemic Malaria	Elimination	36	In areas approaching elimination, determine the best and most cost-effective measures to reach and maintain elimination, such as evaluating surveillance as an intervention
		37	Test malaria mathematical models in highland or low transmission areas to help predict when $R_0$ falls below 1 and vector control can be lifted
	Epidemic Malaria	38	Conduct a pilot evaluation of focused screen and treat and mass screen and treat interventions in response to early epidemic reporting signals in low transmission settings
		39	Determine appropriate/cost effective methods to identify epidemics
Health Systems		40	Evaluate use of continuous surveys to provide information for health system quality improvement (e.g. remedy drug stock outs, improve health worker performance, and measure other indicators related to program impact and effectiveness)
		41	Investigate how best to increase health worker retention, such as through pay for performance schemes
		42	Evaluate cost-effective and sustainable approaches for improving supply chain for drugs, diagnostics, and supplies, such as an SMS for Health program
		43	Conduct economic and cost-effectiveness studies on integrating delivery of malaria control interventions with mass drug administration for neglected tropical diseases
Behavior Change and Communication		44	Evaluate the effectiveness of existing and new behavior change communication strategies
		45	Evaluate the cost-effectiveness of existing and new behavior change communication on changing people's behaviors (e.g. consistent use of ITN use, early care seeking for fever, etc.)

Monitoring and Evaluation	Measurement	46	Compare and determine the most effective, sustainable, moderately costed method to monitor malaria burden and trends in different populations and settings and transmission levels (school-based surveys, cross-sectional surveys including serosurveys, sentinel surveillance sites, etc.)
		47	Develop innovative and sustainable strategies to monitor burden of disease in low transmission settings and changes in approaches as countries transition in transmission level, such as moving to health facility surveillance
		48	Compare different surveillance approaches (such as sentinel/center of excellence model, mobile surveillance team model, the integrated disease and response system (IDSR)) to determine effective and sustainable approaches to capture information, including at the community level: a.) for the DOMC to manage programs b.) to monitor progress towards PMI goals
		49	Determine the appropriate role of routine data, surveillance, and surveys in a comprehensive M&E system by: a.) Conducting a systematic comparison of data from health facilities with data from household surveys between and within countries in different transmission settings b.) Evaluating other surveillance approaches, such as school-based or ANC-based, and compare with quality-controlled facility based data collection and household surveys
		50	Determine how best to measure morbidity and mortality to know if we are meeting malaria control goals, such as using preceding birth technique as part of DHS, data from DSS sites, etc.
		51	Evaluate new approaches to collect IPTp and ITN coverage and measures of effective case management through surveillance at ANC clinics
	Impact of Malaria Control	52	Conduct studies to show the economic impact of malaria control
53		Conduct observational studies of the impact of malaria prevention interventions on other vector-borne illnesses and neglected tropical diseases	
*Pregnant women are the primary adult target group for malaria control interventions, and therefore have been categorized separately. Strategies specific to MIP include IPTp, ITNs/IRS, and diagnosis and treatment.			