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# POLICY BRIEF

## Evaluation of the Performance of Malaria Control Strategies Implemented by Countries in the Amazon Subregion

**Interventions and strategies whose efficacy has been proven at the clinical level or that have a demonstrable effect on vector habits have less successful outcomes if they are not adequately implemented.**

### Introduction

From 2000 to 2008, the total number of cases of malaria decreased by 48 percent in the Amazonian subregion. Nevertheless, this subregion continues to account for some 90 percent of the total number of malaria cases in the Americas, including most cases caused by *Plasmodium falciparum*.

To strengthen malaria control programs in countries of the Amazon, a rapid assessment was conducted to determine the performance of four control strategies being implemented by these countries: (a) residual spraying of homes, (b) insecticide-treated mosquito nets, (c) timely diagnosis, and (d) artemisinin-based combination therapy (ACT). The five countries studied were Bolivia, Colombia, Ecuador, Guyana, and Peru.

Following the scheme proposed by Habicht and others (1999),<sup>1</sup> the evaluation was carried out using the “adequacy” approach, which involved determining whether control strategies are being implemented in a technically correct manner, using the required resources, and attaining the required quality. This type of assessment is extremely important, because interventions and strategies whose efficacy has been proven at the clinical level or that have a demonstrable effect on vector habits (e.g., ACT, insecticide-treated mosquito nets, and so on) have less successful outcomes if they are not adequately implemented.

### Methods

For each of the four strategies, a list of criteria was prepared based on three subject areas: (a) prior research supporting the design and adaptation of the control strategies, (b) control strategy coverage, and (c) quality of strategy implementation. These criteria were selected by the assessment team based on technical guidelines developed by the World Health Organization (WHO).

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<sup>1</sup> Habicht, J., C. Victora, and J. Vaughan. 1999. Evaluation designs for adequacy, plausibility and probability of public health programme performance and impact. *International Journal of Epidemiology* 28:10–18.

**The adequate implementation of control strategies is vitally important for sustaining current achievements, avoiding outbreaks, and eventually moving toward elimination of malaria in the region.**

Each of the four criteria listed was rated in relation to the evidence of compliance (value of 1), noncompliance (value of 0), or partial compliance (value of 0.5) with that particular criterion. The values obtained were totaled and reported on a three-level scale: adequate implementation, intermediate implementation, and deficient implementation.

For each strategy, a questionnaire was prepared and filled out based on interviews conducted with national authorities in each country as well as official information from each country on its control strategies and reports prepared by the Pan American Health Organization. Data gathering also included interviews with key officials in each country as well as with technical advisers having experience in the various countries of the Amazonian subregion.

## **Results**

### **Residual spraying**

All of the countries studied reported incomplete information about prior research, program coverage, and intervention quality. By analyzing national reports and conducting interviews with key officials in each country, it was possible to determine that countries have not systematically implemented the intervention as set forth in WHO technical criteria. On the adequacy scale, two countries obtained a rating of intermediate and two a rating of deficient. Guyana was not included in the assessment of this intervention, because the residual spraying strategy was not implemented in that country. Table 1 shows compliance with criteria for each of the countries studied.

The scores received on the adequacy scale are consistent with observations made by technical personnel and regional authorities. For example, one technical adviser who has worked in most of the countries of the region stated the following:

*“Vector control is not systematically carried out in any country, and it is actually done based on scarce evidence. In general, the households that have minimum building conditions for spraying to work properly also have access to facilities with diagnosis and treatment options; therefore, the population that most needs this intervention is actually left out.”*

A national official from one of the countries explained as follows the difficulties in implementing the spraying strategy:

*“Fumigation and spraying are not carried out in strict observance of guidelines or on the basis of target population groups. In many cases, implementation of these activities depends on whether municipalities have requested that authorities fumigate before their local fair; thus, spraying is contingent more on political decisions than on compliance with the program’s technical criteria.”*

**Table 1. Results of the Assessment of Adequacy Criteria in Implementing the Residual Spraying Strategy**

No.	Criterion	Ecuador	Peru	Bolivia	Colombia	Guyana
1	The at-risk population was stratified based on disease burden and epidemiology of transmission	0	0	0.5	1	N/A
2	Vector habits were studied and verified	0	0	0.5	1	N/A
3	Susceptibility to proposed insecticides was verified before selecting the insecticide(s) producing the best results	0	0	0.5	1	N/A
4	100 percent of target households (based on national standards) have been sprayed at least once a year	0.5	0	0.5	0.5	N/A
5	Stock-outs of the insecticide used for spraying have not exceeded six months in any of the cases	1	0	1	1	N/A
6	Up-to-date standards and programs exist for implementing residual spraying	1	0	1	1	N/A
7	A system is in place to monitor the resistance and sensitivity of insecticides used for household spraying	0	1	1	0.5	N/A
8	Systematic procedures exist for monitoring vector habits	0	1	1	1	N/A
9	Systematic procedures are in place to monitor residuality of the insecticide in households sprayed	0	1	0	0.5	N/A
	<b>Total</b>	<b>2.5</b>	<b>3.0</b>	<b>6.0</b>	<b>7.5</b>	

N/A = not applicable.

### Insecticide-treated mosquito nets

Use of this strategy by the five countries began fairly recently compared to residual spraying, and strategy characteristics are specific to each country. For example, whereas in Bolivia and Colombia studies of population stratification, vector habits, and insecticide susceptibility were carried out before introduction of insecticide-treated mosquito nets, in the other countries mosquito nets were introduced without the benefit of such studies. Although mosquito nets have been distributed in all countries, no country has successfully complied with the coverage criterion of 80 percent of its target population. On the adequacy scale, two countries received a score of intermediate adequacy and three a score of deficient adequacy.

One of the national officials interviewed explains the program's difficulties as follows:

*“Insecticide-treated mosquito nets were purchased, but they were delivered without following established technical criteria. Political authorities deliver them during their visits to the towns and villages without taking into consideration the fact that the area was not targeted for the delivery of bednets.”*

Table 2 shows the criteria scores for each of the countries.

**Table 2. Results of the Assessment of Adequacy Criteria in Implementing the Insecticide-Treated Mosquito Net Strategy**

No.	Criterion	Ecuador	Peru	Bolivia	Colombia	Guyana
1	The at-risk population was stratified based on disease burden and epidemiology of transmission	0	0	1	1	1
2	Vector habits were studied and verified	0	0	1	1	0
3	Susceptibility to proposed insecticides was verified before selecting the insecticide(s) producing the best results	1	0	1	1	0
4	Of the at-risk population, 80 percent has received insecticide-treated mosquito nets	0.5	0.5	0.5	0.5	0.5
5	Insecticide-treated mosquito nets have been distributed to 80 percent of pregnant women in the at-risk area	0.5	0.5	0.5	0.5	0.5

No.	Criterion	Ecuador	Peru	Bolivia	Colombia	Guyana
6	Insecticide-treated mosquito nets have been distributed to 80 percent of children under age five in at-risk areas	0.5	0.5	0.5	0.5	0.5
7	Of those interviewed, 80 percent responded that they slept under a mosquito net on the previous night	0	0.5	0.5	0	0.5
8	Stock-outs of the insecticide used for treating the mosquito nets have not exceeded three months over the last five years	0	0	N/A	1	0.5
9	Stock-outs of new mosquito nets for delivery to target population groups have not exceeded six months in any of the cases	0	0	0	1	0
10	Standards and programs are in place for carrying out retreatment at the household or community level	0	0	N/A	1	0
11	A systematic monitoring procedure is in place to ensure that families that have been given mosquito nets use them appropriately (including washing and retreatment)	0	0.5	1	1	1
12	A system exists for monitoring the resistance and sensitivity of the insecticides used in the mosquito nets	0	0	1	0	0.5
13	Systematic procedures exist for monitoring vector habits	0	0	1	1	0.5
14	Systematic procedures are in place for monitoring insecticide residuality in mosquito nets	0	0	0	0	0.5
	<b>Total</b>	<b>2.5</b>	<b>2.5</b>	<b>8.0<sup>a</sup></b>	<b>9.5</b>	<b>6.0</b>

a. The total in Bolivia was based on 12 criteria, because that country does not retreat mosquito nets (it uses long-lasting mosquito nets).

### Timely diagnosis

The timely diagnosis strategy includes diagnosis by microscopy and the use of rapid tests. Generally speaking, microscopy diagnosis has been the principal strategy used in all five countries, and it has been progressively strengthened over the years. Accordingly, all countries have in place national guidelines and systems for monitoring the quality of microscopic diagnosis.

The rapid test strategy is relatively new. Even though these tests have been introduced and distributed in all countries of the Amazon subregion (with the exception of Guyana), introduction and use have not been carried out systematically. Some countries do not yet have in place national standards to govern the procurement and use of rapid tests, and in countries where such standards do exist, systematic processes for monitoring compliance with transport, storage, and use standards have not been fully implemented.<sup>2</sup> On the adequacy scale, one country obtained a score of adequate while the rest recorded a score of deficient. In Guyana, a complete assessment could not be conducted because the country works with only two criteria. Table 3 shows compliance with each of the criteria in all five countries.

### Artemisinin-Based Combination Therapy

The ACT strategy is notable for its systematic implementation in all countries and for work carried out through a network to ensure the existence of prior research, coverage, and quality. The evidence gathered shows that systematic implementation is primarily the result of support provided by AMI-RAVREDA (the RAVEDRA Amazon Malaria Initiative) to all countries of the region. Countries have available publications, reports of resistance and sensitivity studies, national guidelines, and the like. Systematic implementation of ACT in the countries of the region was also confirmed by the officials interviewed in each of the countries.

With respect to adequacy criteria, all of the countries have complied with most of the criteria expected. Those criteria that have not yet been complied with—and that are common to all countries—involve ensuring the continuous supply of ACT and the implementation of systematic processes for monitoring the proper application of appropriate standards and protocols. As a result of following an implementation process that complies with most of the criteria, all of the countries received an adequate score for implementation of the strategy, based on the technical criteria developed by WHO. Table 4 shows the scores received by the countries for each criterion.

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<sup>2</sup> Harvey, S. 2009. *Malaria Rapid Tests in the Peruvian Amazon: A Promising Start and Uncertain Future. Case Study*. Bethesda, MD: Center for Human Services.

**Table 3. Results of the Assessment of Adequacy Criteria in Implementing the Timely Diagnosis Strategy**

No.	Criterion	Ecuador	Peru	Bolivia	Colombia	Guyana
1	At least 80 percent of all cases are diagnosed within the first 24 hours (time elapsed between drawing the thick smear or rapid test and delivery of results in endemic areas)	1	0.5	0.5	0.5	0.5
2	No stock-outs of rapid tests have occurred in any of the facilities affiliated with the public network in endemic areas	0	0	0	1	N/A
3	A system is in place for monitoring the quality of microscopic diagnosis in the public network	1	1	1	1	1
4	A system exists for monitoring the quality of rapid tests	0	0	0	1	N/A
5	National standards exist to govern the application, distribution, transport, and storage of rapid tests	1	0	0	1	N/A
6	A systematic process exists for monitoring compliance with standards governing distribution, transport, and storage	0	0	0	0.5	N/A
7	A program of training and supervision exists for personnel applying the rapid tests	0	0	0	1	N/A
<b>Total</b>		<b>3.0</b>	<b>1.5</b>	<b>1.5</b>	<b>6.0</b>	<b>1.5<sup>a</sup></b>

a. The evaluation conducted in Guyana was based on only two criteria; rapid tests are not used in that country. N/A = not applicable.

**Table 4. Results of the Assessment of Adequacy Criteria in Implementing the ACT Strategy**

No.	Criterion	Ecuador	Peru	Bolivia	Colombia	Guyana
1	In vivo or in vitro studies have been conducted on the resistance of <i>P. falciparum</i> to medicines in previous treatment schemes	1	1	1	1	1
2	In vivo or in vitro studies have been conducted on the sensitivity of <i>P. falciparum</i> to ACT	1	1	1	1	1
3	At least 80 percent of all cases of <i>P. falciparum</i> are treated with ACT	1	1	1	1	1
4	No stock-outs of ACT have occurred in the public network over the last three years	0	0	0	0.5	0
5	Up-to-date standards and protocols exist for using ACT in national malaria treatment schemes	1	1	1	1	1
6	A system is in place for monitoring therapeutic failures of ACT	1	1	1	1	1
7	According to the guidelines, ACT is administered only in the case of a positive result for <i>P. falciparum</i> (either via microscopy or rapid test)	1	1	1	0.5	1
8	A systematic procedure exists for monitoring the appropriate application of ACT guidelines and protocols	1	0.5	0.5	0	0
	Total	7.0	6.5	6.5	6.0	6.0

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According to the data collected, ACT supply problems are associated with the complexity of implementing processes for the procurement of new medicines while still complying with national procurement guidelines, and with the progressively smaller volume required of these medications. For example, a decreased number of providers has caused bid proceedings for the procurement of ACT to be declared void on several occasions in Peru. Procurement procedures involving ministry of health units not associated with the malaria program have also lengthened procurement processes in

other countries. The result of these situations is that stock-outs of ACT in the countries studied do not directly correspond to a failure to act by those responsible for malaria control in the countries but rather to the currently existing public procurement and contracting processes. One technical adviser who has worked in several of the countries of the region explains it as follows:

*“Currently, one of the greatest weaknesses is linked to the management of medicines and other supplies. Peru and Ecuador have experienced serious stock-outs. These problems arise from the application of purchase and procurement laws in these countries, which affect malaria programs. Therefore, to make improvements in this area, work must be carried out at another level, that is, at the country level as well as with central finance authorities and others”.*

In addition to the preceding, decentralization and other health reforms have created a new organizational architecture in these countries that adds actors and processes for planning, procurement, distribution, and management of supplies. Whereas the procurement of supplies was previously limited exclusively to control programs, it now involves other ministry of health units.

## Conclusion

Assessment of the level of adequacy in the implementation of the four malaria control strategies showed that household residual spraying and insecticide-treated mosquito nets are implemented at a level between intermediate and deficient. In addition, the assessment showed timely diagnosis to be at deficient levels in all countries except one, for which an intermediate score was recorded. Only the ACT strategy received an adequate rating in all countries, because all five have complied with almost all of the technical criteria for implementing that strategy. The criteria for which compliance still needs to be improved are those related to systems for ensuring the continuous supply of ACT and systems for supervising quality in ACT implementation, including adherence to treatment. To summarize, three of the malaria control strategies show significant implementation gaps in meeting technical criteria involving (a) prior research supporting the design and adaptation of control strategies, (b) program coverage, and (c) intervention quality.

## Implications for Decision Making

To ensure sustainable control over malaria, both the combined impact of the strategies involved<sup>3</sup> and the appropriate implementation of each are required. In addition, the current scenario in the various countries where regions of high and low levels of transmission exist requires that all available tools and

**The current scenario in the various countries where regions of high and low levels of transmission exist requires that all available tools and technologies be used and that strategies and activities to be adapted to this epidemiological context.**

<sup>3</sup> WHO. 2009. *World Malaria Report 2009*. Geneva: WHO.

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technologies be used and that strategies and activities to be adapted to this epidemiological context. The adequate implementation of control strategies is vitally important for sustaining current achievements, avoiding outbreaks, and eventually moving toward elimination of malaria in the region.

The results of this study indicate that countries should work to achieve an adequate level of implementation of control strategies. This will involve the preparation of detailed plans for correcting the deficiencies in the various criteria.

The methodology applied in this study has the potential to become a tool that can enable national control programs to monitor their own level of performance. Assessment of malaria control strategies using adequacy criteria is a simple, easy-to-use methodology and a tool that is useful as a step to be taken before conducting more complex and costly assessments.

### **For More Information**

The complete report of the study described here is available at the following website ([http://www1.msh.org/projects/sps/SPS-Documents/upload/ami\\_impact\\_implications\\_art\\_june2011\\_eng.pdf](http://www1.msh.org/projects/sps/SPS-Documents/upload/ami_impact_implications_art_june2011_eng.pdf)). For more information on the topics described herein, please contact:

Edgar Barillas ([ebarillas@msh.org](mailto:ebarillas@msh.org))  
Senior Program Associate  
Strengthening Pharmaceutical Systems  
4301 North Fairfax Drive, Suite 400  
Arlington VA 22203

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