



# Rapid Assessment of Malaria Control Performance in Belize Using an Adequacy Design: Final Report

August 2013



**USAID**  
FROM THE AMERICAN PEOPLE

**SIAPS**   
Systems for Improved Access  
to Pharmaceuticals and Services



# **Rapid Assessment of Malaria Control Performance in Belize Using an Adequacy Design: Final Report**

---

Consultant: Walter Flores, PhD

August 2013



This report is made possible by the generous support of the American people through the US Agency for International Development (USAID), under the terms of cooperative agreement number AID-OAA-A-11-00021. The contents are the responsibility of Management Sciences for Health and do not necessarily reflect the views of USAID or the United States Government.

## **About SIAPS**

The goal of the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program is to assure the availability of quality pharmaceutical products and effective pharmaceutical services to achieve desired health outcomes. Toward this end, the SIAPS result areas include improving governance, building capacity for pharmaceutical management and services, addressing information needed for decision-making in the pharmaceutical sector, strengthening financing strategies and mechanisms to improve access to medicines, and increasing quality pharmaceutical services.

## **Recommended Citation**

This report may be reproduced if credit is given to SIAPS. Please use the following citation.

Flores, W. 2013. *Rapid Assessment of Malaria Control Performance in Belize Using an Adequacy Design: Final Report*. Submitted to the US Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. Arlington, VA: Management Sciences for Health.

## **Key Words**

malaria, adequacy, performance

Systems for Improved Access to Pharmaceuticals and Services Program  
Center for Pharmaceutical Management  
Management Sciences for Health  
4301 North Fairfax Drive, Suite 400  
Arlington, VA 22203 USA  
Telephone: 703.524.6575  
Fax: 703.524.7898  
E-mail: [siaps@msh.org](mailto:siaps@msh.org)  
Website: [www.siapsprogram.org](http://www.siapsprogram.org)

## CONTENTS

Acronyms and abbreviations.....	iv
Introduction.....	1
Methodology.....	3
Literature Review.....	3
Development of Criteria and Adequacy Scales .....	3
Data Collection .....	7
Results.....	9
Household Residual Spraying.....	9
Insecticide-Treated Nets .....	10
Timely Diagnosis .....	10
Case Treatment .....	11
Conclusion .....	14
Recommendations.....	15
Suggested Actions Aimed at Closing Identified Gaps in Adequacy Criteria .....	15
Examples of Interventions and Essential Resources to Address Gaps in the Adequate Implementation of Malaria Control Strategies .....	16
Setting Priorities to Address the Various Gaps.....	18

## ACRONYMS AND ABBREVIATIONS

ACT	artemisinin-based combination therapy
AMI	Amazon Malaria Initiative
ITN	insecticide-treated bednet
MSH	Management Sciences for Health
PAHO	Pan American Health Organization
RAVEDRA	Red Amazónica de Vigilancia de la Resistencia a los Antimaláricos
RDT	rapid diagnostic test
WHO	World Health Organization

## INTRODUCTION

The epidemiology of malaria has significantly changed in the Americas during the last decade. Between the 2000 and 2009, the number of cases reported in the entire region decreased by 50 percent from 1.18 million to 526,000. The variation among countries was also wide. Whereas the number of cases in Suriname decreased by about 90 percent, Haiti experienced a 200 percent increase in the number of cases. The relation between malaria cases caused by *Plasmodium vivax* and *Plasmodium falciparum* has not changed: it is still three cases of *P. vivax* for every case of *P. falciparum*.<sup>1</sup>

By 2007 it was estimated that about 4.5 percent of all cases and 17.9 percent of all population at risk were located within the Mesoamerican region. In contrast to the Amazon region, where most cases are *P. falciparum*, 95 percent of all malaria cases are *P. vivax* in Mesoamerica.<sup>2</sup>

In the case of Belize, by 1995, 10,400 cases were reported; 85 percent of all cases were *P. vivax* and 15 percent *P. falciparum*. From 1995, cases have steadily decreased, to the point that only 74 cases were reported in 2011. Of these cases, 73 were *P. vivax* and only one case was *P. falciparum*.<sup>3</sup>

Evaluating the impact of the different control strategies on the reduction of malaria described above is an important task; however, it is an extremely complex task with high costs. In addition, the positive changes described probably do not result solely from the control strategies but are also the result of a combination of factors that include changes in the environmental and epidemiological conditions determining the transmission of malaria.

Because public health interventions are complex, it is important to be clear about the specific aspects, programs, and interventions to be evaluated. Habicht et al.<sup>4</sup> propose a logical framework to evaluate the performance and impact of public health interventions. This framework has been used in various international studies.<sup>5</sup> The design comprises three levels, ranging from simple to complex, depending on the evaluation designs and type of inference one wishes to make: (a) adequacy, (b) plausibility, and (c) probability. The adequacy level is the most basic and refers to evaluation of public health interventions relative to criteria generally corresponding to technical aspects of the interventions, quality of implementation, and coverage of services. The

---

<sup>1</sup> WHO. 2010. *World Malaria Report 2010*. Geneva: WHO.

<sup>2</sup> Rodriguez, M. 2009. Plan para Eliminación de la Malaria en Mesoamérica. México DF, Septiembre.

<sup>3</sup> Bautista, K. No date. Vector control program overview-malaria. PowerPoint presentation.

<sup>4</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.

<sup>5</sup> Hanson, K., T. Marchant, R. Nathan, et al. 2009. Household ownership and use of insecticide treated nets among target groups after implementation of a national voucher programme in the United Republic of Tanzania: Plausibility study using three annual cross sectional household surveys. *BMJ* 338:b2434 doi:10.1136/bmj.b2434; Hetzel, M., N. Iteba, A. Makemba et al. 2007. Understanding and improving access to prompt and effective malaria treatment and care in rural Tanzania: the ACCESS Programme. *Malaria Journal* 6:83 doi:10.1186/1475-2875-6-83; Chopra, M., S. Patel, K. Cloete, et al. 2005. Effect of an IMCI intervention on quality of care across four districts in Cape Town, South Africa. *Archives of Disease in Childhood* 90:397–401; Bryce, J., C. Victora, J. Habicht, et al. 2004. The multi-country evaluation of integrated management of childhood illness strategy: Lessons for the evaluation of Public Health Interventions. *American Journal of Public Health* 94(3):406–15.

inference that is made in an adequacy evaluation is whether the interventions are being implemented as planned and achieving the desired objectives (i.e., coverage, quality, or others). The plausibility level requires a control group, and the inference indicates the possibility that the effects observed in the intervention group result from the intervention and not external factors. The probability level requires that the control group be assigned randomly, and the inference is presented in terms of effects in the intervention group being results of the intervention with known certainty and statistical reliability, and not results of mixed variables, bias, or chance.

The Habicht et al. framework is also useful in identifying the various levels of evidence required to make decisions about a public health intervention. For example, if one has no knowledge or evidence that an intervention is being implemented adequately, according to technical standards and with the necessary resources, then a probabilistic evaluation cannot be considered because any effects and impact the evaluation finds cannot be attributed to the intervention. Moreover, if the intervention has not been implemented in an adequate manner, one can anticipate that it will have no impact. In these cases, one must first evaluate the adequacy of the interventions. Application of the preceding logic also contributes to avoiding unnecessary expenses in evaluation studies when simpler evaluations can be carried out.<sup>6</sup>

Based on the framework proposed by Habicht et al., the adequacy level was chosen for this study, which involved evaluating whether malaria control strategies are implemented in a technically correct manner and with the necessary resources and required quality. The following malaria control strategies were evaluated: (a) indoor residual spraying, (b) insecticide-treated bednets (ITNs), (c) timely diagnosis, and (d) treatment of malaria cases.

---

<sup>6</sup> Bryce, J., C. Victora, J. Habicht, et al. 2004. The multi-country evaluation of integrated management of childhood illness strategy: Lessons for the evaluation of Public Health Interventions. *American Journal of Public Health* 94(3):406–15.

## METHODOLOGY

### Literature Review

A literature search in PubMed was first carried out using key words to identify experiences with evaluation of malaria control strategies, rapid assessments, and evaluation of public health interventions using the Habicht et al. framework. A second part of the literature search involved identifying and collecting the technical guidelines for malaria control strategies produced by the World Health Organization (WHO) and the Pan American Health Organization (PAHO) Those guidelines were identified through the WHO and PAHO website search engines.

### Development of Criteria and Adequacy Scales

The next step was to develop the framework to be applied in this study. For this, a list of criteria was established for each of the four strategies in three thematic areas: (a) prior research supporting the design and adaptation of the control strategies, (b) coverage of the control strategies, and (c) quality of strategy implementation. The research team selected the criteria based on the technical guidelines established by WHO and PAHO.

Each criterion included in the four lists was graded relative to whether evidence exists that the criterion is satisfied (value 1), not satisfied (value 0), or partially satisfied (value 0.5). The values obtained were added and reported according to a scale with three categories: adequate, intermediate, and deficient implementation. The cut-off point for each of the three categories was decided by the researchers according to the following practical assumptions—

- Although in the strict sense, adequate implementation should require all criteria to be fulfilled, it was important to introduce some flexibility to motivate national programs toward improving performance; hence a flexible understanding of adequacy was introduced, representing 80 percent and higher of criteria fulfilled.
- Anything equivalent to 50 percent or lower of criteria fulfilled should be classified as deficient.
- All values between 51 percent and 79 percent should be considered as intermediate adequacy.

To ease understanding of the scale, each category was converted to cardinal numbers.

The number of criteria that were met corresponds to each of the three categories on the scale, and it differs for each strategy, given that the number of criteria also varies in each list. Each of these four lists is presented in tables 1–4 with the respective rating scale.

**Table 1. Implementation Criteria for Household Residual Spraying Strategy**

SCORE: Total number of criteria: 9 7.5 to 9 criteria met = The program is adequately implemented. 5 to 7 criteria met = The program is implemented with an intermediate level of adequacy. 0 to 4.5 criteria met = The program is deficiently implemented.	
<b>No. Criteria</b>	
<b><i>Research phase prior to the program's start-up</i></b>	
1	A stratification of the population at risk was performed based on disease burden and transmission epidemiology*
2	Vector habits were studied and verified*
3	The susceptibility of prospective insecticides was verified before selecting the insecticide(s) that yielded the best results*
<b><i>Coverage</i></b>	
4	100 percent of target households (according to national regulations) were sprayed at least once a year <sup>+</sup>
5	Stock-outs of spray insecticides did not exceed six months in any case <sup>+</sup>
<b><i>Quality</i></b>	
6	Current regulations and programs are in place to implement residual spraying*
7	A system is in place to monitor the resistance and sensitivity of insecticides used for household spraying*
8	Systematic procedures are in place to monitor the vectors' habits*
9	Systematic procedures are in place to monitor the residual effect of the insecticide used to spray the household*

Sources: \* Nájera, J., and M. Zaim. 2003. *Malaria vector decision-making: Criteria and procedures for judicious use of insecticides*. WHO/CDS/WHOPES/2002.5 Rev.1. Geneva: WHO.

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

**Table 2. Adequacy Criteria for ITN Strategy**

SCORE: Total number of criteria: 14	
11.5 to 14 criteria met = The program is adequately implemented	
7.5 to 11 criteria met = The program is implemented with an intermediate level of adequacy	
0 to 7 criteria met = The program is deficiently implemented	
No.	Criteria
<b>Research phase prior to the program's start-up</b>	
1	A stratification of the population at risk was performed based on disease burden and transmission epidemiology*
2	Vector habits were studied and verified*
3	The susceptibility of prospective insecticides was verified prior to selecting the insecticide(s) that yielded the best results*
<b>Coverage</b>	
4	80 percent of the population at risk received ITNs <sup>+</sup>
5	80 percent of pregnant women in the risk area received ITNs <sup>+</sup>
6	80 percent of the children under five in the risk area received ITNs <sup>+</sup>
7	80 percent of the people surveyed stated that they had slept under a bednet the previous night <sup>+</sup>
8	Stock-outs of the insecticide used to impregnate bednets did not exceed three months during the past five years <sup>+</sup>
9	Stock-outs of new bednets for delivery to the population did not exceed six months in any case <sup>+</sup>
<b>Quality</b>	
10	Regulations and programs for retreatment of ITNs are in place at the household or community level*
11	A systematic procedure is in place to monitor whether the families that have bednets use them adequately (including retreatment and washing)*
12	A resistance and sensitivity monitoring system is in place for insecticides used in bednets*
13	A systematic procedure is in place to monitor the vectors' habits*
14	A systematic procedure is in place to monitor residual insecticide in bednets*

Sources: \* Nájera, J., and M. Zaim. 2003. *Malaria vector decision-making: Criteria and procedures for judicious use of insecticides*. WHO/CDS/WHOPES/2002.5 Rev.1. Geneva: WHO.

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

**Table 3. Adequacy Criteria for Timely Diagnosis Strategy**

SCORE: Total number of criteria: 7 6 to 7 criteria met = The program is adequately implemented 4 to 5.5 criteria met = The program is implemented with an intermediate level of adequacy 0 to 3.5 criteria met = The program is deficiently implemented	
<b>No.</b>	<b>Criteria</b>
<b>Coverage</b>	
1	At least 80 percent of all cases are diagnosed during the first 24 hours (time elapsed between the blood sample taken for the thick blood smear or rapid test and the delivery of results in endemic areas) <sup>+</sup>
2	No stock-outs of rapid tests occurred in any facilities of the public network in endemic areas <sup>+</sup>
<b>Quality</b>	
3	A system is in place to monitor the quality of microscopic diagnosis in the public network <sup>**</sup>
4	A system is in place to monitor the quality of rapid tests <sup>*</sup>
5	National regulations are in place for the application, distribution, transportation, and storage of rapid tests <sup>*</sup>
6	A systematic process is in place to monitor compliance with distribution, transportation, and storage regulations <sup>*</sup>
7	Staff training and supervision programs are in place for personnel who apply rapid tests <sup>*</sup>

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

<sup>\*</sup> WHO. 2006. *The Role of Laboratory Diagnosis to Support Malaria Disease Management: Focus on the Use of Rapid Diagnostic Tests in Areas of High Transmission*. Geneva: WHO.

<sup>\*\*</sup> WHO. 2009. *Malaria Case Management: Operations Manual*. Geneva: WHO.

**Table 4. Adequacy Criteria for Treatment of Malaria Cases**

SCORE: Total number of criteria: 11	
9.5 to 11 criteria met = The program is adequately implemented	
6 to 9 criteria met = The program is implemented with an intermediate level of adequacy	
0 to 5.5 criteria met = The program is deficiently implemented	
No.	Criteria
<b><i>Prior studies and surveillance</i></b>	
1	Studies in vivo, in vitro, or molecular markers were carried out to determine drug resistance and sensitivity of <i>P. falciparum</i> to the drugs included in the treatment schemes in any of the past four years
2	Studies in vivo or in vitro were carried out to determine drug resistance and sensitivity of <i>P. vivax</i> to the drugs included in the treatment scheme in any of the past four years
3	A system is in place to monitor therapeutic failures of first-line drugs (chloroquine, primaquine, or artemisinin-based combination therapy [ACT])
<b><i>Updated guidelines, norms, and protocols</i></b>	
4	According to current guidelines and norms, ACT is first-line treatment for uncomplicated <i>P. falciparum</i>
5	According to current guidelines and norms, chloroquine + primaquine is first-line treatment for uncomplicated <i>P. vivax</i> . Alternatively, ACT + primaquine may be used (if ACT is first-line treatment in the country).
6	According to current regulations, malaria treatment (ACT, chloroquine, or primaquine) is delivered only when test results are positive (either microscopic or rapid test) for <i>P. falciparum</i> or <i>P. vivax</i>
<b><i>Coverage and quality</i></b>	
7	At least 80 percent of <i>P. falciparum</i> cases receive ACT
8	At least 80 percent of <i>P. vivax</i> cases receive either chloroquine + primaquine or ACT+ primaquine
9	No ACT stock-outs have occurred in the public network during the past two years
10	Neither chloroquine nor primaquine stock-outs have occurred in the public network during the past two years
11	A systematic procedure is in place to monitor the adequate application of malaria control regulations and protocols

Source: OPS. 2011. *Directrices para el tratamiento de la malaria*. 2da edición. Washington, DC.

## Data Collection

Several data collection tools were designed. First, detailed and comprehensive questionnaires addressing each criterion for the four interventions were developed. A consultant for Management Sciences for Health (MSH) visited the country to collect the data in the questionnaires.

A second set of data collections tools were interview guidelines for the following actors: (a) national malaria authorities and (b) procurement directors. These guidelines aimed to expand issues related to technical studies, procurement, and treatment of cases. Interviews were carried out face to face by an MSH consultant.

For triangulation purposes, every response to the questionnaires by malaria national

programs had to be accompanied by specific means of verification (i.e., treatment guidelines, copies of the reports of the specific studies on resistance to antimalarials, vector habits).

## RESULTS

### Household Residual Spraying

Authorities report that the program has evolved over the years to base spraying on disease burden. Initially, all six districts were sprayed twice a year with no stratification. Currently, spraying is based on the number of cases and breeding sites in the communities. A few communities in three districts have been determined to be high risk, and those are sprayed three times per year.

Specific studies of vector habits have been implemented in collaboration with international researchers. Those studies have been published in academic journals.<sup>7</sup>

The country used DDT insecticide prior to 1994. Since 1995, Deltamethrin was introduced and is the insecticide still in use. Authorities report that when introduced, the insecticide was studied for susceptibility.

Coverage is reported to be over 80 percent, and authorities explained that all target households are sprayed at least twice a year, so this criterion was assessed as achieved.

The country has regulations and guidelines in place to implement residual spraying.<sup>8</sup> In terms of systematic procedures to monitor insecticide resistance and sensitivity and the residual effects, no evidence of such procedures was identified; hence, those two criteria were not achieved.

As stated earlier, vector habits have been studied through specific international collaboration studies; however, there is no evidence of continuous entomological work, and authorities provided no data on entomological indicators.

Of nine criteria, the country achieved six, which is equivalent to intermediate implementation in the adequacy scale.

---

<sup>7</sup> Achee, N., J. Grieco, Richard Andre, et al. 2007. A mark-release-recapture study to define flight behaviors of *Anopheles Vestitipennis* and *Anopheles Albimanus* in Belize, Central America. *Journal of the American Mosquito Control Association* 23(3):276–82; Achee, N., C. Korvis, M. Bangs, et al. 2005. Biting patterns and seasonal densities of *Anopheles* mosquitoes in the Cayo District, Belize, Central America, with emphasis on *Anopheles darlingi*. *Journal of Vector Ecology* 31(1):45–57; Pecor, J., R. Harbach, E. Peyton, et al. 2002. Mosquito studies in Belize, Central America: Records, taxonomic notes, and checklist of species. *Journal of the American Mosquito Control Association* 18(4):241–76.

<sup>8</sup> Vector control spray manual. Revised 2009. Ministry of Health, Government of Belize.

**Table 5. Adequacy Criteria for Household Residual Spraying**

No.	Criteria	Score
<b>Research phase prior to the program's start-up</b>		
1	A stratification of the population at risk was performed based on disease burden and transmission epidemiology	1
2	Vector habits were studied and verified	1
3	The susceptibility of prospective insecticides was verified before selecting the insecticide(s) that yielded the best results	1
<b>Coverage</b>		
4	100 percent of target households (according to national regulations) were sprayed at least once a year	1
5	Stock-outs of spray insecticides did not exceed six months in any case	1
<b>Quality</b>		
6	Current regulations and programs are in place to implement residual spraying	1
7	A system is in place to monitor the resistance and sensitivity of insecticides used for household spraying	0
8	Systematic procedures are in place to monitor the vectors' habits	0
9	Systematic procedures are in place to monitor the residual effect of the insecticide used to spray the household	0
Total		6
Adequacy scale		Intermediate

Note: 1 = Yes; 0 = No; 0.5 = Partial; N/A = not applicable.

### **Insecticide-Treated Nets**

At the time of data collection, Belize had not implemented treated nets as part of its malaria program. There were plans to acquire nets through the national tender in 2013 and distribute them to selected communities, using the Amazon Malaria Initiative (AMI) guidelines that were being developed 2012. Therefore, no results were reported for this strategy.

### **Timely Diagnosis**

Authorities reported that although no specific study to assess time from blood sample to diagnosis has been carried out, their knowledge is that time for diagnosis depends on the locality and the time at which the slide was taken. It can range from within 24 hours to seven days. At the various health facilities, slides that are collected have results within 24 hours and in some instances, on the same day.

In terms of quality of microscopic diagnosis, the country has in place a system in which all positive slides and 10 percent of negative slides from each district are sent to another district for verification. A microscopist from another district reviews each of the slides presented from the other district and provides a second diagnosis. The results are then sent to the director of the Vector Control Program for comparison. In addition, Belize has signed onto the regional

program for external performance evaluation in microscopic diagnosis of malaria, supported by PAHO and AMI-RAVREDA (Red Amazónica de Vigilancia de la Resistencia a los Antimaláricos; Amazonian Antimalarial Resistance Surveillance Network).

Country regulations for the use of rapid diagnostic tests (RDTs) state that they are only to be used on weekends in the national referral hospital (by trained medical staff) because microscopists are not available on weekends. In addition to the RDT, a thick blood smear is taken at the same time for verification when the microscopist returns to work on the next business day. The use of RDTs is restricted to the preceding situation, and no plans exist to introduce them more widely in the public sector. Because demand for RDTs in the country is very low,<sup>9</sup> the program has appropriate follow-up to the use of RDTs.

From a total of seven criteria, one is not applicable to the country; hence, the assessment is based on six criteria. The score obtained was 5.5, which is equivalent to adequate implementation.

**Table 6. Adequacy Criteria for Timely Diagnosis**

No.	Criteria	Score
<b>Coverage</b>		
1	At least 80 percent of all cases are diagnosed during the first 24 hours (time elapsed between the blood sample taken for the thick blood smear or rapid test and the delivery of results in endemic areas)	0.5
2	No stock-outs of rapid tests occurred in any facilities of the public network in endemic areas	1
<b>Quality</b>		
3	A system is in place to monitor the quality of microscopic diagnosis in the public network	1
4	A system is in place to monitor the quality of use of rapid tests	1
5	National regulations are in place for the application, distribution, transportation, and storage of rapid tests	1
6	A systematic process is in place to monitor compliance with distribution, transportation, and storage regulations	N/A
7	Staff training and supervision programs are in place for personnel who apply rapid tests	1
Total (over 6 criteria)		5.5
Adequacy scale		Adequate

*Note:* 1 = Yes; 0 = No; 0.5 = Partial; N/A = not applicable.

## Case Treatment

Authorities reported that no study has been carried out (either in vivo, in vitro, or molecular markers) to assess resistance and sensitivity of first-line drugs used for *P. falciparum* and

<sup>9</sup> Compared with other countries in the region. For instance, in 2010 only six kits of 24 tests were procured (a total 144 units of RDT).

*P. vivax*. No evidence was provided on the existence of a system to monitor therapeutic failures of first-line drugs in the country.

The WHO's guidelines state: "To counter the threat of resistance of *P. falciparum* to monotherapies, and to improve treatment outcome, WHO recommends that artemisinin-based combination therapies (ACT) be used for the treatment of uncomplicated *P. falciparum* malaria."<sup>10</sup> In the case of Belize, ACT is not the first line of treatment (it is chloroquine + primaquine instead), and the new updated guidelines (2012) state that ACT should be used in case of chloroquine resistance.

In terms of delivering treatment only when there is a positive test, at the time of data collection (July 2012) the existing regulations indicated presumptive treatment to all patients presenting fever, and in the draft new Malaria Protocol (2012), there are no explicit and clear indications against presumptive treatment. Authorities interviewed also confirmed that presumptive treatment forms part of the country's malaria treatment procedures.

In terms of adequate follow-up to guidelines and protocols, the country has produced several guidelines and protocols, such as the vector control passive system and guidelines for spraying. However, authorities reported a shortage of staff to provide adequate supervision of implementation of guidelines and protocols. These criteria are partially achieved.

From the nine criteria, one does not apply to Belize. From a total of eight criteria, the country scored 3.5, which equals deficient implementation of case treatment.

---

<sup>10</sup> WHO. 2010. *Guidelines for the Treatment of Malaria*. 2nd edition. Geneva: WHO.

Table 7. Adequacy Criteria for Case Treatment

No.	Criteria	Score
<b><i>Prior studies and surveillance</i></b>		
1	Studies in vivo, in vitro, or molecular markers were carried out to determine drug resistance and sensitivity of <i>P. falciparum</i> to the drugs included in the treatment schemes in any of the past four years	0
2	Studies in vivo or in vitro were carried out to determine drug resistance and sensibility of <i>P. vivax</i> to the drugs included in the treatment scheme in any of the past four years	0
3	A system is in place to monitor therapeutic failures of first-line drugs (chloroquine, primaquine, or ACT)	0
<b><i>Updated guidelines, norms, and protocols</i></b>		
4	According to current guidelines and norms, ACT is first-line treatment for uncomplicated <i>P. falciparum</i>	0
5	According to current guidelines and norms, chloroquine + primaquine is first-line treatment for uncomplicated <i>P. vivax</i> . Alternatively, ACT+ primaquine may be used (if ACT is first-line treatment in the country).	1
6	According to current regulations, malaria treatment (ACT, chloroquine, or primaquine) is delivered only when test results are positive (either microscopic or rapid test) for <i>P. falciparum</i> or <i>P. vivax</i>	0
<b><i>Coverage and quality</i></b>		
7	At least 80 percent of <i>P. falciparum</i> cases receive ACT	0
8	At least 80 percent of <i>P. vivax</i> cases receive either chloroquine + primaquine or ACT+ primaquine	1
9	No ACT stock-outs have occurred in the public network during the past two years	N/A
10	Neither chloroquine nor primaquine stock-outs have occurred in the public network during the past two years	1
11	A systematic procedure is in place to monitor the adequate application of malaria control regulations and protocols	0.5
Total (over 10 criteria)		3.5
Adequacy scale		Deficient

Note: 1 = Yes; 0 = No; 0.5 = Partial; N/A = not applicable.

## CONCLUSION

In the three malaria control strategies assessed, Belize scored adequate implementation in timely diagnosis, intermediate implementation in residual household spraying, and deficient in treatment of cases. These scores differ from those of other countries in the region.<sup>11</sup> For instance, whereas most countries that have been assessed scored deficient for household spraying and intermediate for timely diagnosis, Belize scored intermediate and adequate, respectively. However, most other countries scored adequate or intermediate in case treatment, whereas this is the weakest intervention in Belize.

---

<sup>11</sup> See Flores, W., J. Chang, and E. Barillas. 2011. Rapid assessment of the performance of malaria control strategies implemented by countries in the Amazon subregion using adequacy criteria: Case study. *Malaria Journal* 10:379 doi:10.1186/1475-2875-10-379, <http://www.malariajournal.com/content/10/1/379>.

## RECOMMENDATIONS

This study has identified gaps in malaria control programs in relation to the technical criteria recommended by WHO. The next step is to implement actions to address identified gaps and to achieve compliance with all technical criteria for adequacy. The actions to close gaps must follow a logical order and identify essential resources (financing, human resources, supplies) that are needed to implement planned actions. Some examples of actions that can be implemented for to close these gaps are presented below.

### **Suggested Actions Aimed at Closing Identified Gaps in Adequacy Criteria**

The four lists to assess the adequacy of implementation of malaria control strategies have a total of 41 criteria, which can be classified into five different types of actions.

#### ***Training of Personnel and Technical Assistance to Implement Field and Laboratory Studies***

These actions include the training of malaria control personnel in charge of applying processes, methods, and techniques to collect and analyze field and laboratory data. Some examples of these are entomology studies for vector behavior, resistance to insecticide, and residuality in homes sprayed. Activities related to laboratory studies include in vivo and in vitro assessment of drug resistance.

#### ***Increasing Coverage***

This refers to all actions aimed at increasing the coverage of malaria control strategies, for instance, targeting households for spraying, population using bednets, and coverage of cases diagnosed within the first 24 hours.

#### ***Strengthening Management of Supplies***

These are actions aimed at implementation of processes and activities to improve the management of key supplies in the malaria control strategies, such as medicines, laboratory supplies, insecticides, and RDTs.

#### ***Strengthening Implementation of Norms and Protocols***

These are actions aimed at updating, distributing, and training technical and operational personnel in the application of norms and protocols.

### **Training of Personnel and Technical Assistance to Implement Monitoring and Evaluation**

These are actions aimed at designing and implementing processes and activities to strengthen the monitoring and evaluation of quality and coverage of malaria control strategies. Table 8 presents the five types of actions and the criteria that correspond to each of them.

**Table 8. Types of Actions and Number of Criteria from the Lists of Adequate Implementation of Malaria Control Strategies**

<b>Type of actions</b>	<b>Number of criteria</b>
Training of personnel and technical assistance to implement field and laboratory studies	15
Increasing coverage	7
Strengthening the management of supplies	6
Strengthening implementation of norms and protocols	5
Training of personnel and technical assistance to implement monitoring and evaluation	8
Total	41

### **Examples of Interventions and Essential Resources to Address Gaps in the Adequate Implementation of Malaria Control Strategies**

Based on the type of actions and the different criteria in the four lists of malaria interventions, countries should identify interventions and the essential resources that are needed to implement selected interventions. Some examples for three of the malaria control strategies are provided in the following tables.

**Table 9. Example of Interventions and Essential Resources to Address Gaps in the Implementation of Indoor Residual Spraying**

No.	Criterion	Interventions to address gaps	Essential resources
4	100 percent of target households (according to national regulations) were sprayed at least once a year	<ul style="list-style-type: none"> <li>• Quantify/stratify target households based on technical criteria</li> <li>• Increase coverage of spraying in target households</li> </ul>	<ul style="list-style-type: none"> <li>• Study of vector habits and sensitivity to insecticides</li> <li>• Procurement of insecticides</li> <li>• Availability of personnel for spraying and equipment</li> </ul>
7	A system is in place to monitor the resistance and sensitivity of insecticides used for household spraying	<p>Implementing a monitoring system that includes—</p> <ul style="list-style-type: none"> <li>• Technical guidelines for studies on resistance and sensitivity to insecticides</li> <li>• Sentinel sites</li> <li>• Trained personnel to carry out the studies</li> <li>• A process to collect and analyze information, disseminate findings, and make decisions based on information/evidence from studies</li> </ul>	

**Table 10. Example of Interventions and Essential Resources to Address Gaps in the Implementation of ITNs**

No.	Criterion	Interventions to address gaps	Essential resources
7	80 percent of the people surveyed stated that they had slept under a bednet the previous night	<ul style="list-style-type: none"> <li>• Developing a knowledge, attitude, and practice survey on adequate use of ITNs</li> <li>• Implementing knowledge, attitude, and practice survey</li> </ul>	Distribution of ITNs to target population
11	A systematic procedure is in place to monitor whether the families that have bednets use them adequately	<ul style="list-style-type: none"> <li>• Implementing a monitoring systems that includes— <ul style="list-style-type: none"> <li>▪ Technical guidelines on the monitoring of ITN use at household level</li> <li>▪ Sentinel sites</li> <li>▪ Trained personnel to carry out the monitoring</li> <li>▪ A process to collect and analyze information, disseminate findings, and make decisions based on information/evidence from studies</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Updated list of families that received ITNs</li> <li>• Estimating the personnel, transport, per diem required to carry out the monitoring</li> <li>• Securing financial resources to carry out data collection</li> </ul>

**Table 11. Example of Interventions and Essential Resources to Address Gaps in the Implementation of Timely Diagnosis**

No.	Criterion	Interventions to address gaps	Essential resources
1	At least 80 percent of all cases are diagnosed during the first 24 hours	<ul style="list-style-type: none"> <li>• Use of RDTs in places with no access to microscopic diagnosis</li> <li>• Strengthening the network of laboratories</li> <li>• System to monitor time taken for diagnosis</li> </ul>	<ul style="list-style-type: none"> <li>• Securing personnel and supplies for laboratory network</li> <li>• Availability of RDTs in distant places with no access to laboratory</li> <li>• Guidelines to implement monitoring system</li> </ul>
6	A systematic process is in place to monitor compliance with distribution, transportation, and storage regulations	<ul style="list-style-type: none"> <li>• Implementing a monitoring systems that includes—                             <ul style="list-style-type: none"> <li>▪ Technical guidelines for distribution, transport, and storage</li> <li>▪ Data collection forms, processes, and activities to monitor the adequate implementation of guidelines and norms</li> <li>▪ Trained personnel to monitor compliance with guidelines and norms</li> <li>▪ A process to collect and analyze information, disseminate findings, and make decisions based on information/evidence from studies</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Existence of updated guidelines and norms</li> </ul>

### Setting Priorities to Address the Various Gaps

In the previous section, it was mentioned that 41 different criteria were used in the assessment of adequacy in the implementation of malaria control strategies. In the assessment of Belize, different gaps were identified, and some gaps are larger than others. Therefore, it is not feasible to think that action can be implemented to tackle all gaps, at the same time, and with the same level of effort and resources. Hence, priorities should be set based on the feasibility and ease of implementing the various actions without requiring a large amount of resources as follows—

- Priority 1: Interventions aimed at strengthening processes and activities that already exist but need additional technical inputs, such as pharmaceutical supply management.
- Priority 2: Interventions aimed at developing processes to strengthen monitoring and evaluation systems and the training of personnel on those systems. This assistance could be implemented by AMI-RAVREDA.
- Priority 3: Interventions that require training of technical personnel to carry out field and laboratory studies.
- Priority 4: Interventions that require financial resources, hiring new personnel, and acquiring additional supplies to expand coverage of malaria control strategies.

The preceding is only a guideline. Belize should decide the specific order of implementation based on context and opportunities for support. For example, if Belize is a beneficiary of the Global Fund or a similar donor, it is feasible to start implementing interventions to expand coverage, assuming resources are available for such interventions. In addition, the possibility exists of adding training sessions to regional meetings in which technical personnel participate.

Finally, the implementation of actions to address gaps requires a detailed action plan. The plan can follow the structure described above and in addition develop baseline and progress indicators. AMI-RAVREDA could provide support to Belize to develop a detailed action plan for closing of gaps in the adequate implementation of malaria control strategies.