THE AMAZON MALARIA INITIATIVE:
Goals and Accomplishments
October 2001 – May 2009
THE ROLE OF THE U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT IN MALARIA CONTROL AND PREVENTION

The U.S. Agency for International Development (USAID) supports malaria control and prevention programs in Africa, Asia, and South America through activities in 28 countries. Led by USAID and implemented jointly with the Centers for Disease Control and Prevention, the President’s Malaria Initiative assists the national malaria control programs in 15 African countries in efforts to reduce malaria deaths by 50 percent. In Southeast Asia, the USAID–funded Mekong Malaria Programme initiates strategic projects for malaria control in the Greater Mekong subregion. Through the Amazon Malaria Initiative, USAID aims to reduce morbidity and mortality in the Amazon Basin subregion of South America by ensuring that national malaria control programs in participating countries substantially incorporate selected best practices.
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ACKNOWLEDGEMENTS

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### ACRONYMS AND ABBREVIATIONS

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<tr>
<th>Acronym</th>
<th>Description</th>
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<tr>
<td>ACT</td>
<td>Artemisinin-based combination therapy</td>
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<td>AMI</td>
<td>Amazon Malaria Initiative</td>
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<tr>
<td>CDC</td>
<td>U.S. Centers for Disease Control and Prevention</td>
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<tr>
<td>CICFV</td>
<td>Centro de Investigaciones de Campo Dr. Francesco Vitanza (Center for Field Research, in Venezuela)</td>
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<tr>
<td>CIPAC</td>
<td>Collaborative International Pesticides Analytical Council</td>
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<td>CNCC</td>
<td>Centro Nacional de Control de Calidad (National Center for Quality Control, in Peru)</td>
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<tr>
<td>DRA</td>
<td>Drug regulatory agency</td>
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<tr>
<td>ELISA</td>
<td>Enzyme-linked immunosorbent assay</td>
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<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
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<tr>
<td>FDD</td>
<td>Food and Drug Department (of Guyana's Ministry of Health)</td>
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<td>GLP</td>
<td>Good laboratory practices</td>
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<td>GPHF</td>
<td>Global Pharma Health Fund e.V.</td>
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<tr>
<td>HPLC</td>
<td>High-performance liquid chromatography</td>
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<tr>
<td>IIR</td>
<td>Intermittent irrigation of rice</td>
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<tr>
<td>INLASA</td>
<td>Instituto Nacional de Laboratorios de Salud (National Institute of Health Laboratories, in Bolivia)</td>
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<tr>
<td>INS</td>
<td>Instituto Nacional de Salud (National Institute of Health, in Peru)</td>
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<tr>
<td>INVIMA</td>
<td>Instituto Nacional de Vigilancia de Medicamentos y Alimentos (National Institute of Drug and Food Surveillance, in Colombia)</td>
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<tr>
<td>IRS</td>
<td>Indoor residual spraying</td>
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<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
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<td>ITN</td>
<td>Insecticide-treated bed net</td>
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<tr>
<td>LAC</td>
<td>Latin American and Caribbean Bureau</td>
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<td>MDG</td>
<td>Millennium Development Goals</td>
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<tr>
<td>M&amp;E</td>
<td>Monitoring and evaluation</td>
</tr>
<tr>
<td>MOH</td>
<td>Ministry of Health</td>
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<tr>
<td>MSH/SPS</td>
<td>Management Sciences for Health/Strengthening Pharmaceutical Systems</td>
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<tr>
<td>Abbreviation</td>
<td>Full Name</td>
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<tr>
<td>MSP</td>
<td>Ministerio de Salud Pública (Ministry of Public Health, in Ecuador)</td>
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<tr>
<td>MSyD</td>
<td>Ministerio de Salud y Deportes (Ministry of Health and Sports, in Bolivia)</td>
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<tr>
<td>MZ</td>
<td>Medische Zending (Primary Health Care Suriname)</td>
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<tr>
<td>NF</td>
<td>National Formulary</td>
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<td>NHMT</td>
<td>National Institute of Hygiene and Tropical Medicine</td>
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<tr>
<td>OMCL</td>
<td>Official medicine control laboratory</td>
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<tr>
<td>PAHO</td>
<td>Pan American Health Organization (also the World Health Organization Regional Office for the Americas)</td>
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<tr>
<td>PAMAFRO</td>
<td>Malaria Control in Border Areas of the Andean Countries: A Community Approach</td>
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<td>PMM</td>
<td>Pharmaceutical Management for Malaria</td>
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<tr>
<td>QA</td>
<td>Quality assurance</td>
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<td>QC</td>
<td>Quality control</td>
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<td>RAVREDA</td>
<td>Red Amazónica para la Vigilancia de la Resistencia a los Antimaláricos (Amazon Network for the Surveillance of Antimalarial Drug Resistance)</td>
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<td>RBM</td>
<td>Roll Back Malaria</td>
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<tr>
<td>RDT</td>
<td>Rapid diagnostic test</td>
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<td>SARI</td>
<td>South American Regional Infectious Diseases Program</td>
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<td>SC</td>
<td>AMI steering committee</td>
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<td>SNEM</td>
<td>Servicio Nacional de Erradicación de la Malaria (National Malaria Eradication Service, in Ecuador)</td>
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<tr>
<td>TA</td>
<td>Technical assistance</td>
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<tr>
<td>TLC</td>
<td>Thin-layer chromatography</td>
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<tr>
<td>UN</td>
<td>United Nations</td>
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<td>USAID</td>
<td>U.S. Agency for International Development</td>
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<td>USP/DQI</td>
<td>U.S. Pharmacopeia/Drug Quality Information</td>
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<tr>
<td>UV</td>
<td>Ultraviolet</td>
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<td>WHO</td>
<td>World Health Organization</td>
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**Artemisinin-based combination therapy**: A combination of artemisinin or one of its derivatives with one or more other antimalarials of a different class.

**Bioassay**: A test to determine the effects of a substance (such as an insecticide) on a living organism (such as a mosquito).

**Coartem®**: The commercial name of the drug combination artemether–lumefantrine.

**Compendial (or pharmacopeial)**: Practices that follow the procedures described in the monographs used for the analysis of medicines.

**Endemic**: In epidemiology, an endemic disease is one that is maintained in a particular population or location without external inputs, and an endemic area is one in which such a disease is maintained.

**Half-life**: The time required for a living tissue, organ, or organism to eliminate, through biological processes, half of a given quantity of a drug or other substance that has been introduced into it.

**Hematozoon**: A parasite found in the blood (plural, hematozoa).

**In vivo (technique)**: A technique used within a living organism.

**In vitro (technique)**: A technique used outside of a living organism—generally in a controlled laboratory environment.

**Molecular marker**: A molecule within an organism that is indicative of a particular chemical or physical process or disease state.

**Monograph**: In the pharmacopeial field, a set of guidelines for a particular medicinal ingredient or preparation that includes the name of the ingredient or preparation; packaging, storage, and labeling requirements; and the specification. The specification consists of a series of tests, test procedures, and acceptance criteria.

**Monotheraphy**: Treatment using a single medicine—either a single active compound or a synergistic combination of two compounds with related mechanisms of action.

**Morbidity**: The state of being unhealthy or affected by disease.

**Parasitemia**: A quantitative measure of the level of parasites in the blood.

**Plasmodium**: A genus of protozoan vertebrate blood parasites that includes the causal agents of malaria. *Plasmodium falciparum, P. malariae, P. ovale,* and *P. vivax* cause malaria in humans.

**Stock-out**: In the health sector, a temporary lack of medicines or other medical supplies at a health facility or pharmacy.

**Uncomplicated malaria**: Symptomatic infection with malaria parasitemia without signs of severity and/or evidence of vital organ dysfunction.

**Vector**: An organism that transmits a pathogen. In malaria, mosquitoes of the genus *Anopheles* (the vectors) transmit malaria-causing parasites of the genus *Plasmodium* (the pathogen) to humans (the hosts).
Venezuela was a participant in AMI from 2001-2007. The initiative is not currently supporting Venezuela.

1. 

French Guiana is not a formal member of AMI, but participates in regular meetings.

2. 

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AMI FOCUS COUNTRIES
The U.S. Agency for International Development (USAID) Latin America and Caribbean Bureau, Office of Regional Sustainable Development launched the Amazon Malaria Initiative (AMI) in 2001 as a collaborative partnership among international technical organizations and Amazon Basin countries to improve the control and treatment of malaria. The initiative’s mission is to (i) ensure that national malaria control programs in the Amazon Basin substantially incorporate selected best practices and (ii) promote lasting, evidence-based policy change in the partner countries.

The technical partners provide expertise and collaborate with the nations’ ministries of health (MOHs) and national malaria control programs to proactively address malaria prevention and control.

AMI partner countries are Bolivia, Brazil, Columbia, Ecuador, Guyana, Peru, Suriname, and Venezuela (2001–2007). The partner countries collaborate with one another and maintain an ongoing exchange of information and expertise (i.e., South–South collaboration).

The most important gauge of AMI’s impact on malaria control in the Amazon Basin subregion is in terms of lives saved and illness averted. Although malaria remains a significant public health problem in the subregion, malaria morbidity and mortality have declined considerably since AMI’s inception in 2001. Some AMI countries have achieved major international goals for malaria control. AMI’s subregional approach, which has promoted evidence-based decision-making in the subregion, and fostered South-South collaboration, will help ensure the sustainability of its accomplishments and impacts.

AMI addressed a number of specific problems that have hindered effective malaria control and treatment in the Amazon Basin subregion, including:

- the periodic emergence and spread of malaria-causing parasites that are resistant to antimalarial medications;
- treatment policies that are not based on the best available medicine efficacy information;
- inadequate diagnostic quality assurance/quality control (QA/QC) systems in many Amazon countries and limited access to diagnosis;
- deficiencies in QA/QC systems of antimalarial medicines, preventing the effective and rapid identification of poor-quality medicines and the implementation of appropriate corrective actions;
- insufficient availability and the inappropriate use of antimalarial medicines; and
- the use of nonselective and/or nonintegrated, and sometimes ineffective, vector control approaches.

**AMI TECHNICAL PARTNERS**

- Pan American Health Organization (PAHO)
- USAID/LAC and USAID/Peru
- U.S. Centers for Disease Control and Prevention (CDC)
- U.S. Pharmacopeia (USP/DQI)
- Management Sciences for Health (MSH/SPS)
- Links Media
- Research Triangle Institute (RTI)
The accomplishments of AMI are measured by the initiative’s progress in achieving the following results:

- Reliable and standardized surveillance information on malaria medicine resistance and vector control are available and used to monitor trends and to more effectively target disease control efforts.
- The laboratory diagnosis of malaria is improved.
- Tools and approaches for malaria control, diagnosis, and prevention are developed, adapted, tested in local settings, and disseminated.
- Sustainable systems for ensuring the availability of high-quality antimalarial medications are adopted.

The initiative's major accomplishments are:

**Antimalarial medicine resistance.** In collaboration with the Red Amazónica para la Vigilancia de la Resistencia a los Antimaláricos (RAVREDA) (Amazon Network for the Surveillance of Antimalarial Drug Resistance), AMI has established a network of sentinel sites for ongoing surveillance of medicine efficacy in Amazon countries using standardized protocols. This surveillance provides AMI partner countries with reliable information on the distribution and intensity of resistance to antimalarial medicines. As a result, each country has now modified its official malaria treatment regimens to more effective combination therapies and continues ongoing medicine efficacy monitoring through the surveillance network, searching for new forms of resistance. AMI is also supporting the development of new tools, such as molecular markers, to further enhance medicine efficacy surveillance in these countries.

**Diagnostic quality assurance and access to diagnosis.** AMI led the development of guidelines and recommendations for improving diagnostic QA/QC systems in the Amazon Basin subregion. To facilitate the implementation of these guidelines, AMI engaged in technical collaboration and provided funding for a number of activities in the partner countries, including (i) training to improve competency in laboratory diagnosis, (ii) efforts to introduce proficiency testing as a component of diagnostic QA/QC systems, and (iii) efforts to improve the efficiency of diagnostic performance monitoring. RAVREDA–AMI has supported training for microscopists in several AMI countries, demonstrating improvements in their competence following training. Further, several AMI partner countries are adopting the proficiency testing and performance monitoring methodologies recommended by RAVREDA–AMI. Improved diagnostic QA/QC systems in Amazon countries will permit public health laboratories to train personnel, provide supervision and monitoring, carry out operations research, contribute to evidence-based decision-making, and participate in the design of interventions to improve malaria treatment.

**Antimalarial medicine quality.** AMI has promoted increased awareness about antimalarial medicine quality issues among all Amazon countries and has encouraged the strengthening of proper quality assurance and quality control systems for medicines used in national malaria control programs in these countries. Specifically, the initiative has contributed to (i) strengthening the official medicine control laboratory (OMCL) in each AMI partner country by providing guidance on quality management systems and training in pharmacopeial techniques; (ii) implementing a decentralized methodology in the subregion to monitor and control the quality of medicines under the conditions in which they are stored and distributed in endemic areas through the use of portable laboratories; and (iii) increasing awareness about the issue of antimalarial medicine quality among Amazon countries by documenting shortcomings in QA systems. As a result of numerous AMI–supported trainings in analytical techniques and good laboratory practices, other forms of technical assistance, and the supply of analytical instrumentation, the personnel of OMCLs or other laboratories in all AMI countries are now better trained and equipped to ensure the quality of antimalarial medicines. In addition, all AMI partner countries have agreed to implement the use of portable laboratories as an inexpensive, rapid, and efficient approach for continuously assessing antimalarial medicine quality.

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1 A molecular marker within an organism may indicate a particular chemical or physical process or disease state.
2 Pharmacopeial techniques are those that follow the procedures described in the monographs (or guidelines) used for the QC analysis of medicines.
3 An endemic area is one in which a disease is maintained without external inputs.
Antimalarial medicine access and use. In collaboration with national malaria control programs, AMI technical partners have systematically intervened in each component of the pharmaceutical management cycle to institutionalize best practices meant to improve the access to and use of antimalarial medicines in the partner countries. First, AMI sought to sensitize partners and stakeholders to the role of good pharmaceutical management in reaching policy goals and thus to sustainably improving the access to and use of good-quality medicines in AMI countries. Second, AMI used assessments to identify the causes of poor availability and use of antimalarials and the resulting problems. AMI technical partners conducted baseline studies, trained personnel from the partner countries’ malaria control programs to conduct further studies, and later assessed the state of antimalarial supply management in the partner countries. This has led most countries to implement country-specific interventions to face the most critical problems in pharmaceutical management. Third, to confront problems shared among Amazon countries, AMI has supported regional workshops to (i) improve antimalarial procurement and supply chain management systems and (ii) improve rational use strategies.

Vector control, insecticide resistance, and entomology. AMI has sought to improve the development and implementation of vector control strategies in the Amazon countries by promoting the rational selection of vector control measures and improving insecticide resistance monitoring and evaluation (M&E). In consultation with the partner countries and entomology experts in the subregion, AMI has (i) developed a strategy for selecting and targeting malaria vector control measures and evaluating their effectiveness via integrated vector control and (ii) supported regional and national workshops to design and implement this strategy. In addition, the initiative has developed a strategy to implement an insecticide resistance surveillance system employing field-ready bioassays. AMI has promoted insecticide resistance M&E through workshops to standardize M&E procedures and guidelines as well as field activities using a bioassay to assess the susceptibility of malaria vector mosquitoes to several insecticides. By providing training in basic entomology to AMI partner countries and promoting a certification process for vector control workers, AMI has contributed to improving the partner countries’ capabilities in entomology and vector control. Additional ongoing efforts are related to the entomological evaluation of insecticide-treated bed nets, insecticide quality monitoring, and support for the increased understanding and implementation of specific vector control interventions.

Communication and information dissemination. Communication and information dissemination are cross-cutting components of AMI and are helping the partners and stakeholders have the knowledge and tools necessary to make the best decisions for improving the outcomes of the initiative. In particular, AMI seeks to share its success stories, best practices, and lessons learned throughout the subregion and with a wider audience. The communication component targets diverse audiences, including the general public, policymakers, healthcare providers, and technical and scientific audiences. For these audiences, AMI has developed comprehensive communication strategy. The objectives of the dissemination strategy are to:

- Increase information sharing between AMI partners about AMI achievements.
- Publish and promote AMI achievements among the greater international public health community as a means of establishing credibility and bringing attention to the work.
- Ensure a continued and structured flow of information to stakeholders in order to increase and maintain their interest and awareness of AMI.
- Deepen stakeholders understanding of AMI’s work in prevention and treatment of malaria in the Amazon region to benefit target users.
- Influence stakeholders to adopt products, materials, or approaches offered by AMI to bring about change, and/or sustain effective policies and practices within their organizations and countries, in the prevention and treatment of malaria in the Amazon region.

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4 A bioassay is an experiment or field test to determine the effects of a substance (e.g., insecticide) on a living organism.
AMI’s mission is to ensure that national malaria control programs in the Amazon Basin substantially incorporate selected best practices and promote lasting, evidence-based policy change in the partner countries that will result in healthier lives for the population.
“USAID, together with a select group of technical assistance providers and partner countries, has forged an initiative to improve the control and prevention of malaria, in response to the specific needs of countries and the region. AMI’s multipronged approach assesses the effectiveness of current drugs, develops new treatment policies, improves drug quality and accessibility, improves diagnostic accuracy, promotes integrated vector control approaches, and devises social media tactics that serve to educate the people of the Amazon Basin regarding prevention measures and access to effective treatments.”

Jaime Chang, USAID, Peru
OVERVIEW: THE AMAZON MALARIA INITIATIVE

MALARIA IN THE AMAZON BASIN

In the 21 Latin American and Caribbean countries in which malaria is endemic, an estimated 42.9 million people, about 8 percent of the population, were at moderate to high ecological risk of malaria transmission in 2007.5 Of the 774,446 cases of malaria recorded in the Americas in 2007, the vast majority (92 percent) occurred in the countries that make up the Amazon Basin subregion of South America: Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname, and Venezuela. Brazil alone accounted for nearly 60 percent of malaria cases in the Americas.6

The malaria burden in the Amazon Basin subregion worsened in the 1990s with the increased prevalence of the parasite *Plasmodium falciparum*, which causes a more severe, potentially fatal, form of malaria than that caused by *P. vivax* (the predominant malaria parasite in the region). Resistance of *P. falciparum* to some of the less expensive, first-line antimalarial treatments is now widespread in the subregion. Moreover, the movement of humans among countries in the subregion means that ineffective malaria treatment and control in one country can detrimentally impact neighboring regions and countries.

AMI MISSION AND PARTNERSHIPS

In October 2001, the United States Agency for International Development (USAID) Latin America and Caribbean Bureau (LAC), Office of Regional Sustainable Development launched the Amazon Malaria Initiative (AMI) to improve the control and treatment of malaria in nations of the Amazon Basin subregion: Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, and Venezuela.7 The initiative is a partnership among countries and organizations (technical partners), each of which brings specialized expertise and skills to bear on the problem of malaria control in the Amazon Basin (see Table 1). The technical partners are: Pan American Health Organization/World Health Organization (PAHO/WHO), U.S. Centers for Disease Control and Prevention (CDC), U.S. Pharmacopeia Drug Quality Information program (USP/DQI), Management Sciences for Health’s Strengthening Pharmaceutical Systems program (MSH/SPS), Research Triangle Institute (RTI), and Links Media. Supported by approximately US $2 million per fiscal year, AMI complements ongoing USAID mission bilateral programs as well as other regional and global efforts to combat malaria. In particular, AMI is closely connected with the Red Amazónica para la Vigilancia de la Resistencia a los Antimaláricos (RAVREDA) (Amazon Network for the Surveillance of Antimalarial Drug Resistance), which was established by the countries of the Amazon Basin and PAHO in March 2001 (see Table 1).

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7 Although not formally a member of AMI, French Guiana participates in the regular AMI meetings and is invited to training workshops as a means of ensuring greater uniformity in malaria treatment policies throughout the Amazon Basin subregion. Venezuela was a participant in AMI from 2001-2007. The initiative is not currently supporting Venezuela.
MISSION

AMI’s mission is to (i) ensure that national malaria control programs in the Amazon Basin substantially incorporate selected best practices and (ii) promote lasting, evidence-based policy change in the partner countries. By directing resources using a common conceptual framework to selected and coordinated activities in priority countries, AMI strives to improve malaria control at the subregional level, and to contribute to decreased morbidity and mortality at the national level.

INTERVENTIONS

To achieve this mission, AMI partners have developed the following interventions:

- Surveillance of antimalarial medicine resistance via
  - in vivo methods
  - in vitro methods
  - molecular markers
- Medicine policy implementation

TABLE I. ROLES OF AMI TECHNICAL PARTNERS

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<tr>
<th>Partner</th>
<th>Role</th>
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<tbody>
<tr>
<td>CDC</td>
<td>Participates in the initiative’s planning process. Provides TA in areas such as entomology and vector control, malaria diagnosis, molecular epidemiology, and malaria treatment to support the implementation of regional and national-level activities. The emphasis is on specific technical aspects, such as in vitro diagnostics, and vector control tools.</td>
</tr>
<tr>
<td>Links Media</td>
<td>Participates in the initiative’s planning process. Assists USAID and other AMI partners in the design and implementation of AMI’s communication strategy. Develops dissemination plans, provides support for the identification of target audiences, and develops communication materials. Provides editorial support to the partners for the development of scientific and technical documents and articles. Disseminates AMI information to the media, and through multiple information channels, including the AMI website.</td>
</tr>
<tr>
<td>MSH/SPS</td>
<td>Participates in the initiative’s planning process. Provides TA in pharmaceutical management with a focus on (i) medicine availability, prescribing and dispensing practices, and patient adherence to treatment regimens and (ii) management of the supply chain, including quantifying needs and identifying and correcting weaknesses in the system for supplying malaria medicines and supplies.</td>
</tr>
<tr>
<td>PAHO</td>
<td>Participates in the initiative’s planning process and coordinates this process under USAID direction. Provides general technical assistance (TA) and oversight to countries. Provides TA in malaria surveillance and entomological surveillance and control. Coordinates planning, monitoring, and evaluating for PAHO regional and in-country activities financed through PAHO. Coordinates the development and dissemination of standard policies, strategies, interventions, guidelines, and protocols. Prepares an aggregated general report in coordination with other partners.</td>
</tr>
<tr>
<td>RTI</td>
<td>Participates in the Initiative's planning process. Provides specialized TA in malaria eco-epidemiology, entomological surveillance, and control systems. Supports the development of training materials on entomology to facilitate national vector control capacity strengthening.</td>
</tr>
<tr>
<td>USAID/LAC and USAID/Peru</td>
<td>Participates in the initiative’s planning process. Provides specialized TA in malaria surveillance and entomological surveillance and control systems (e.g. design, monitoring, evaluation). Leads the initiative’s planning process. Provides general coordination and TA.</td>
</tr>
<tr>
<td>USP/DQI</td>
<td>Participates in the initiative’s planning process. Provides specialized TA in quality assurance (QA), of antimalarials and insecticides, with a focus on (i) implementation of proper quality control processes throughout the supply chain and (ii) strengthening of OMCL capabilities to analyze medicines and provide trustworthy and reliable results.</td>
</tr>
</tbody>
</table>
• Access to and quality of diagnosis and treatment, including:
  - improved access to and quality of diagnosis
  • training of microscopists
  • use of rapid diagnostic methods in remote areas
  • quality assurance (QA) and quality control (QC) of diagnosis
  - improved medicine quality
  - improved availability and use of antimalarials
• Improved decision-making in malaria vector control
• Communication and information dissemination
• Stratification
• Improvements in malaria information systems

More specifically, AMI supported:
• determining medicine efficacy across the subregion and implementing new, evidence-based antimalarial medicine policies;
• harmonizing national medicine policies among the partner countries;
• building human capacity in the subregion regarding malaria issues, with an emphasis on training;
• building decentralized medicine quality testing capacity through the use of portable laboratories;
• testing the effectiveness and appropriate use of selected new rapid diagnostic methods;
• promoting integrated vector control through the appropriate use of insecticides and other vector control approaches;
• improving the capacity of partner countries to ensure the quality of medicines and to ensure that quality treatment is available when and where it is needed;
• addressing medicine QC from procurement and throughout distribution to dispensing sites; and
• helping national malaria control programs to evolve in response to changes in malaria epidemiology and its determinants.

**STRATEGIES**

To achieve its objectives and to ensure that the results are sustained and sustainable, AMI partners have worked to (i) formulate a sentinel surveillance network, (ii) train personnel from the partner countries’ national malaria control programs, (iii) promote the adoption and adaptation of new tools, and (iv) promote cooperation and information exchange among the countries (referred to as South–South collaboration).

AMI’s subregional approach has a number of advantages. Subregional training, TA, and the development of guidelines and protocols provide economies of scale. The replication of research studies in multiple sites using common protocols allows for country comparability and provides a critical mass of useful information. Comparable epidemiological and entomological information across the countries of the subregion increases the knowledge base and facilitates better research, treatment, and policy decisions.

Finally, the subregional approach facilitates coordinated approaches to addressing cross-border problems.

AMI’s anticipated results are as follows:
• Reliable and standardized surveillance information on malaria medicine resistance and vector control are available and used to monitor trends and more effectively target disease control efforts.
• The laboratory diagnosis of malaria is improved.
• Tools and approaches for malaria control, diagnosis, and prevention are developed, adapted, tested in local settings, and disseminated.
• Sustainable systems for ensuring the availability of high-quality antimalarial medications are adopted.

Planned interventions and illustrative activities for AMI are summarized below:
• Surveillance of antimalarial medicine resistance
  - Update strategies for the surveillance of antimalarial efficacy under high- and low-transmission conditions, including the use of molecular markers.
  - Develop or update standardized protocols and other tools for the surveillance of antimalarial efficacy.
- Strengthen networking within and among countries through the timely availability of information on the efficacy of antimalarials at subregional and national levels.

- Improve the sustainability of RAVREDA in terms of the sustained participation of member countries in network activities and increased reliance on funding from member countries (including funding of their participation in network activities).

- Implement timely, evidence-based updates of subregional and national antimalarial treatment policies.

- Systematize and publish current information on the efficacy of antimalarials being used in each country and share it with other countries in the subregion.

- Support sustained implementation by countries of antimalarial medicine policies.

- Access to quality diagnosis and treatment
  - Support countries in the continuous improvement of logistical systems for antimalarial medicines and other pharmaceuticals and supplies used in malaria diagnosis and treatment.
  - Develop or improve tools for monitoring the use of antimalarials.

- Appropriate use of quality medicines
  - Develop or update standardized protocols and other tools for training healthcare staff that provide malaria treatment.
  - Develop or update tools for pharmacological surveillance (of secondary effects).

- QA and QC of pharmaceuticals and insecticides
  - Develop or update standardized protocols and other tools for the QA/QC of pharmaceuticals and other supplies necessary for malaria control.
  - Improve countries’ capacity to appropriately perform QC of antimalarial medicines and insecticides used in the country and ensure that they have agreements in place with other AMI countries that provide access to such capacity.

- Entomology and integrated vector management
  - Develop or update standardized protocols and other tools for vector surveillance and control interventions, including the monitoring of vector susceptibility to insecticides and changes in vector behavior.

- Strengthen networking within and among countries by ensuring the timely availability of information for the subregion and at national levels on vector susceptibility to insecticides, vector control activities implemented, and so forth.

- Stratification and information use for control measures
  - Support countries in the improvement of the malaria epidemiological surveillance system and its integration with vector surveillance and control and monitoring and evaluation (M&E) of other malaria control activities.

- Strengthen networking within and among countries by ensuring the timely availability of information on malaria surveillance and control activities implemented at subregional and national levels.

- Strengthen networking between AMI partner countries and other major malaria control stakeholders in the region (e.g., implementers of projects financed by the Global Fund to Fight AIDS, Tuberculosis, and Malaria).
### BOX 1. AMI’S OBJECTIVES AND OUTCOMES

**Objective 1:** The evidence base for Amazon Basin malaria prevention and control priorities is increased.

**Outcome 1:** Antimalarial medicine resistance is assessed, medicine policies are defined, the use of efficacious antimalarials is promoted, and entomological information is available to guide control activities and to promote integrated vector management.

**Illustrative indicators:** (i) The number of participating countries that have evidence-based medicine policies in place and have institutionalized activities for monitoring the efficacy of antimalarials and (ii) the number of participating countries that routinely collect data for use in integrated vector management at selected sites in malaria transmission endemic areas.

**Objective 2:** The evidence base for Amazon Basin malaria prevention and control priorities is communicated and used.

**Outcome 2:** Healthcare workers, policymakers, professional societies, and vulnerable groups are informed of appropriate strategies and interventions to be implemented.

**Illustrative indicator:** The number of participating countries that collect, analyze, evaluate, and disseminate information.

**Objective 3:** More inclusive and better informed policy processes are promoted.

**Outcome 3:** Health policymakers and other stakeholders are using information to ensure the implementation of revised policy.

**Illustrative indicators:** (i) The number of participating countries defining and implementing policies with the participation of all sectors, including the community and (ii) the number of actions taken for sharing strategies, tools, achievements, and lessons learned with other participating countries, other countries in LAC, and other stakeholders in malaria control efforts in other regions (e.g., the President’s Malaria Initiative, the Mekong Regional Initiative, and PAMAFRO).

### MONITORING AMI’S PROGRESS

The AMI Steering Committee (SC), which consists of representatives from each AMI technical partner organization, directs the initiative and develops consensus on issues. PAHO, in coordination with USAID, organizes two annual SC meetings. In September, at the beginning of the initiative’s fiscal year, the SC and two to three RAVREDA members from national malaria programs meet in Washington, DC, to discuss progress and difficulties in project implementation over the previous year and to review each country’s work plan for the next 12-month period. The emphasis for this meeting is to refine lines of work and activities for the next period and to approve the budget for activities supported by the counterpart funds that complement the funding from USAID.

A second SC meeting, held in March, takes place as part of the RAVREDA Annual Meeting, which is held in a different partner country each year. The meeting includes representatives of the MOHs and AMI country coordinators, along with institutions and partners that support the initiative at the local and regional levels. In the days leading up to the SC meeting, the partner countries and the technical partners hold detailed discussions on the results of activities carried out during the preceding year.

The SC formulates recommendations based on the results presented; revises the agenda for the current period; and defines the content, locations, and dates for the agenda of joint activities among the countries.
Each August, the RAVREDA team in each country, led by the MOH and with support from PAHO, prepares a work plan for the next period following the general guidelines developed during the RAVREDA Annual Meeting and the lines of work that were defined and agreed to, based on ongoing regional activities. PAHO’s RAVREDA coordinating team and the other AMI partners also prepare work plans for the new period at this time.

These plans are reviewed at the September SC meeting to facilitate the coordination of proposals for work by the technical partners with the interests of the countries and to identify opportunities for South–South collaboration. The AMI technical partners provide comments to each country on its activity plan to ensure that the proposals respond to regional priorities. Progress on the plans is reviewed with the countries at the March RAVREDA and SC meetings, which call attention to any deviations from protocols and work plans.

USAID, the technical partners, and the partner countries monitor progress toward AMI’s objectives via a number of specific outcomes and indicators (Box 1). In addition, a SARI purpose-level indicator for AMI is the percentage of partner countries that newly implement or maintain selected best practices for containing malaria based on local information.

**SOUTH AMERICAN REGIONAL INFECTIOUS DISEASES PROGRAM (SARI)**

Recently, AMI has been incorporated under the umbrella of the South American Regional Infectious Diseases Program (SARI) managed by USAID/Peru. The purpose of SARI is to improve infectious disease prevention and control at a subregional level and help decrease national morbidity and mortality. This will be accomplished by substantially incorporating promising practices, innovations, and lessons learned into prevention and control programs for SARI’s two main components: (i) AMI and (ii) the South American Infectious Diseases Initiative (SAIDI). The objectives of SARI are to (i) increase the evidence base for prevention and control of malaria and other infectious diseases; (ii) ensure that this evidence base is appropriately communicated to policymakers and put to use in the development of policies and programs; and (iii) promote a better informed and more inclusive policy process.
RAVREDA: AMAZON NETWORK FOR THE SURVEILLANCE OF ANTIMALARIAL DRUG RESISTANCE

In March 2001, at the Third Meeting of the Surveillance Network for Emerging Infectious Diseases in the Amazon Countries in Bahia, Brazil, RAVREDA was established as part of the Roll Back Malaria (RBM) Partnership by Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, and Venezuela, with technical support from PAHO and WHO Headquarters in Geneva. (French Guiana, a department of France, currently participates as an observer.)

RAVREDA was formed in response to the challenge of antimalarial medicine resistance in the Amazon Basin. The network’s goal is to regularly monitor medicine resistance across the subregion and to use monitoring information as the basis for modifications to malaria treatment policies. The network has partnered with international institutions and local, in-country organizations to achieve its goals, which have been expanded to include the components of PAHO’s Regional Strategic Plan for Malaria in the Americas 2006–2010.8 Local and international partners include the national malaria control programs, national institutes and ministries of health (MOHs) in the partner countries, official medicine control laboratories (OMCLs; or other laboratories identified by the MOH), local research institutes, universities, and public health laboratories.

RAVREDA and AMI collaborate closely on a number of AMI’s line of work, including antimalarial resistance surveillance and efforts to improve antimalarial medicine access and use. RAVREDA provides AMI with a means by which to achieve its goal to monitor medicine efficacy throughout the subregion and to promote malaria control policies reflecting this information. In turn, AMI provides RAVREDA with the additional expertise and resources of the AMI technical partners.

ROLL BACK MALARIA PARTNERSHIP

Launched in 1998 by WHO, the United Nations Children’s Fund, the UN Development Programme, and the World Bank, the RBM Partnership provides a coordinated global approach to fighting malaria. With a wide range of partners—including malaria-endemic countries, bilateral and multilateral development partners, the private sector, nongovernmental and community-based organizations, foundations, and research and academic institutions—the partnership brings together a considerable depth and diversity of expertise to fight malaria.

The RBM Partnership’s mission is to work together to enable sustained delivery and use of the most effective prevention and treatment methods for those affected most by malaria by promoting increased investment in health systems and the incorporation of malaria control into all relevant multisector activities.9

THE GLOBAL FUND TO FIGHT AIDS, TUBERCULOSIS, AND MALARIA

The Global Fund is a global public-private partnership dedicated to attracting and disbursing resources to prevent HIV/AIDS, tuberculosis, and malaria. In the case of malaria, the Global Fund supports large-scale interventions and the purchase of commodities such as insecticide-treated bed nets (ITNs), which are an effective intervention. A number of malaria-related Global Fund projects in the Amazon countries have been funded. Currently funded projects in Amazon countries include (i) “Malaria Control in Border Areas of the Andean Countries: A Community Approach,” or PAMAFRO, a subregional project targeting the border areas of Colombia, Ecuador, Peru, and Venezuela, and (ii) individual projects in Bolivia, Guyana, and Suriname. Additional projects in Bolivia, Brazil, Colombia, and Ecuador recently have been approved and endorsed for funding in the eighth round of the Global Fund.10

Although direct interaction between AMI and the Global Fund has been limited to date, Global Fund projects comply with national treatment policies designed with AMI’s support. Moreover, the two programs are complementary, and the potential therefore exists for collaborative efforts, such as TA by AMI partners in Global Fund projects.

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Mosquitoes in the genus *Anopheles* transmit malaria in the Amazon Basin.
“Experience has shown that we can achieve faster results when countries work together. In a chain reaction, one country increases its malaria control capacity and its neighbors catch on to the new approach or technologies, improving their own capacity.”

Roberto Montoya, former technical adviser, PAHO Brazil
At AMI's inception, effective malaria control and treatment in the Amazon Basin subregion was hindered, in part, by:

- the periodic emergence and spread of antimalarial resistance and treatment policies that were not based on the best available medicine efficacy information;
- inadequate diagnostic QA/QC systems in most Amazon countries and limited access to diagnosis and treatment;
- deficiencies in QA/QC systems of antimalarial medicines, which prevented the effective and rapid identification of poor-quality medicines and the implementation of appropriate corrective actions;
- insufficient availability and the inappropriate use of antimalarial medicines; and
- the use of nonselective and/or nonintegrated, and sometimes ineffective, vector control approaches.

These specific problem areas are reflected in AMI's major interventions and are described in more detail below. The need for a comprehensive communications component for the initiative is also addressed as an issue that cuts across all lines of work and problem areas.

**ANTIMALARIAL MEDICINE RESISTANCE**

Most national malaria control strategies in the Amazon and throughout the Americas rely on prompt and effective antimalarial treatment as the primary means for reducing malaria morbidity and mortality. The emergence and spread of resistance of malaria-causing parasites to antimalarial medicines could undermine such strategies and complicate decisions regarding appropriate treatment schemes.

Antimalarial agents, especially those with long half-lives (e.g., sulfadoxine–pyrimethamine and mefloquine), may select for resistant parasite strains because of the persistence of low levels of the medicine in the blood. To reduce the probability of selecting for resistant parasites and to prolong the useful therapeutic lifetimes of these medicines, WHO now recommends that antimalarial medicines be administered in combination rather than as monotherapy. The antimalarial most commonly recommended for such combination therapy is artemisinin or one of its derivatives—among the most efficacious and rapidly acting of all antimalarial medicines.

Evidence of resistance or decreased sensitivity of the malaria-causing parasite *P. falciparum* to inexpensive, first-line antimalarial medicines, such as chloroquine and sulfadoxine–pyrimethamine, was found in several South American countries in the 1980s and 1990s. However, such medicines continued to be used as first-line therapy—and often as monotherapy—throughout much of LAC during the 1990s and after 2000. In fact, mefloquine was being used as monotherapy in low doses, a treatment scheme known to have led to mefloquine resistance in Southeast Asia. The utility of efficacy studies carried out in the 1980s and 1990s was compromised because they were not part of a systematic effort to map the geographic distribution or intensity of medicine resistance in the region. Furthermore, those studies employed a variety of *in vivo* and *in vitro* methods and did not follow standardized protocols; thus, the validity of results was arguable in some cases, and comparisons among studies and among countries were hindered, as were policy decisions regarding the most appropriate first-line treatment in each country.

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Diagnostic Quality Assurance and Access to Diagnosis

Malaria treatment in the Americas has been mostly based on clinical findings. But effective treatment should be supported with trusted laboratory tests with quality assurance/quality control (QA/QC). Both are being supported by AMI. The importance of accurate laboratory diagnosis in the Americas has become even more important, in part, because of: (i) the findings of malaria parasites that are resistant to first-line treatments; (ii) the introduction of more expensive artemisinin-based combination therapies (ACTs); and (iii) the need to evaluate new rapid diagnostic tests (RDTs) for malaria. With the reduction in malaria incidence in the Amazon Basin in the late 1990s, there are fewer malaria cases overall, but *P. falciparum* malaria is a more severe form of the disease and must be diagnosed accurately and quickly.

The implementation of policies that guarantee access to appropriate treatment requires a healthcare system that offers access to reliable diagnosis. As part of their decentralization processes, Amazon countries have been moving the responsibility for malaria diagnosis out of a vertical structure and turning it over to various actors within networks of public and private health services. The multiplicity of partners, the instability of human resources, and the greater structural complexity of this service network impose ever-growing challenges as the malaria control programs and the heads of laboratory networks in the countries strive to ensure laboratory accuracy.

The development and implementation of QA/QC in microscopy diagnosis and guidelines for the use of RDTs require procedures and tools to promote and monitor diagnostic quality within the structure of the laboratory network. The existing QC systems for malaria diagnosis in Amazon countries needs to be strengthened. However, the existing structure and available resources of the laboratory networks can be optimized to establish quality management systems that allow health services to expand access to treatment and provide reliable information to health authorities.

At AMI’s inception, some countries lacked standardized training in microscopy, standardized procedures for testing proficiency after training, and a certification process that would improve the enrollment of new microscopists in special decentralized scenarios. Existing QA systems focused only on performance monitoring. Weaknesses in the performance monitoring methodology used by partner countries included the following: (i) no randomized selection of slides; (ii) no blind validation guidelines; (iii) heavy reviewer workloads; (iv) no focus on slides with low parasite density, which pose additional challenges for microscopists; and (v) no prompt feedback to health facilities or implementation of corrective measures.

Regarding RDTs specifically, at AMI’s initiation, the partner countries lacked national-level systems and regular procedures for the QA of RDTs as well as guidelines to ensure the achievement of operational requirements for the appropriate management and use of RDTs on a large scale.
ANTIMALARIAL MEDICINE QUALITY

The burden of malaria in the Amazon Basin subregion could be exacerbated by poor-quality antimalarial medicines. Widespread occurrence of poor-quality medicines can result from the interplay of numerous factors, particularly poorly developed QA/QC systems and capacities, weak or inadequate medicine regulatory authorities, and the inability to enforce existing regulations. An essential component to ensuring good-quality medicines is the development and implementation of a comprehensive QA/QC system that includes pre- and post-marketing monitoring.

The existence of illegal channels for the distribution of antimalarial medicines poses one specific medicine quality challenge. Although all AMI countries provide malaria treatment free of charge via the public sector—and, in most countries, the sale of medicines for the treatment of malaria is prohibited—illegal commerce via private and informal sectors occurs in some countries. Such illegal commerce of antimalarials escapes the controls exerted throughout the official supply chain, thereby posing health risks to patients and ultimately counteracting efforts by national malaria control programs to effectively treat malaria. Of utmost concern is the potential impact on the effectiveness of ACTs, as consuming poor-quality medicines and improper use can accelerate the onset and the extent of resistance to a treatment for which no alternative currently exists. Because the prevalence of illegal commerce and the quality of the available antimalarials has not been quantified in any AMI country, the magnitude of the health risks associated with this problem is unknown.

ANTIMALARIAL MEDICINE ACCESS AND USE

For effective first-line antimalarial treatments to have an impact, they must be accessible to patients and used appropriately. To ensure appropriate use, the treatments must be prescribed and used according to standard guidelines.

In all Amazon countries, malaria treatment policies state that the population should have free access to antimalarial medicines, which are to be purchased and distributed by the MOH. Indeed, the vast majority of malaria cases in the subregion are treated with medicines that are purchased with public resources and are available to the population free of charge.

However, at AMI’s inception, the technical partners found deficiencies in the following areas:

• Quantification, procurement, and supply management processes. For example, many AMI partner countries failed to consider sufficient lead times for medicine procurement and did not maintain adequate safety stocks. Procurement processes were sometimes carried out in the context of potential supply crises, which required requesting donations or turning to expensive or low-quality local markets to avoid stock-outs (temporary medicine shortages).

• Policies related to the appropriate use of antimalarials. A wide variety of interventions aimed at improving adherence to malaria treatment had been reported in AMI partner countries, but the impact of these interventions had not been evaluated.

• Integrated supervision systems to monitor antimalarial access and use. The lack of standardized data collection also impeded the collection of regional data and comparisons among countries.

In addition, AMI partner countries lacked standardized procedures for managing the medicine and consumables supply for malaria diagnosis and treatment. This led to a lack of replication and extension of successful practices (through AMI or other mechanisms) when filling technical and management positions. In addition, the lack of standardized procedures prevented monitoring activities (such as the supervision of facilities) from having references against which to evaluate medicine supply management in the facilities and other points in the supply chain. The lack of standardized procedures was a cross-cutting limitation affecting each area of deficiency described above.

To correct these problems, the AMI technical partners determined that the countries of the Amazon Basin subregion had to identify gaps in their respective pharmaceutical systems and take sustainable corrective actions. Ultimately, each country should have pharmaceutical systems that can ensure the continuous access to and use of effective, quality-assured medicines and supplies for malaria.
VECTORS, INSECTICIDES, AND ENTOMOLOGY

The large-scale implementation of selective malaria vector control activities has been somewhat limited in the Amazon Basin subregion. Currently, vector control in the Amazon countries focuses on extensive IRS. This type of insecticide application, however, is not always concentrated in the areas with the greatest burden of disease in the Amazon subregion. In addition, the use of ITNs has not yet been considered for widespread use in Amazon countries, partly because of the limited evidence of this strategy’s effectiveness in areas of low malaria endemicity, such as the Amazon.

Although chemical control is an important component of malaria vector control, the widespread, nonselective use of insecticides for malaria control can be problematic because of the cost of insecticides, the potentially detrimental health and environmental effects of their use (especially if misused), and the possible promotion of insecticide resistance in mosquito populations. Such problems may be minimized through a more efficient and rational approach to vector control decisions (i.e., through the use of integrated vector management); by improving approaches to insecticide resistance monitoring; and through efforts to more effectively link vector surveillance and control to malaria surveillance, prevention, and control.

At least three problems can hinder the adoption of integrated vector management strategies. First, entomological knowledge may not be systematically used or thoughtfully applied to vector control in some areas. Thus, approaches that would be most appropriate for particular areas and seasons—including innovative, nonchemical approaches—have sometimes been overlooked.

Second, insecticide resistance monitoring may be lacking or inadequate, potentially resulting in the continued use of insecticides that are ineffective and the continued employment of vector control approaches that contribute most to the emergence and spread of resistance.

Third, the effectiveness of particular approaches, such as ITNs, may not be sufficiently assessed and optimized in some areas.

In addition to the shortcomings of vector control strategies and insecticide resistance monitoring, the Amazon Basin subregion lacks sufficient strategies for monitoring the quality of insecticides. Reports by WHO suggest that a high percentage of insecticides used in developing countries do not meet internationally accepted quality standards.13 In a survey that included 13 American countries (5 of which were AMI partner countries), several deficiencies in insecticide QA/QC were identified, including the procurement of pesticides not recommended by WHO, a lack of WHO specifications for QC in public tenders, a lack of pre- and/or postshipment QC by the procurement authority, and the absence of national QC facilities.14 The use of poor-quality insecticides in vector control may have many detrimental effects, including:

- low efficacy of vector control, with the consequent waste of financial and human resources;
- the development of vector resistance to insecticides;
- detrimental impacts on countries that are using effective treatments resulting from ineffective treatment by neighboring countries in national border areas (attributable to the potential contribution of such ineffective approaches to the emergence and spread of insecticide resistance in vector mosquito populations);
- flawed data on vector resistance; and

• a higher risk of human toxicity resulting from synthetic toxic byproducts in pesticides not manufactured in accordance with guidelines from WHO, the Food and Agriculture Organization of the United Nations (FAO), and the Collaborative International Pesticides Analytical Council (CIPAC).\textsuperscript{15}

These considerations also apply to ITNs because manufacturers sell insecticides and kits for the local preparation of treated nets. Although the risk for pretreated ITNs may be lower, AMI technical partners found that a periodic assessment of insecticide content is warranted for these products as well, and WHO–FAO–CIPAC guidelines and procedures are also available for this purpose.

Another consideration is the distribution and/or treatment of nets outside of the national malaria control programs, which could bypass established controls during procurement at the national level.

**COMMUNICATION AND INFORMATION DISSEMINATION**

From 2001 through 2007, AMI did not include an explicit, dedicated communications component; instead, communication efforts were undertaken by the technical partners individually and in some cases with limited coordination. One of the recommendations of a 2007 external review of AMI\textsuperscript{16} (see Appendix A) suggested that the initiative should incorporate a communications element to design and implement targeted communication strategies for audiences such as policymakers, healthcare providers, and researchers. The initiative required a coordinated, comprehensive approach to communication and information dissemination that would address each of AMI’s interventions and encompass (i) the generation and tracking of media coverage for AMI events, results, and accomplishments; (ii) the development and distribution of informational printed, audiovisual, and Internet-based materials targeting a variety of audiences; and (iii) support for facilitating the publication of research and intervention results obtained by AMI technical partners.
The correct malaria diagnosis is the key to successful treatment.

3 ACTIVITIES AND ACCOMPLISHMENTS
“One of the primary contributions of AMI has been identifying malaria parasites’ resistance to drugs through a regional surveillance network. The initiative has also helped align the countries toward the best way to treat malaria by changing treatment policy.”

José Pablo Escobar de Pasco, PAHO representative, Colombia
This section describes the specific activities, products, and accomplishments of AMI, broken down by objective within major lines of work or problem areas.

ANTIMALARIAL MEDICINE RESISTANCE

OBJECTIVE 1: EVIDENCE BASE FOR AMAZON BASIN MALARIA PREVENTION AND CONTROL PRIORITIES IS INCREASED

Medicine efficacy surveillance network. In response to the increasing problem of antimalarial medicine resistance in the Amazon Basin subregion and the need for standardized medicine efficacy protocols, RAVREDA–AMI established a network of sentinel sites (with approximately 2–7 sites in the endemic areas of each AMI partner country) for the surveillance of medicine efficacy. The sentinel sites, all of which were existing health facilities, initially conducted in vivo medicine efficacy studies to assess the efficacy of the existing first-line malaria treatments, and tested treatments that were being considered for replacement. Now, as part of ongoing surveillance efforts, studies at these sites to monitor efficacy have been scheduled to occur every two to three years using standardized protocols that are based on guidelines developed by WHO with minor modifications.

Through in vivo therapeutic efficacy testing, the clinical and parasitological status of patients treated with a particular medicine over a fixed period of time is assessed repeatedly. The reappearance or persistence of malaria parasites—with or without accompanying symptoms and signs of clinical malaria—is used as an indicator of reduced parasite sensitivity to that medicine. The studies conducted through this surveillance network are meant to enable national malaria control programs in the region to monitor medicine efficacy and make informed decisions about changes in their malaria treatment policies.

Through this network, all AMI partner countries now have executed in vivo medicine efficacy studies for the treatment of malaria caused by P. falciparum using the standardized protocols, and Bolivia, Brazil, Colombia, Peru, and Venezuela have also done so for P. vivax malaria. To date, 74 medicine efficacy studies have been conducted at the sentinel sites (Table 2).

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<th>Country</th>
<th>Locality</th>
<th>Species</th>
<th>Medicine(s)</th>
<th>Year completed</th>
<th>No. patients evaluated</th>
<th>No. (%) patients with treatment failure</th>
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<td>46</td>
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<tr>
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<td>AQ</td>
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<td>El Bagre</td>
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</tr>
<tr>
<td></td>
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<td>46</td>
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<tr>
<td></td>
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<td></td>
<td>AS+SP</td>
<td>2004</td>
<td>51</td>
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<td>47</td>
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<td>2004</td>
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<td>2003</td>
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<td>2003</td>
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<td>SP</td>
<td>2003</td>
<td>44</td>
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<tr>
<td></td>
<td></td>
<td>PV</td>
<td>CQ</td>
<td>2003</td>
<td>34</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

18 Source: PAHO. In preparation. RAVREDA–AMI: An operational system for the surveillance of antimalarial drug resistance to improve the treatment of malaria in the Amazon region. See also sources cited therein.
<table>
<thead>
<tr>
<th>Country</th>
<th>Locality</th>
<th>Species</th>
<th>Medicine(s)</th>
<th>Year completed</th>
<th>No. patients evaluated</th>
<th>No. (%) patients with treatment failure</th>
</tr>
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<td>Tumaco</td>
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<td>2003</td>
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<td>2003</td>
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<td>50</td>
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<td></td>
<td></td>
<td>PV</td>
<td>CQ</td>
<td>2003</td>
<td>49</td>
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<tr>
<td></td>
<td>Turbo</td>
<td>PF</td>
<td>AQ</td>
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<td></td>
<td></td>
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<td>20</td>
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</tr>
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<td></td>
<td></td>
<td>PV</td>
<td>CQ</td>
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<td></td>
<td></td>
<td>CQ+SP</td>
<td>2003</td>
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<td></td>
<td></td>
<td>PV</td>
<td>AQ</td>
<td>2003</td>
<td>22</td>
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<td></td>
<td>Esmeraldas-Milagro-Santo Domingo</td>
<td>PF</td>
<td>AT+LM</td>
<td>2005</td>
<td>62</td>
<td>0 (0)</td>
</tr>
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<td>Machala</td>
<td>PF</td>
<td>AS+SP</td>
<td>2003</td>
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<td>CQ</td>
<td>2003</td>
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</tr>
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<td>2003</td>
<td>49</td>
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<td></td>
<td>Santo Domingo</td>
<td>PF</td>
<td>AQ</td>
<td>2004</td>
<td>60</td>
<td>28 (46.7)</td>
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<td><strong>Guyana</strong></td>
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<td>PF</td>
<td>AT+LM</td>
<td>2004</td>
<td>72</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2008</td>
<td>63</td>
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<td></td>
<td>Madhia</td>
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<td>AS+MQ</td>
<td>2005</td>
<td>82</td>
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<td></td>
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<td>2005</td>
<td>95</td>
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<td>CQ</td>
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<td></td>
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<td>Marowijne</td>
<td>PF</td>
<td>AT+LM</td>
<td>2003</td>
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<td></td>
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<td>2003</td>
<td>49</td>
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<td>2002</td>
<td>52</td>
<td>3 (5.8)</td>
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<td></td>
<td></td>
<td></td>
<td>2003</td>
<td>41</td>
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<td></td>
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<td>2003</td>
<td>53</td>
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<td>Species</td>
<td>Medicine(s)</td>
<td>Year completed</td>
<td>No. patients evaluated</td>
<td>No. (%) patients with treatment failure</td>
</tr>
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<td>---------</td>
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<td>------------------------</td>
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<tr>
<td>Venezuela</td>
<td>Atures</td>
<td>PF</td>
<td>AS+MQ</td>
<td>2005</td>
<td>60</td>
<td>0 (0)</td>
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<tr>
<td></td>
<td></td>
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<td>2005</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>CQ</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Q+PQ</td>
<td>2003</td>
<td>52</td>
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<tr>
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<td>CQ</td>
<td>2005</td>
<td>65</td>
<td>1 (1.5)</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>CO+PQ</td>
<td>2002</td>
<td>102</td>
<td>0 (0)</td>
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<tr>
<td></td>
<td>KM 88</td>
<td>PV</td>
<td>CQ</td>
<td>2003</td>
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<td>Tumeremo</td>
<td>PF</td>
<td>CQ</td>
<td>2002</td>
<td>21</td>
<td>16 (76.2)</td>
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<tr>
<td></td>
<td></td>
<td>Q+PQ</td>
<td>2003</td>
<td>45</td>
<td>10 (22.2)</td>
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<tr>
<td></td>
<td>PV</td>
<td>CQ+PQ</td>
<td>2003</td>
<td>94</td>
<td>0 (0)</td>
<td></td>
</tr>
<tr>
<td>Yaguara paro</td>
<td>PV</td>
<td>CO+PQ</td>
<td>2002</td>
<td>102</td>
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Notes: AQ, amodiaquine; AS, artesunate; AT, artemether; CQ, chloroquine; DX, doxycycline; LM, lumefantrine; MQ, mefloquine; Q, quinine; PF, Plasmodium falciparum; PQ, primaquine; PV, Plasmodium vivax; SP, sulfadoxine–pyrimethamine.

* Studies in Colombia and Ecuador were carried out in the Pacific Coast region of each country and in northern Colombia.

New techniques for ongoing resistance surveillance. In vitro tests and molecular markers of resistance constitute the next step in the surveillance system. Because such techniques can potentially permit the early detection of resistance to new medicines used in the region when in vivo tests are not possible, they may be particularly appropriate as part of an antimalarial medicine resistance early warning system and in a lower-transmission context. RAVREDA–AMI recently has made progress in the standardization of the methodology for the use of enzyme-linked immunosorbent assay (ELISA)–based in vitro tests to monitor temporal and spatial variations in medicine susceptibility. In addition, molecular markers of resistance to some antimalarial medicines have been identified in recent years. In the Amazon Basin subregion, the use of such tools may be particularly useful for monitoring resistance to sulfadoxine–pyrimethamine, which remains a component of first-line therapy in parts of Ecuador, Peru, and Colombia.

Since 2003, AMI has supported efforts in Peru and Ecuador to process samples for molecular markers to the antimalarial medicine sulfadoxine–pyrimethamine. In 2004, to support the development of techniques for using molecular markers of resistance, RAVREDA–AMI provided support for technical personnel from the countries to attend a basic course in molecular epidemiology. Beginning in 2005, AMI has supported trainings in the use of the in vitro medicine efficacy methodology standardized by RAVREDA–AMI in Brazil, Colombia, Guyana, Peru, and Venezuela; preliminary results using ELISA were obtained at the end of 2006. At a meeting of experts in São Paolo, Brazil, participants designed an approach and priorities for using these tools to contribute to malaria control in the subregion and to identify possibilities for AMI and RAVREDA to participate. In 2008, the CDC started to work intensely in training partner country scientists in molecular epidemiology and also assisted them on processing samples already collected.

OBJECTIVE 2: EVIDENCE BASE FOR AMAZON BASIN MALARIA PREVENTION AND CONTROL PRIORITIES IS COMMUNICATED AND USED

By evaluating the official treatment regimens in use, the national malaria control programs of the partner countries now have a good understanding of the current distribution and intensity of resistance to antimalarial medicines. The in vivo medicine efficacy studies conducted through the network have also confirmed the efficacy of artemisinin derivatives as alternative treatments, and each country has modified its malaria treatment policy accordingly.19

19 Peru and Bolivia previously had evaluated ACTs and their existing first-line treatments prior to the initiation of RAVREDA using essentially the same protocol.
In addition, each partner country has adopted a monitoring plan under which the regimens in use are scheduled to be reevaluated every two to three years. In this way, in vivo surveillance will allow for continued evidence-based adjustments to policy, while network sites continue to focus on routine malaria treatment as their principal activity. The steep decrease in malaria cases, especially in *P. falciparum*, has hindered the execution of in vivo studies in some areas. The partners are actively discussing this situation and pursing alternatives for medicine efficacy monitoring.

**OBJECTIVE 3: MORE INCLUSIVE AND BETTER INFORMED POLICY PROCESSES ARE PROMOTED**

Prior to the in vivo studies conducted through RAVREDA–AMI, several countries employed chloroquine or sulfadoxine–pyrimethamine monotherapy\(^{20}\) as their first-line treatments for *P. falciparum* infections. As a direct consequence of the efficacy tests, each partner country has evaluated one or more ACT regimens, shown them to be safe and efficacious, and implemented these combinations as their first-line treatments for uncomplicated *P. falciparum* malaria. Changes in treatment policies are shown in Figure 1.

AMI partners expect national malaria control programs to continue to make informed malaria treatment decisions based on the ongoing in vivo efficacy tests at the sentinel sites and, in the future, the results of surveillance efforts employing in vitro assays and molecular markers. Recommendations for monitoring the efficacy of and resistance to antimalarials in low-transmission conditions, using a combination of the tools available, were produced in an AMI workshop held in Washington, DC, in September 2008. This workshop responded to the current situation of malaria in the region.

**FIGURE 1. CHANGES IN FIRST-LINE TREATMENTS FOR UNCOMPROMISED P. FALCIPARUM MALARIA FROM 1998 TO 2006 IN AMAZON COUNTRIES ANTIMALARIAL POLICY CHANGE**\(^{21}\)

<table>
<thead>
<tr>
<th>AT+LM</th>
<th>MQ+AS</th>
<th>SP+AS</th>
<th>AQ+AS</th>
<th>MQ</th>
<th>Q+DX/Q+T</th>
<th>Q</th>
<th>Q + SP</th>
<th>AQ+SP</th>
<th>CQ+SP</th>
<th>CQ or SP</th>
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<tbody>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

- Late 1990s
- 2006

**Notes:** By 2006, based on evidence of geographic variation in antimalarial resistance, Colombia had established distinct treatment policies for its Pacific Coast region and the remainder of the country’s endemic area, and Peru had established distinct treatment policies for its Pacific Coast and Amazon regions. AQ, amodiaquine; AS, artesunate; AT, artemether; CQ, chloroquine; DX, doxycycline; LM, lumefantrine; MQ, mefloquine; Q, quinine; SP, sulfadoxine–pyrimethamine; T, tetracycline.

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\(^{20}\) Although sulfadoxine–pyrimethamine is a combination of two drugs, it is considered to be monotherapy rather than a combination therapy because its effectiveness relies on the synergistic actions of the two components (WHO 2006a).

**DIAGNOSTIC QUALITY ASSURANCE AND ACCESS TO DIAGNOSIS**

**OBJECTIVE 1: EVIDENCE BASE FOR AMAZON BASIN MALARIA PREVENTION AND CONTROL PRIORITIES IS INCREASED**

AMI’s approach to improving diagnostic QA and access to diagnosis in AMI partner countries is based on the general principle that all malaria treatment in the Amazon Basin should be based on a laboratory diagnosis using either microscopy or an RDT. Microscopy generally is considered the gold standard for malaria diagnosis because it allows for a determination of parasite density and has higher sensitivity. Therefore, AMI supports the strengthening of microscopy in those settings where it already exists and promotes extending coverage with it where feasible. The use of RDTs is complementary to microscopy and provides a means of extending laboratory diagnosis to other settings. For example, RDTs could be used in more peripheral health facilities that lack laboratories, at the village level by community health workers, when or where microscopists are not available.

To promote improvements in QA/QC systems for malaria diagnosis in the Amazon countries, RAVREDA–AMI has facilitated an increased understanding and more effective use of performance monitoring (microscopy diagnosis validation) and proficiency testing of the microscopists responsible for the laboratory diagnosis of malaria. RAVREDA–AMI seeks to help improve national systems for microscopy QA/QC, contribute to the establishment of regional or national systems for the QA/QC of RDTs, and establish national guidelines on the operational requirements for the use of RDTs.

**Diagnostic quality guidelines.** As an initial step, AMI technical partners met with regional experts on quality management in malarial microscopy to evaluate diagnostic quality management systems in use in AMI countries and to find ways to improve their efficiency. They then produced a set of guidelines with recommendations for improving diagnostic QA management systems that are consistent with WHO priorities. The recommendations addressed (i) the need to adopt procedures consistent with the International Organization for Standardization (ISO) 15189 framework and the Clinical and Laboratory Standards Institute; (ii) changes in the methodology used by the countries for performance monitoring; (iii) the use of tools such as proficiency testing procedures using prepared slide sets, or panels; and (iv) rationalizing, correcting biases in, and increasing the objectivity of traditional procedures for the validation of readings during performance monitoring.

The guidelines include several recommendations to correct weaknesses in the countries’ existing performance monitoring practices, including suggestions to (i) reduce the frequency of evaluation, (ii) reduce the number of slides to be evaluated in each period, (iii) ensure the randomized selection of slides to be validated by a third party, and (iv) ensure blind validation of slides by the validation laboratory. The guidelines also address results analysis and decision-making. Regarding the assessment of microscopists’ competency, the recommendations include suggestions for specific procedures, the roles of the different levels of the laboratory network, the appropriate composition and preparation of panels, and decision-making. The guidelines additionally define procedures for material shipment, information flow, assessment frequency, and analysis parameters.

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To facilitate the implementation of the new guidelines, AMI has provided TA and funding for a number of activities in the partner countries—in cooperation with national malaria control programs and in conjunction with local efforts and South–South collaboration activities—with a focus on those countries with the greatest diagnostic quality limitations. These activities have included (i) training to improve the competency of microscopists, (ii) efforts to introduce proficiency testing as a component of diagnostic QA/QC systems, and (iii) efforts to improve the efficiency of performance monitoring.

**Training to improve competency.** AMI supported a number of workshops (Table 3) geared toward improving competency in diagnosis. Evaluations conducted before and after training sessions demonstrated improvements in the competency of microscopists in Bolivia, Ecuador, Guyana, Suriname, and Venezuela.

### TABLE 3. TRAINING COURSES IN MALARIA MICROSCOPY SUPPORTED BY RAVREDA–AMI, 2002–2006

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Province or city</th>
<th>Institution</th>
<th>Participants</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolivia</td>
<td>2005</td>
<td>Cobija</td>
<td>INLASA</td>
<td>48 staff members: 2 physicians, 9 nurses, 28 technical personnel in malaria, and 9 volunteers</td>
<td>Procedures for hematic extended sampling and processing of thick blood film; microscopy malaria diagnosis</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>Riberalta</td>
<td>INLASA</td>
<td>17 staff members: 5 nurses, 7 technical personnel in malaria, 5 volunteers, and all staff of the MSyD</td>
<td>Procedures for hematic extended sampling and processing of thick blood film; microscopy malaria diagnosis</td>
</tr>
<tr>
<td>Ecuador</td>
<td>2005</td>
<td>Esmeraldas</td>
<td>SNEM</td>
<td>Technical personnel from 55 centers of diagnosis of the MSP and 34 from the private sector</td>
<td>Technique standardization and reading of thick blood film</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>El Oro</td>
<td>SNEM</td>
<td>Technical personnel from 7 centers of diagnosis of the MSP and 38 from the private sector</td>
<td>Technique standardization and reading of thick blood film</td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>Manabí</td>
<td>SNEM</td>
<td>46 technical personnel from centers of diagnosis of the MSP and from 1 private sector center</td>
<td>Technique standardization and reading of thick blood film</td>
</tr>
<tr>
<td>Guyana</td>
<td>2003</td>
<td>Georgetown</td>
<td>MOH Malaria Program</td>
<td>21 microscopists</td>
<td>Updating (refreshing)</td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>Georgetown</td>
<td>MOH Malaria Program</td>
<td>11 microscopists</td>
<td>Updating (refreshing)</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>Georgetown</td>
<td>MOH Malaria Program</td>
<td>24 microscopists</td>
<td>Updating (refreshing)</td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>Lethem</td>
<td>MOH Malaria Program</td>
<td>12 microscopists</td>
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</tr>
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</table>
Proficiency testing. Pilot projects conducted to date to introduce proficiency testing include those conducted in Brazil and Ecuador.

A pilot project to assess malaria diagnostic competence was coordinated by the General Office for Laboratory Coordination of MOH and the malaria reference laboratory of the Instituto Evandro Chagas (Evandro Chagas Institute). Laboratories were assessed according to their abilities to detect the presence of the parasite and identify the species and stage. The assessment found 55% agreement on species and 91% agreement on \textit{P. falciparum} stage. Of the 11 laboratories participating in the pilot project, 5 (45.5%) were deemed satisfactory and the remaining 6 (54.5%) were considered in need of training.

In 2005, a diagnostic quality management system was introduced in two pilot provinces of Ecuador—Esmeraldas and El Oro—with the participation of approximately 80 laboratories in Esmeraldas and nearly 130 in El Oro. As part of the pilot system, slide panels are prepared at the national level, and each microscopist is assessed at least twice each year using a double-blind evaluation (i.e., one in which neither those who select the slides nor those who examine them know the diagnosis). In 2006, this system was also introduced in the provinces of Manabí, Los Ríos, and Guayas. A software application was developed to facilitate the analysis of the results of diagnostic QC, and analytical and decision-making routines have been established. In particular, proficiency testing performed in Esmeraldas with 25 Ministerio de Salud Pública (MSP; Ministry of Public Health) laboratories indicated that 7 of these laboratories were deemed in poor agreement in October 2005; by March 2006, all 25 laboratories had achieved acceptable agreement.
Performance monitoring. Activities to improve the efficiency of performance monitoring have also been undertaken in Brazil and Ecuador. At a meeting coordinated by Brazil’s Malaria Control Program and the MOH’s General Office for Laboratory Coordination, the technical personnel responsible for QC in endemic states and at the Evandro Chagas Institute reference laboratory agreed to introduce changes in performance monitoring by reducing the number of slides, including the use of randomized slide selection, ensuring blind review, and giving priority to slides with low levels of parasitemia.24

Based on the recommendations of the RAVREDA–AMI guidelines, a number of changes were introduced to Ecuador’s indirect supervision methodology in 2005, including the following: (i) microscopists should send all positive slides, individually packaged and labeled, as well as negative slides, to validation laboratories; (ii) the slides to be evaluated should be selected at random; (iii) the procedure should be double blind; and (iv) a maximum of 100 slides should be examined. This methodology has been implemented in the provinces of Esmeraldas and El Oro and is expected to be implemented soon in Manabi, Los Rios, and Guayas. Results of the performance monitoring evaluations of 25 microscopists that perform diagnosis in the MSP and in 21 private laboratories are noteworthy. In December 2005, 6 of the 25 microscopists (24%) evaluated with slide validation of 100 slides were rated as “fair,” 4 (16%) as “unacceptable,” and the remaining 15 (60%) as “good.” By April 2006, all 25 were classified as “good.”

Rapid diagnostic tests. To define the priorities of AMI in relation to RDTs, the initiative supported a 2005 workshop in Guayaquil, Ecuador, with two objectives: (i) to define lines of operations research on the implementation of RDTs and (ii) to establish a work plan for joint operations research among Amazon countries to be conducted within the RAVREDA–AMI framework. Most recently in 2008, CDC working with WHO and other partners found that some of the P. falciparum parasites in the region lacked the gene responsible for the HRP-2 protein. This protein is used as the diagnostic piece of some commonly used RDTs and this finding may impair these RDTs ability to detect malaria infections. CDC started working with partners to collect samples from countries in the region to assess the extent of this occurrence and make recommendations about RDT use.

OBJECTIVE 2: EVIDENCE BASE FOR AMAZON BASIN MALARIA PREVENTION AND CONTROL PRIORITIES IS COMMUNICATED AND USED

The guidelines and activities developed under RAVREDA–AMI have begun to improve the effectiveness of the diagnostic QA/QC systems in the countries of the Amazon Basin subregion. Improved management of diagnostic quality in Amazon countries will permit public health laboratories to train personnel, provide supervision and monitoring, carry out operations research, report and disseminate information for decision-making, and participate in the design of interventions to improve malaria treatment.

Some countries and provinces are in the process of adopting new proficiency testing and performance monitoring methodologies. Examples of AMI’s impacts on the use of information regarding diagnostic quality management are described below:

- The 2004 update to Bolivia’s national manual on malaria prevention and control included a new model of diagnostic quality management based on the RAVREDA–AMI guidelines and recommendations.
- In response to the findings from proficiency testing in Brazil, the Evandro Chagas Institute, the malaria laboratory of the Instituto Oswaldo Cruz (Oswaldo Cruz Institute), and the MOH’s General Office for Laboratory Coordination have begun joint efforts to assess the competence of microscopists in state validation laboratories.
- AMI technical partners are working with national authorities and reference laboratories in Brazil on a document intended to change the performance monitoring methodology as described above. Selected states will implement the methodology as a pilot project following a competence assessment using the panels promoted by RAVREDA–AMI.

24 Parasitemia refers to the level of parasites in the blood.
• Although Colombia’s Instituto Nacional de Salud
(National Institute of Health) had previously
recommended the use of panels to evaluate the
competence of microscopists, additional changes have
now been introduced in the methodology with respect
to the number of slides in each panel; the inclusion
of positive specimens, negative specimens, artifacts,
and negative results for other hematozoa; and
adjustments in scoring criteria. In addition, a national
recommendation was made to implement changes
in performance monitoring in accordance with the
methodology proposed by RAVREDA–AMI.

• In Ecuador, the Servicio Nacional de Erradicación
de la Malaria (SNEM; National Malaria Eradication
Service) is taking action to promote the official
adoption by the MSP of the proficiency testing
methodology that was pilot tested in 2005 and 2006.

• In 2008, officials in Ecuador produced a guidance
document regarding the new performance
monitoring methodology described above. AMI
technical partners are providing recommendations to
more fully incorporate the WHO recommendations.

• In Guyana, national health authorities designed a
new policy for the preparation of smears in malaria
diagnosis and developed updated malaria diagnosis
guidelines. Staff at the central level have been
trained, and improvements have been recorded in
the competence and performance of microscopists.

• In Suriname, a protocol for implementing a QC
system for the microscopy diagnosis of malaria
was designed with RAVREDA–AMI funds and
was prepared by Dutch microscopist Truss Derks.
This protocol includes an external performance
monitoring component and methodology for the
QC of RDTs.

ANTIMALARIAL MEDICINE QUALITY

OBJECTIVE 1: EVIDENCE BASE FOR AMAZON
BASIN MALARIA PREVENTION AND CONTROL
PRIORITIES IS INCREASED

To ensure sustainable access to and use of effective and
quality-assured antimalarial medicines, AMI countries
may consider the implementation of national QA/
QC systems that guarantee the following: registration
of malaria medicines on the basis of sound evidence
for quality, safety, and efficacy; procurement of
medicines by the MOHs from reliable sources;
quality assessment of medicines before they enter the
distribution chain; and implementation of a post-
marketing surveillance program to assess the quality
of malaria medicines at critical stages throughout the
distribution chain. With respect to the latter, rapid
and effective communication between the stakeholders
involved in post-marketing surveillance activities and
the national institution that has the mandate and
power to implement corrective actions is required to
ensure that poor-quality medicines are immediately
withdrawn from circulation and that the proper action
is implemented to address the cause of the problem.

AMI has contributed to raising awareness about
medicine quality issues among all Amazon countries.
In particular, the initiative has promoted quality
systems for medicines used in malaria programs that
emphasize two main objectives: (i) consolidate QA
processes during the procurement of antimalarial
medicines by the MOHs and (ii) establish systems
to control the quality of antimalarials and their
determinants in the health services network.

To accomplish its objectives to ensure the quality of
antimalarial medicines, AMI has conducted activities
in three complementary areas: (i) strengthening
the OMCL in each country by providing guidance
on quality management systems, training in
pharmacopeial techniques, and the provision of
analytical supplies and equipment; (ii) assisting in
implementing a decentralized methodology in the
subregion to monitor and control the quality of
medicines under the conditions in which they are
stored and distributed in endemic areas through the
use of portable laboratories, or Minilabs® (produced
by Global Pharma Health Fund e.V. [GPHF]); and
(iii) raising awareness about the issue of antimalarial
medicine quality among Amazon countries by
documenting shortcomings in QA systems.

Strengthening OMCLs. AMI has contributed to
technical improvements in the OMCLs of Amazon
countries by assessing laboratory conditions, training

25 A hematozoon (plural, hematozoa) is a parasite found in the blood.
personnel, and providing other support between 2003 and 2008. These activities, coordinated by PAHO and USP/DQI, emphasized training in (i) good laboratory practices (GLP); (ii) the provision and use of testing equipment; (iii) analytical techniques, such as dissolution, high-performance liquid chromatography (HPLC), UV, and gas chromatography (GC); and (iv) the appropriate use of monographs for the main antimalarials used in the region.

For example, in 2005, a workshop in Georgetown, Guyana, trained professionals from the national OMCL (the MOH's Food and Drug Department, or FDD), academia, and the private sector (the pharmaceutical company New GPC, Inc.) in the QC of first-line antimalarial medicines for malaria caused by *P. vivax* and *P. falciparum*. The workshop focused on the adequate use of HPLC and dissolution test equipment according to compendial specifications and GLPs. The quality of chloroquine and primaquine prepared locally by the New GPC laboratory and used in the National Health Program was evaluated, and methodological guidelines were also established for the QC of the antimalarials mefloquine, artesunate, and quinine.

In 2006, following a request by the FDD for more in-depth training on GLP and specific laboratory methodologies, an additional workshop was performed at Guyana’s OMCL. The purpose of this workshop was to (i) train participants on how to perform dissolution, HPLC, and UV testing according to USP methodology; (ii) train analysts on GLP, strongly emphasizing traceability, recordkeeping, reproducibility of data, organization of laboratory work, and proper use of laboratory equipment; and (iii) train the participants on how to properly use the General Notices chapter of the *U.S. Pharmacopeia National Formulary* (USP–NF). The 17 workshop participants included staff from the FDD, New GPC, Inc., the MOH, Regional Health Services, and Guyana’s Malaria Control Program.

At a regional workshop held in July 2008 in Bogotá at the laboratory of the Subdirección de Medicamentos y Productos Biológicos (Subdirectorate of Medications and Biological Products) from the Instituto Nacional de Vigilancia de Medicamentos y Alimentos (INVIMA; National Institute of Drug and Food Surveillance, Colombia’s OMCL), participants learned to (i) effectively perform GC analysis according to USP–NF specifications, (ii) properly use a particular type of laboratory equipment (a headspace apparatus), (iii) better understand GC and the headspace apparatus troubleshooting procedures, (iv) improve certain laboratories’ procedures, and (v) use and interpret more effectively the USP–NF Residual Solvents General Chapter. A total of 18 analysts attended from INVIMA, the Colombian network of laboratories, and OMCLs from Brazil, Colombia, Ecuador, Peru, Guatemala, and Panama.

Brief descriptions of additional workshops, training sessions, and other TA provided to date with funding and TA by AMI are listed below:

- A 2003 workshop in Guayaquil, Ecuador, sought to implement a QC program for antimalarial medicines. Attendees included 54 participants from different regions in Ecuador and 21 laboratory personnel from Bolivia, Brazil, Ecuador, Guyana, Peru, Suriname, and Venezuela.

- In 2004, AMI technical partners visited Peru’s Instituto Nacional de Salud (INS; National Institute of Health), Centro Nacional de Control de Calidad (CNCC; National Center for Quality Control, Peru’s OMCL) to introduce AMI and to assess the facilities, laboratories, laboratory equipment, staffing, and procedures.

- At a 2005 workshop in La Paz, Bolivia, participants standardized analytical techniques (identification, dissolution, and quantification) suitable for tablets of two antimalarial medicines—artesunate and mefloquine. Fourteen personnel from Bolivia, Ecuador, and Paraguay participated.

- In 2008, at the Instituto Nacional de Higiene y Medicina Tropical (NHMT; National Institute of Hygiene and Tropical Medicine) “Leopoldo Izquieta Pérez” in Guayaquil, Ecuador, a regional training workshop attended by 27 OMCL personnel from

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26 In the pharmacopeial field, the term monograph refers to a set of guidelines—including test procedures—for a particular medicinal ingredient or preparation.

27 Compendial (or pharmacopeial) practices are those that follow the procedures described in the monographs (or guidelines) used for the analysis of medicines.
Brazil, Colombia, Ecuador, Guatemala, Honduras, and Panama addressed (i) the proper use of the USP–NF, emphasizing HPLC, ultraviolet (UV), dissolution, and uniformity of content techniques, as well as the General Notices and (ii) GLP, strongly emphasizing traceability, recordkeeping, safety, reproducibility of data, organization of laboratory work, and the proper use of laboratory equipment.

• In 2008, two interns—one from Peru’s CNCC and one from Colombia where INVIMA is located—spent three months as interns at USP’s ISO 17025:2005–accredited laboratories. The ultimate objective of the internship was that the trainees would, upon return to their home countries, share their experiences and knowledge to strengthen the capabilities of their OMCLs and support management and operational procedures toward attaining working conditions compliant with internationally recognized standards, such as 17025:2005 accreditation and/or WHO prequalification. (In April 2009, CNCC was awarded ISO/IEC 17025:2005 accreditation, certifying that the laboratory’s technical operations and administrative systems are functioning at the highest quality levels by international standards.)

Monitoring and improving the quality of antimalarial medicines at sentinel sites. Following the assessments by AMI technical partners of the storage conditions and availability of antimalarial medicines in sentinel sites and feedback from in-country stakeholders, AMI partners decided to implement a strategy that included monitoring the quality of antimalarials under the storage and dispensing conditions found in the field, using basic tests in decentralized locations. To enable the performance of the basic tests, GPHF Minilabs® were provided to all AMI partner countries. These portable laboratories provide an affordable way for countries with scarce human and financial resources to routinely screen the quality of antimalarials available in critical areas. Trained personnel perform visual and physical inspections of the medicines, followed by analytical basic tests conducted using the portable laboratories. Visual and physical inspections assess labeling and packaging properties and the appearance, conditions, and physical characteristics of the medicines. The basic tests performed utilizing the portable laboratories assess four critical quality attributes—identity, content (semi-quantitative), impurities, and, for solid dosage forms, disintegration.

Between 2005 and 2006, AMI coordinated four workshops, listed below, to provide training on the use of the portable laboratories, sampling, and analysis techniques in sentinel sites in Bolivia, Ecuador, Guyana, and Venezuela. Technical personnel from national and provincial laboratories in all AMI partner countries attended these workshops:

• Ecuador (2005): attendance Bolivia (2) and Ecuador (22)
• Venezuela (2005): attendance Brazil (3), Colombia (2), Ecuador (1), Guyana (2), Suriname (2), and Venezuela (9)
• Bolivia (2006): attendance Bolivia (12) and Peru (6)
• Guyana (2006): attendance Guyana (17) and Suriname (2)

As a result of AMI activities promoting and facilitating the use of portable laboratories for medicine quality testing, all AMI partner countries agreed to implement this approach to monitor the quality of antimalarial medicines in the field. All but one of these countries has now performed and reported the results of several rounds of monitoring using the portable laboratories. Performing basic tests with portable laboratories has been restricted so far to the assessment of the quality of antimalarials at decentralized storage facilities and dispensing sites. However, several AMI countries currently are developing strategies to integrate and institutionalize this approach throughout the supply chain. Institutionalizing the use of the basic test approach will help increase countries’ capabilities to ensure the quality of malaria medicines through the entire supply chain, including dispensing facilities at sentinel sites.

One field team is responsible for each portable laboratory, and includes personnel from the national malaria control program and the local institutions responsible for ensuring the quality of medicines in the regional health system. Each field team regularly collects and analyzes samples of antimalarial medicines.
currently in use in the health service network. To ensure some uniformity in sample collection, the field teams have adopted a methodology based on the stratification of the malaria burden (i.e., the number of cases). Field teams select towns in the provinces and municipalities with the highest malaria burden, where they identify three types of sampling sites: medicine storage centers, locations in the formal health services network, and malaria program diagnostic stations in outlying areas. In areas where antimalarial medicines are sold in the private and informal sector, such sites have oftentimes been included in the sampling. Nevertheless, most of the sampling to date has been performed in the public health sector. The medicines sampled first undergo “basic tests” using the portable laboratories. All of the failed and doubtful samples and a predetermined percentage of the medicines passed samples are then sent to the reference laboratory for verification analyses using the same basic tests. If further complementary analyses are still required, the selected medicines are analyzed with pharmacopeial methods at the OMCL.

As of April 2009 more than 1,400 malaria medicines have been sampled in seven AMI countries, and most of these samples have been analyzed. Partial results (from 946 medicines analyzed from 2006 to 2008) indicate that 8.2% of the medicines were expired, 9.2% were not registered, 3.0% presented a damaged package, 7.1% failed visual inspection, 1.5% failed disintegration, and 5.9% failed thin-layer chromatography (TLC) analysis. The individual countries vary widely in most of these measures. For example, the percentage of expired medicines among those sampled varied from 0% to 22.8%, and the percentage that failed TLC ranged from 0% to 20.3%. Further highlights of these results are provided below:

- Assessment of four critical quality attributes through disintegration and TLC revealed a total of 7.4% noncompliant medicines. Although worrisome, this percentage of noncompliance is still significantly below that reported in other regions of the world. However, most of the medicines in AMI countries were sampled from the public health sector; only minimal sampling was conducted from the private and/or informal sector. A more comprehensive analysis including all sectors may reveal a different situation. An ongoing study is assessing the private and informal sectors in Colombia, Guyana, and Suriname.

- The majority of the expired medicines were from one country, and most were identified in the first round of testing. In a subsequent round of testing, the number diminished, and no expired medicines were identified in the latest round. This highlights the importance of routine QC assessment as a diagnostic tool, which in this case allowed for a correction in the inventory of medicines stored at the sentinel sites.

- No quality problems were identified with artesunate and other artemisinin derivative medicines, in contrast to the situation reported in other malaria-endemic regions in the world. This is important because ACTs are the first-line treatment for malaria caused by the most dangerous malaria parasite, *P. falciparum*. However, these results do not include a medicine containing an artemisinin derivative that was sampled in the private and informal sector in Suriname. For this medicine, whose use is not included in the national treatment strategy, a basic test methodology is not currently available. The presence of counterfeit and/or substandard samples of ACTs would pose a risk of contributing to the development of resistance to a treatment that has no foreseeable replacement in the near future. Again, however, these samples are mostly from the public sector; the findings in the private and/or informal sectors may be different.

**Improving shortcomings in QA systems.** One of AMI’s key objectives is to contribute to the implementation of strategies and activities that are sustainable and will continue to be implemented once AMI funding is no longer available. For the quality of antimalarial medicines, two components must be considered for this process: (i) strengthening the capabilities of the institutions that perform analytical testing (as detailed above) and (ii) ensuring that QA systems establish the appropriate procedures to guarantee the quality of the medicines throughout the entire supply chain, including the identification and correction of issues that could compromise the delivery of good-quality medicines (discussed in this section).

Some of the shortcomings and barriers to implementing sustainable QA systems became evident through AMI-sponsored activities such as
those described above. In addition, RAVREDA–AMI promoted specific evaluations in Guyana and Brazil; these case studies have helped AMI document the magnitude of the antimalarial medicine quality problem, provide evidence to regulatory authorities, and encourage actions to correct the deficiencies (see Objective 2, below).

First, in Guyana, the AMI–funded evaluation—carried out by the FDD with the support of AMI technical partners—consisted of a round of quality analyses of the antimalarials used in gold mining areas. In the Amazon region, gold mining areas are important foci of malaria transmission. In countries such as Guyana, Suriname, and Venezuela, they are responsible for most of the malaria-related burden of disease. Sales of illegal antimalarials, self-medication, incomplete treatment, and the use of monotherapy with suboptimal doses are frequent problems of malaria treatment in gold mining areas. Such practices lead to persistent transmission in these areas, result in risks to the lives of individuals, and are major determinants in the emergence and spread of antimalarial resistance.

Mining areas are among the locations at greatest risk for the circulation of substandard antimalarial medicines. So a rapid study of the QC of antimalarials used in these areas in Guyana was conducted by AMI technical partners. Samples of the antimalarials were collected at points of sale in the gold mining areas and sent to USP where the samples were analyzed. The results were sent to Guyana’s health authorities for actions to increase control and prevention. At the same time, a new study to assess the quality of medicines available at various mining sites began and is ongoing in Guyana and Suriname.

In 2005, the MOH of Brazil, with support from the QC laboratory and the Federal University of Minas Gerais, evaluated the quality of antimalarials procured at the national level (under regular conditions of storage) in health units and at points of distribution. Two malaria treatment units were selected in each of three states (Amazonas, Pará, and Rondônia), based on epidemiological criteria and the number of malaria cases. Samples of four basic medicines—chloroquine, primaquine, quinine, and mefloquine—were left for five months in each selected health unit. After this period, content analysis and dissolution testing were conducted using pharmacopeial techniques.

Several of the activities undertaken or supported by AMI had been limited in scope and had not been formally integrated into the daily functioning of malaria programs. To resolve this issue and incorporate the lessons learned from the case studies and other regional and in-country activities, AMI partners decided to focus on supporting the integration and institutionalization of national malaria control program QA/QC activities into national QA systems.

In Bogotá, Colombia, in May 2008, 50 participants (from Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, and Suriname) attended a regional workshop to improve the management of supply and QA systems for malaria. The primary objective of this workshop was for each country to develop technical procedures that will serve as the basis for the institutionalization and integration of processes that will result in an uninterrupted supply of medicines of guaranteed quality. AMI technical partners are currently collaborating with in-country stakeholders to develop and implement these technical procedures to create sustainable systems.

Additionally, in support of extending AMI’s approach and experiences to Central American countries, a workshop similar to that described above was provided in Guatemala City, Guatemala, in November 2008. The workshop was attended by 29 participants from Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama. Planning of future work with Central American countries is ongoing.

**OBJECTIVE 2: EVIDENCE BASE FOR AMAZON BASIN MALARIA PREVENTION AND CONTROL PRIORITIES IS COMMUNICATED AND USED**

In peripheral zones with malaria incidence, AMI has contributed to the establishment of a decentralized monitoring system for rapid and economical QC. In countries with scarce human and financial resources, the use of portable laboratories allows for constant assessment of antimalarial medicine quality that otherwise would go unchecked. Additionally, as a result of AMI–supported activities, the OMCL personnel of all AMI countries are now better able to ensure the quality of antimalarial medicines.
This resulted after numerous trainings in analytical techniques and GLP as well as after improving the supply of basic instruments needed. To further facilitate analytical capabilities, USP has initiated a free-access publication on its Internet portal of monographs for medications used to treat neglected diseases—including malaria—that are not marketed in the United States (USP non-U.S. monographs) and for which there are no available monographs.

Examples of specific outcomes related to the use of the increased evidence base regarding medicine quality are summarized below.

Brazil. Based on the results of the antimalarial quality evaluation (described above), the MOH instigated a review of deficiencies in the manufacturing process and required the manufacturing laboratories to correct these problems. Further, the national malaria control program is promoting the adoption of routine procedures for evaluating the quality of procured antimalarials.

Ecuador. In Ecuador during the past two years, the NHMT has conducted QC of all antimalarial batches that were acquired by the MSP and received as donations. In addition, findings of quality deficiencies in primaquine samples allowed officials to remove them from MSP warehouses and to define the methodology and procedures that they subsequently adopted for selecting and acquiring antimalarials, in accordance with the technical guidelines of SNEM. Findings related to deficiencies in the storage of antimalarials in the regions studied in Ecuador (i) prompted the development and distribution of guidelines on good practices for antimalarial storage, (ii) prompted the provision of training workshops for staff involved in physically modifying all SNEM warehouses to meet the minimum technical requirements established for this purpose, and (iii) resulted in the promise of support from other MSP authorities and international organizations.

Guyana. As a result of the antimalarial quality evaluation conducted in mining areas (described above), the FDD routinely conducts quality analyses of antimalarials available in the country and those used by the national malaria control program and in self-medicating mining populations.

AMTI MEDICINE ACCESS AND USE

OBJECTIVE 1: EVIDENCE BASE FOR AMAZON BASIN MALARIA PREVENTION AND CONTROL PRIORITIES IS INCREASED

AMI technical partners identified weaknesses in several areas related to the access to and use of quality antimalarial medicines in AMI partner countries, including (i) the quantification, procurement, and supply management processes; (ii) policies related to the appropriate use of antimalarials; and (iii) an integrated supervision system to monitor antimalarial access and use. (Some of these problems were exacerbated by changes in the malaria treatment regimens in AMI partner countries, as described in the Antimalarial Drug Resistance section above.)

RAVREDA–AMI has thus collaborated with the partner countries to institutionalize best practices to address these weaknesses. To achieve this goal, AMI technical partners have systematically intervened in all components of the pharmaceutical cycle. The pharmaceutical management framework developed by MSH (Figure 2) depicts the flow of activities that must be coordinated to ensure that appropriate, good-quality medicines are available when patients need them. The framework emphasizes the relationships among the key components of pharmaceutical management—selection; procurement; distribution; use; management support; and policies, laws, and regulations—and guides the determination of appropriate system-strengthening interventions given a country’s specific health system and economic and political situations.

The AMI approach. AMI technical partners (i) address product quality issues by ensuring that the appropriate stakeholders can ensure and evaluate the quality of antimalarial medicines at the time of registration, procurement, and throughout the supply
chain (also see Activities and Accomplishments section regarding Antimalarial Drug Quality, above); (ii) provide TA related to overall management support for antimalarial medicines and supplies, including pharmaceutical system design and human and institutional capacity building; and (iii) facilitate activities in all AMI countries through experts in the area of health policy and local contacts with national technicians and health authorities.

FIGURE 2. PHARMACEUTICAL MANAGEMENT FRAMEWORK

Source: MSH

FIGURE 3. THE AMI EVIDENCE-BASED APPROACH TO IMPROVE ACCESS TO AND USE OF QUALITY-ASSURED ANTIMALARIAL MEDICINES AND SUPPLIES

Sensitize counterparts to the role of good pharmaceutical management in reaching policy goals

Identify problems and causes of poor availability and use of antimalarials through assessments

(a) Improve procurement and supply chain management
(b) Improve QA/QC systems
(c) Improve rational use strategies

Monitor availability and use of medicines

Evaluate country results
Through this comprehensive approach (Figure 3), AMI technical partners have worked with national counterparts in AMI countries to conduct assessments identifying issues affecting the access to and use of quality-assured antimalarials. Based on these assessments, AMI partners supported regional and national activities, including (i) training workshops; (ii) subregional meetings with opportunities for knowledge exchange; (iii) the development of guides, tools, and standard operating procedures; (iv) studies of adherence and care practices; and (v) direct TA to national counterparts in all seven countries.

AMI principles for planning, conducting, and evaluating activities supported by the initiative are to:

• work closely with national governments, international organizations, and within existing malaria control plans and programs to ensure that investments are complementary;

• develop the capacity of national institutions and staff to address the challenges of malaria control in their countries to ease the scaling-up process and attain sustainability;

• employ a comprehensive, evidence-based approach;

• strengthen surveillance, monitoring, and evaluation to improve program effectiveness; and

• document and rapidly disseminate best practices to other countries and regions.

In an initial sensitization phase, AMI technical partners encouraged national malaria control programs to review matters related to medicine access and use and to bring this issue to the attention of the MOHs. In the second phase, AMI technical partners focused on the identification of problems and causes of poor availability and use of antimalarials through assessments. This phase began with some preliminary studies on the availability and use of antimalarials and the implementation of a methodology developed by MSH to evaluate the access to and use of antimalarials. The third phase focused on the improvement of antimalarial procurement and supply chain management as well as improvements in rational use strategies. In this phase, AMI supported (i) activities to strengthen the forecasting of pharmaceutical needs and the management of antimalarial medicines and supplies and (ii) the design and adoption of strategies to achieve good patient adherence to the new regimens for the treatment of uncomplicated *P. falciparum* malaria and *P. vivax* malaria. The final phase of the process involved a system for monitoring antimalarial medicine availability and use. In this phase, AMI has encouraged the systematic monitoring of medicine management and compliance with prescription and dispensing procedures in health care.

Following this stepwise, evidence-based approach, AMI technical partners have implemented a number of activities to date with a long-term goal of improving the access to and use of quality medicines.

**Sensitize partners and stakeholders to the role of good pharmaceutical management in reaching policy goals.** Decisionmakers’ awareness of the importance of good pharmaceutical management to achieving policy goals is critical to sustainably improving the access to and use of high-quality medicines in AMI countries. Since its inception, AMI has worked collaboratively with diverse groups of counterparts and stakeholders, including malaria control programs (at the national and local levels), medicine regulatory agencies (DRAs), MOH offices responsible for procurement and distribution, the private sector, local nongovernmental organizations, and international agencies and funders. As a result of these collaborations, AMI has increased the access to and use of quality-guaranteed antimalarials and supplies by supporting the full integration of the components of the pharmaceutical management framework into policy documents and country activities. The resulting awareness of good pharmaceutical management strategies has led to improved communication among all levels of the national malaria control programs, DRAs, and other relevant partners; less frequent stock-outs resulting from errors in quantification and/or procurement; and the adoption of more rational standard treatment guidelines.

Among the specific activities supported by AMI, a 2003 workshop in Guayaquil, Ecuador, addressed the process of change in antimalarial policies and the issues to be considered for their successful implementation. AMI technical partners reviewed the policy cycle, the role of various stakeholders, and the determinants of implementation, including the availability and use of medicines, with representatives from the partner countries. AMI promoted the use of an electronic matrix to help central-level government agencies identify problems in the different processes of the policy cycle and institute concrete solutions. This tool included examples and the principal recommendations of WHO\textsuperscript{30} on every aspect of the cycle.

In October 2004, AMI technical partners held a workshop in Lima, Peru, on the management of medicines and essential supplies for national malaria control programs in the Amazon Basin. Representatives from the MOHs of Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, and Venezuela participated in the workshop. AMI technical partners introduced key concepts in pharmaceutical management, specifically for malaria, to begin strengthening the capacity of Amazon countries to manage antimalarial medicines more effectively through rational selection, prudent procurement, effective distribution, and appropriate use. AMI also provided support for the replication of this training course—conducted by participants from the Lima workshop—in two of Colombia’s endemic regions.

**Identify problems and causes of poor availability and use of antimalarials through assessments.** AMI international and national partners are committed to collecting solid evidence of the problems related to the poor availability and use of antimalarials to better understand their true or “root” causes. Beginning in 2003, AMI partners carried out baseline studies in most AMI partner countries regarding the availability and use of antimalarial medicines. These studies documented several weaknesses in the pharmaceutical management systems, including problems with quantification methods, storage, and distribution systems and a lack of standardized procedures for managing the stock of medicines and supplies. AMI technical partners also found problems related to patients’ failure to adhere to treatment in some countries as well as deficiencies related to antimalarial medicine access, prescription, and dispensation.

To address these problems, AMI technical partners trained personnel from the countries’ malaria control programs in the use of MSH’s Pharmaceutical Management for Malaria (PMM) Assessment Tool at an AMI–supported workshop in July 2005.\textsuperscript{31} Representatives from each AMI partner country participated in the workshop. After the workshop, in 2005 and 2006, AMI encouraged the countries to conduct studies of the availability and use of antimalarial medicines using the methodology outlined in the PMM Manual. The access and use studies were coordinated by the MOHs of the respective countries with the involvement of some of the RAVREDA sentinel sites and TA by AMI. During this phase, studies were conducted in Colombia, Ecuador, Bolivia, Guyana, and Suriname, and a pilot study was conducted in Venezuela. Additional studies on the quality of care and the handling of medicines at health units, using other methodologies, were also conducted in Ecuador, Guyana (see Box 2), Peru, and Suriname. Also in this phase, AMI promoted the use of guidelines for implementing ACTs\textsuperscript{32} and a checklist of the components of the medicine management cycle.

In 2008, MSH and USP/DQI systematically assessed the state of antimalarial supply management in seven AMI countries.\textsuperscript{33} The assessments identified a number of positive aspects of supply management


\textsuperscript{31}Rational Pharmaceutical Management Plus Program/MSH. 2004. The PMM Manual presents a methodology for evaluating the management of antimalarials by assessing their availability and use and producing objective measures (indicators) to identify strengths and weaknesses in the system. The manual and its accompanying Data Collectors Guide provide general instructions and sample tools. Each country is expected to adapt the tools and the corresponding indicators according to its specific context and need.


in several of these countries, including (i) up-to-date inventory reports and the use of automated medicine management systems, (ii) excellent storage conditions, (iii) training in the use of a diagnosis and treatment form, (iv) the use of written instructions or illustrated prescriptions for patients, and (v) daily supervision of treatment for patients. However, the assessments also identified problems in some countries, including:
- insufficient coordination among various partners participating in the management of antimalarials;

**BOX 2. ACCESS TO AND USE OF ANTIMALARIALS BY GOLD AND DIAMOND MINERS IN GUYANA**

In 2005, a study was carried out to evaluate the access to and use of antimalarial medicines among miners in Guyana. The National Malaria Program, the Guyana Geology and Mines Commission, and the Guyana Gold and Diamond Miners Association collaborated on the study design. The target population was composed of gold and diamond miners living in camps in three regions of the country—a population in which the National Malaria Program had previously estimated a 60% incidence of malaria.

A total of 533 individuals from 112 mining camps were surveyed, and quantitative questionnaires were administered to participants meeting the inclusion criteria. The major findings are as follows:

- **Knowledge, attitudes, and perceptions:** Only 11.3% of the miners could recognize the primary symptoms of malaria.
- **Information, education, and communication:**
  - 42.5% of surveyed miners chose oral communication as the best means of providing malaria information.
  - 25.1% of miners chose informational posters placed in health centers and shops.
  - 13.0% of miners chose electronic media (e.g., television, video, DVD).
- **Diagnosis:** Of the miners surveyed, 37.6% self-diagnosed.
- **Treatment:** Of the miners surveyed,
  - 44.2% did not know the correct treatment for *P. falciparum* malaria.
  - 53.6% did not know the correct treatment for *P. vivax* malaria.
  - 90.5% did not know the correct treatment for *P. malariae* malaria.
  - 79.6% did not know the correct treatment for malaria caused by mixed *Plasmodium* species.
  - 46.7% of miners received malaria treatment from a friend, boss, or local shop.
  - 56.2% of miners had received artemisinin monotherapy for treatment in the previous six months.

In addition,
- Artemisinin monotherapy was available to 43.1% of the miners.
- Only 19.0% of antimalarial medicines used by miners came from the public health service.
- **Communication:**
  - 80.9% of miners were open to participating in the study.
  - Miners tend to have fixed abodes away from the mining camps, and 55.1% of miners surveyed visit their homes every one to three months.
• lengthy procurement processes resulting from conflicts between procurement contracts and national laws;

• a lack of standard operating procedures for inventory management;

• a lack of data on the consumption and stock of medicines, preventing accurate quantification;

• antimalarials and other supplies kept under poor storage conditions;

• stock-outs of some medicines, the maintenance of expired medicines, the exhaustion of safety stocks, or frequent emergency purchases of antimalarials;

• higher purchase prices, apparently resulting either from frequent emergency purchases or a lack of access to international markets;

• an official malaria treatment guide that has not been completed, validated, and disseminated;

• a lack of awareness of some patient populations that antimalarials are available free of charge; and

• insufficient access to quality-assured antimalarial testing and treatment in some populations (e.g., gold mining communities).

These findings guided TA by AMI technical partners to help improve the access to and use of antimalarial medicines. With AMI’s support, most countries are implementing supervision and monitoring practices that will provide regular information about the management of medicines and supplies.

**Improve antimalarial procurement and supply chain management systems.** As depicted in the pharmaceutical management framework (Figure 2), the availability of and access to medicines are directly related to the effectiveness of the procurement and supply systems. AMI technical partners identified procurement planning as a weak area in several of the national malaria control programs. Beginning in 2003, AMI organized regional workshops addressing (i) the changes in malaria treatment policies (Ecuador, 2003), (ii) the management of malaria medicines and supplies (Peru, 2004), (iii) the quantification of antimalarials (Bolivia, 2006), and (iv) the procurement and supply management for malaria (Colombia, 2008). These activities helped increase the capacity of public-sector personnel to perform accurate needs quantification, procurement, distribution, and management of available stock.

Assessments conducted in AMI countries from October 2007 to August 2008 documented improvements in all areas of pharmaceutical management and found that virtually no major medicine stock-outs had occurred during the preceding year. AMI interventions have contributed to improved quantification procedures, procurement methods, and distribution practices. However, not all of the problems previously identified had been addressed, and most of the practices successfully implemented had not been institutionalized. AMI supported the institutionalization of the best pharmaceutical management practices though the elaboration of proposed standard operating procedures for all AMI countries.34

**Improve rational use strategies.** To ensure effective, appropriate use of antimalarials, patients must receive the medicines in the correct dosage, with sufficient supply, and at a low cost to themselves and/or the health system. The prescriber, dispenser, and patient each must understand his/her role in treating the illness.

The introduction of prepackaged treatments for *P. falciparum* malaria in Brazil, Colombia, Guyana,
and Suriname constituted an important step in improving antimalarial dispensing practices in the Amazon Basin subregion. In addition, AMI supported studies on patient adherence to treatment to (i) identify deficiencies in the current guidelines, in the malaria control programs, and in prescription and dispensing practices and (ii) evaluate the effectiveness of measures that could be adopted by national malaria control programs to improve patients’ use of antimalarials (e.g., written instructions and the use of blister packs in \( P. \) vivax malaria).

In 2005, AMI organized a workshop in Caracas, Venezuela, to develop a methodology to improve patient adherence to treatment. Meeting participants agreed on a strategy of promoting better standards and practices in the prescription and dispensing of antimalarials. This strategy included the use of adherence studies as a basis for devising better treatment policies, complemented by medicine use studies in which compliance with such policies could be evaluated. Toward this end, AMI technical partners developed a set of guidelines to help the national malaria control programs carry out studies of patients’ adherence to the official treatment regimens recommended by the countries’ malaria control programs. The measurement of adherence in studies conducted with AMI support prioritizes a quantitative approach based on a questionnaire to identify treatment failures as well as verification of the number of tablets left over following treatment. This methodology guarantees the fulfillment of two basic precepts: (i) dispensing of the full treatment and (ii) compliance with the prescription according to official standards.

At least four Amazon countries undertook studies on the use of medicines and adherence to treatment. These studies (Table 4) showed poor adherence to malaria treatments, particularly those for malaria caused by \( P. \) vivax. As a result of these studies, various countries implemented interventions to improve dispensing practices and promote adherence.

Assessments conducted in several AMI partner countries documented the implementation of different types of interventions aimed at improving adherence to treatment: written instructions in Ecuador, directly observed treatment (by provider) in Peru, and co-blistered presentations (a type of medicine packaging in which the two components of a combination therapy are presented in separate pills packaged together) in most countries. The impact of these and other interventions has not been assessed.

**Monitor antimalarial medicine availability and use.**

National malaria control activities hinge on the ability of national partners to monitor the availability, use, and quality of medicines. This includes generating, collecting, and managing accurate, useful, and up-to-date information systems. Malaria treatment in the Amazon Basin subregion has gradually been integrated into the health services network, but the problem largely continues to be addressed in rural health posts. In this context, many national malaria control programs have maintained regular supervision of the network of diagnostic posts. However, although these activities entail great operational effort, especially in the areas with the lowest population density, they often do not constitute a monitoring system.

Therefore, during 2006 and 2007, AMI technical partners developed a tool for the supervision of medicine availability and use and a guide to implement and evaluate the pilot testing of this tool. This methodology includes the creation of a hierarchy of supervision and analysis entities and the implementation of three mechanisms for compiling information that complement and validate one another. The goal is to use monitoring and communication channels and work routines that already exist but are not structured to allow for the periodic and systematic analysis of the operation of the treatment and diagnosis network. The data collection mechanisms consist of (i) systematizing the evaluation of the malaria diagnostic posts through the use of a simplified reporting form during supervisory visits; (ii) generating a periodic report on medicines and supplies, to be completed by the same diagnostic post; and (iii) establishing analysis routines by using the existing variables in the malaria morbidity information systems related to the management of diagnosis and treatment and by promoting a joint analysis of the supervision and epidemiological data. By the end of 2008, the tool had been pilot tested in most AMI partner countries and was shown to be effective in most settings.
A number of actions have resulted from AMI’s collaborative efforts with the national malaria control programs. These include improvements in antimalarial purchasing and distribution processes and improvements in policies for dispensation and use, as outlined below.

**Improvements in antimalarial purchasing and distribution processes:**

- In Bolivia, the findings of the access and use study allowed for the preparation of the Strategic Malarial Drug Management Plan. The aim of the project was to provide strategic guidelines on malaria medicine management to support the policies of the national malaria control program in adhering to the standards of the Unified National Drug System.

- In Brazil, a workshop on antimalarial management was held in 2006, attended by the personnel responsible for guaranteeing the supply of antimalarials in the Amazon nations. The course, which was coordinated by the General Coordination Office of the MOH’s Malaria Program, addressed the issues raised at the RAVREDA–AMI regional workshops and also used the instruments developed at those workshops.

- In Colombia, the national malaria control program promoted within its departments the use of an instrument for forecasting antimalarial needs based on the methodology developed with MSH.

- In Ecuador, the SNEM adopted a methodology at the central level for forecasting medicine needs. RAVREDA’s coordinating office in the SNEM prepared a set of guidelines on good antimalarial storage practices to provide direction at the provincial and local levels on improved handling of medicines.

- In Guyana, based on the findings of the AMI–funded studies, a new medicine supply channel was determined, and measures to improve the procurement, distribution, and handling of medicines were decided upon. In 2006, morbidity information was used with the Quantimed program to calculate antimalarial needs.

- Also in Guyana, a study of antimalarial medicine use and access in mining areas (see Box 2) prompted

### TABLE 4. ADHERENCE STUDIES, 2005-2006

<table>
<thead>
<tr>
<th>Country</th>
<th>Locality</th>
<th>Species</th>
<th>Medicine, treatment duration if known</th>
<th>No. of patients evaluated</th>
<th>Deficiency in adherence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolivia</td>
<td>Guayaramerin</td>
<td>P. vivax</td>
<td>CQ+PQ, 7 d</td>
<td>89</td>
<td>53.0</td>
</tr>
<tr>
<td></td>
<td>Riberalta</td>
<td>P. vivax</td>
<td>CQ+PQ, 14 d</td>
<td>90</td>
<td>57.8</td>
</tr>
<tr>
<td>Brazil</td>
<td>Bragança, Augusto Corrêa</td>
<td>P. vivax</td>
<td>CQ+PQ, 7 d</td>
<td>94</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>Colniza</td>
<td>P. vivax</td>
<td>CQ+PQ, 7 d</td>
<td>115</td>
<td>8.0</td>
</tr>
<tr>
<td></td>
<td>Tucuruí e Cachoeira do Pinhã</td>
<td>P. falciparum</td>
<td>Q(3d)+D(5d)</td>
<td>93</td>
<td>22.2</td>
</tr>
<tr>
<td>Colombia</td>
<td>Apartadó</td>
<td>P. vivax</td>
<td>CQ+PQ, 14 d</td>
<td>61</td>
<td>12.6</td>
</tr>
<tr>
<td></td>
<td>Apartadó</td>
<td>P. falciparum</td>
<td>AQ+SP</td>
<td>22</td>
<td>10.1</td>
</tr>
<tr>
<td>Ecuador</td>
<td>Esmeraldas, Santo Domingo, Milagro, Machala</td>
<td>P. vivax</td>
<td>CQ+PQ, 7 d</td>
<td>101</td>
<td>39.8</td>
</tr>
</tbody>
</table>

* Patient’s adherence is determined based on the interview and the remaining medicine balance. “Not adherent” means that the patient has tablets remaining; “probably not adherent” means that the patient reported not to have taken all the tablets within the timeframe and in the correct dose amount; and, “probably adherent” means that the patient reported to have taken all the tables within the timeframe and in the correct dose amount.

Percent adherence deficiency is the percentage of patients who did “not adhere” and “probably did not adhere.”

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**OBJECTIVE 2: EVIDENCE BASE FOR AMAZON BASIN MALARIA PREVENTION AND CONTROL PRIORITIES IS COMMUNICATED AND USED**

The findings of the adherence studies are summarized in Table 4. The data from these studies are crucial for informing the prioritization of antimalarial interventions in the Amazon basin. The studies conducted in Bolivia, Brazil, Colombia, and Ecuador provide insights into the effectiveness of different antimalarial regimens and the adherence rates among different populations. The results indicate varying levels of adherence and efficiency in treatment duration, which can guide the development of targeted interventions to improve adherence and overall treatment outcomes. Understanding these patterns is essential for the effective allocation of resources and the implementation of evidence-based malaria control strategies in the Amazon region.
the elaboration of a plan of action supported by a memo-
randum of understanding signed in October 2006. The
mining companies are registering to participate in this plan,
and one company already has a miner trained as microscopist
in the malaria program. An information, education,
and communication strategy was developed with
informational materials in English and Portuguese.

Improvements in policies for dispensation and use:

- A prepackaged treatment for uncomplicated
  \( P. \text{falciparum} \) malaria (Coartem\(^*\)) was introduced in
  Brazil, Guyana, and Suriname to improve patient
  adherence to treatment and was used as a high-
  impact intervention in Colombia.

- Ecuador has implemented the use of written
  instructions in the treatment of \( P. \text{vivax} \) malaria.

- Ecuador and Colombia have implemented a
  seven-day chloroquine–primaquine regimen for the
  treatment of \( P. \text{vivax} \) malaria.

- In Guyana and Venezuela, primaquine was
  requested in blister packages for the purpose of
  improving patients’ adherence to treatment.

The activities undertaken by the national malaria
control programs and MOHs to resolve some of
the problems found in the recent (2007–2008)
assessment of the state of antimalarial supply
management—often with assistance from
RAVREDA–AMI and/or the Global Fund—include:

- integrating the health supply system and
  implementing a logistics administration and
  information system to improve the procedures for
  planning for needs and the distribution chain;

- strengthening the management of the
  quantification, procurement, storage, and
  distribution of medicines;

- conducting an analysis of public goods supply
  problems and developing proposals for addressing
  the problems identified;

- building new warehouses or improving existing
  warehouses to improve storage conditions;

- creating a facility-level surveillance system to
  provide regular information on inventories to the
  state and federal levels;

- standardizing reporting systems; and

- developing a new manual of malaria
treatment protocols.

VECTOR CONTROL, INSECTICIDE RESISTANCE, AND ENTOMOLOGY

OBJECTIVE I: EVIDENCE BASE FOR AMAZON BASIN MALARIA PREVENTION AND CONTROL PRIORITIES IS INCREASED

AMI seeks to improve the development and
implementation of vector control strategies in
the Amazon countries by promoting the rational
selection of vector control measures and improved
insecticide resistance M&E and information
sharing systems. The initiative is also promoting
efforts related to the entomological evaluation
of ITNs and insecticide quality monitoring.

Rational selection of vector control measures.
AMI has developed a local-level (state and municipal)
instrument for selecting and targeting malaria vector
control measures and evaluating their effectiveness
as part of an integrated vector control strategy. This
approach aims to contribute to the creation of an
assessment–intervention–assessment strategy, based
on epidemiological and entomological indicators,
that will allow for the selection, implementation, and
evaluation of vector control interventions following the
principles of selective and integrated vector control and
emphasizing the primary interventions recommended
by WHO. \(^{35}\) The ultimate goal is to support partner
countries in institutionalizing a more efficient and
rational approach for malaria vector control decisions
and to promote a more systematic and rigorous
use of entomology by the national malaria control
programs. In this way, the countries of the Amazon
Basin subregion will move toward integrated vector
management, which has the potential to achieve vector
control—and to reduce the malaria burden—in a more
selective and sustainable manner.

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The strategy supported by AMI includes two components:
• the stratification of malaria transmission areas and the selection of localities and interventions based on epidemiological data and
• the development and validation of an approach to ensure that
  - field entomology is systematically incorporated into malaria control programs and
  - vector surveillance and control information is managed in an integrated manner with information on malaria epidemiological surveillance and on malaria prevention and control activities beyond vector control.

Specifically, this strategy outlines criteria for malaria stratification in a country’s priority areas and for selecting priority localities for vector control measures based on the burden of disease (number of cases), characterization of risk (incidence), predominant Plasmodium species, and affected age groups. According to this strategy, the technical vector control team—at the municipality, department, province, or state level—should select the most appropriate intervention(s) based on this stratification as well as other factors, including periods of increased transmission, types of housing and habits, occupational exposure, and available entomological information. The strategy emphasizes routine assessments by the technical team of the effectiveness of interventions, based especially on epidemiological indicators that produce routine surveillance system data. The methodology includes guidelines for a well-founded systematic analysis of an intervention’s effectiveness by observing variations in malaria patterns before and after the intervention, comparisons among localities, and comparisons with malaria patterns during the same period in previous years. The methodology defines the entomological data that will be considered in selecting interventions and in charting the indicators to be used in assessing the efficacy and effectiveness of each type of intervention. Repeating the process in several different localities using standardized procedures and conducting longitudinal follow-up for six months after the intervention will make the data more robust. This will ensure that the information generated from various localities can be centralized to help guide strategies and decisions on the procurement of insecticides and other supplies.

In the past three years, AMI has supported several regional and national workshops, listed below, to design and implement the strategy for promoting a rational, selective, targeted approach to vector control and the evaluation of vector control efficacy:
• Regional meetings with experts in entomology from all Amazon countries to design the strategy in
  - Atlanta, Georgia, USA, 2004,
  - Lima, Peru, 2005, and
  - Panama City, Panama, 2006.
• Local meetings for review of the strategy for vector control with the malaria control program staff in Brazil, Colombia, Ecuador, and Venezuela.

**Strengthening insecticide resistance M&E and information sharing systems.** Monitoring the resistance of malaria vector mosquitoes (Anopheles spp.) to insecticides is a priority activity for AMI. The initiative’s goal is to help implement a surveillance system based on monitoring temporal and spatial variations in patterns of resistance to the main insecticides used in the Amazon Basin subregion. Initial detection and characterization of insecticide
resistance is accomplished using bioassays. These bioassays—which are essentially “low-tech” tactical surveillance tools for detecting changes in susceptibility to insecticides in vector populations—are easy to perform in the field and are designed to be carried out by the decentralized technical units of the MOH in each partner country. For example, AMI technical partners trained and equipped staff at the Dirección General de Salud Ambiental (General Directorate of Environmental Health), Department of Loreto, Peru, a decentralized technical unit of the MOH, to conduct the bottle bioassay; these staff then trained other Peruvian staff in the technique.

The bottle bioassay, developed by the CDC, was proposed to be used for monitoring variations in insecticide resistance in Amazon countries. Because of its practicality, this method can easily be adopted by the health services and can serve as part of an early warning system. The approach advocated by AMI also uses WHO’s impregnated paper test to confirm the finding of resistant strains with respect to international reference standards. When bioassay data show reduced insecticide susceptibility in a vector population, either resistance management or a change in the insecticide used in IRS may be needed.

To reproduce the capacity to conduct insecticide resistance M&E throughout the subregion, AMI technical partners have distributed the bottle bioassay protocol, have provided formal training in its use as an insecticide resistance M&E tool, and have revised the protocol with experts from AMI countries. With a few exceptions, however, bioassay results obtained by 2007 showed that (i) bioassays are not being used for routine surveillance, (ii) bioassay data are not being shared among countries for planning purposes, and (iii) further analyses of vector populations (and resistance mechanisms)—from the areas where bioassay results show resistance—are not being conducted.

Among the exceptions, Brazil and Colombia do have insecticide resistance M&E programs that incorporate diagnostic chemical and molecular testing methods to identify resistance mechanisms when bioassay data show reduced insecticide susceptibility. The results inform decisions about substitute insecticides. As part of its dengue control program, Brazil has developed the capacity to run diagnostic tests and has integrated the tests into a standard set of protocols for the quantification of enzyme activity related to insecticide resistance.36 This expertise potentially could be shared with and used by Brazil’s malaria control program. Colombia has developed a similar level of expertise and has published on the use of diagnostic tests for malaria vector insecticide resistance M&E. Personnel from Brazil’s Oswaldo Cruz Foundation and the Universidad Nacional de Colombia (National University of Colombia) have worked with CDC to develop this capacity.

In addition to supporting existing decentralized activities to carry out bioassays, AMI seeks to bring further analytical capacity to resistance surveillance in Amazon countries by partnering with Brazil and Colombia, as well as other interested groups, to establish centralized diagnostic capacity in the subregion. Unlike bioassays, insecticide resistance diagnostic tests are not intended for field use; they are best implemented by centralized national laboratories in interested partner countries as they constitute a second step for determining mechanisms related to insecticide resistance.

Ongoing lines of work to strengthen insecticide resistance M&E and information sharing systems include efforts to (i) encourage the expanded use of standardized bioassays at the local level as part of ongoing insecticide resistance surveillance, (ii) introduce tests for resistance enzymes and molecular tests, and (iii) strengthen data sharing systems from the technical level to the planning and policy levels. Specific activities supported by AMI and related to insecticide resistance M&E are listed below:

- Workshops on the design of a work plan and the standardization of procedures and guidelines for insecticide resistance M&E in
  - Iquitos, Peru, 2005, and
  - Paramaribo, Suriname, 2005.

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36 Brazil MOH. No date. The LIFICAVE protocols. Quantification methodology for enzyme activity related to insecticide resistance in Aedes aegypti.
Field activities for insecticide resistance M&E using the bottle bioassay to assess the susceptibility of malaria vector mosquitoes to several insecticides (including bendiocarb, cyfluthrin, cypermethrin, DDT, deltamethrin, fenitrothion, lambda-cyhalothrin, malathion, permethrin, pyrimiphos methyl, and propoxur) in Brazil, Colombia, Ecuador, Peru, Suriname, and Venezuela.

An expert meeting on improving species identification and taxonomy in Bogotá, Colombia, in 2006.

Entomological evaluation of ITNs. CDC/Guatemala, CDC/Atlanta, the Navy Medical Research Center Detachment, and Rothamsted, U.K., have the capacity to promote studies to evaluate the efficacy of ITNs in AMI countries (e.g., studies using experimental huts). With financial support from AMI, these organizations have imparted knowledge and technical expertise to interested partners in conducting their own ITN evaluations. Preliminary results of these evaluations are expected by mid-2009.

Insecticide quality monitoring. To identify gaps in pesticide QA/QC within the national malaria control programs, AMI technical partners have determined that a survey of practices currently in place in the Amazon Basin subregion is warranted. Gaps identified at the central and local levels will aid the development of strategies for corrective actions and will help strengthen national and regional capabilities, including the alignment of QA in procurement processes and the identification and strengthening of national pesticide control laboratories for regional support.

Additional technical support. AMI has also supported efforts to improve human resources capabilities in entomology and vector control, including (i) training in basic entomology in Ecuador and Suriname, (ii) the promotion of a certification process for vector control workers in Colombia, and (iii) meetings between partner countries’ and CDC’s entomologists for training and discussions of collaborations.

OBJECTIVE 2: EVIDENCE BASE FOR AMAZON BASIN MALARIA PREVENTION AND CONTROL PRIORITIES IS COMMUNICATED AND USED

AMI has supported increased understanding and implementation of specific vector control interventions, such as an innovative rice irrigation strategy in Peru, described in Box 3.

Aside from specific success stories, such as the example of IIR in Peru, AMI’s activities associated with vector control and entomology are currently at an early stage. Nevertheless, AMI has succeeded in introducing the concept of epidemiological stratification for vector control to the agendas of the national malaria control programs. In addition, AMI technical partners have designed operational solutions to address entomological work. The AMI–supported activities described above will aid the health authorities in AMI partner countries in determining their ability to invest in and implement these strategies.

COMMUNICATION AND INFORMATION DISSEMINATION

In 2007, AMI added a technical partner to the team with the goal of providing communications leadership and support to the other technical partners, including efforts that complement PAHO’s malaria advocacy and communications activities throughout the subregion. Specifically, Links Media is tasked with developing communication strategies targeting the general public, policymakers, healthcare providers, and technical and scientific audiences. Communication accomplishments and ongoing efforts constitute an integral component of each line of work and each objective described above.

Communication accomplishments and ongoing activities to date include:

- the development of an AMI Web site,
- the generation and tracking of media coverage for major AMI events,
- the development of a dissemination plan for the diffusion of knowledge about malaria in the region and to demonstrate AMI’s achievements.

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the development of lines of communication and efficient relationships with technical partners and partner countries to identify communication needs, and

• the provision of editorial, writing, and graphic design support for the development and publication of technical and nontechnical publications.

In late 2008, AMI technical partners began developing an AMI project Web site. The objective of this Web site is to provide information about the initiative and about malaria in the Amazon Basin subregion that will be accessible to a variety of audiences but will primarily target policymakers, scientists, and healthcare providers. Importantly, the Web site will also provide an online information exchange that should facilitate further scientific progress and promote evidence-based decision-making in the region.

In 2008, the VII AMI-RAVREDA technical meeting and AMI SC meeting in Lima, Peru, received significant high-quality media coverage. USAID officials, partner country representatives, and technical partner representatives were interviewed for television, radio, newspapers, and online publications. These efforts reached a total audience of more than 2,156,600. Links Media prepared a comprehensive earned media report.

In commemoration of the second annual Malaria Day in the Americas (November 6, 2008), AMI technical partners, in collaboration with the Peruvian MOH, the Colegio Médico del Perú (Medical College of

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Peru), and the Peruvian congress coordinated two roundtables in Peru (held on November 6 and 7, 2008) to discuss the significant achievements that have occurred in the reduction of morbidity and mortality from malaria. The panelists’ presentations focused on developments in malaria control, the implementation of best practices, lessons learned, and the identification of strategies to continue the fight against malaria in the region. Considerable media coverage, reaching a total audience of more than 2,507,400, was obtained for this event, as shown in Table 5. Links Media updated press materials and distributed them among local and international media.

In April 2009, the CNCC (Peru’s OMCL) was awarded ISO/IEC 17025:2005 accreditation—an internationally recognized standard for testing and calibration laboratories—for five critical analytical tests. This important achievement by a laboratory responsible for the quality control of pharmaceutical products will have a significant impact on the distribution of good-quality medicines. To ensure the broad communication of this accomplishment and its significance for the control of malaria and other infectious diseases, the technical partners supported the overall dissemination of CNCC’s accreditation in Peru, the United States, and throughout the Americas through a number of activities. In particular, AMI supported the organization of an event in May 2009 to recognize CNCC’s accreditation and the commitment of CNCC staff and leadership to improving access to good-quality medicines in the Amazon Basin subregion. AMI technical partners also (i) organized and coordinated a press conference to follow the recognition event; (ii) prepared and disseminated media materials in English and Spanish, including press releases, media advisories, talking points, and a technical report, to 55 media outlets in Peru and the United States; (iii) filmed the event and the press conference, including interviews with key spokespersons from USP, CNCC, INS, and USAID; (iv) produced and disseminated a video news release to 15 television stations in Peru and the United States; (v) arranged for interviews of CNCC and USAID/Peru spokespersons in key local media outlets (radio, television, and print media); (vi) organized outreach to government officials, the academic and scientific community, and consumer protection organizations; and (vii) produced an earned media report of the media coverage.

Also see Appendix B for a listing of specific products completed or in progress via AMI throughout the initiative’s lifetime.
### TABLE 5. EARNED MEDIA COVERAGE, MALARIA DAY IN THE AMERICAS ROUNDTABLES, NOVEMBER 6–7, 2008

<table>
<thead>
<tr>
<th>Name of media outlet</th>
<th>Type of media</th>
<th>Date of coverage (and time if applicable)</th>
<th>Length of transmission</th>
<th>Number of times printed or aired</th>
<th>Circulation or audience</th>
<th>Link, if available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colegio Médico del Perú</td>
<td>Online</td>
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<td>639 words</td>
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Significant changes in first-line treatment for malaria occurred from 2001 to 2006 in many Amazon countries, based on evidence of geographic variation in antimalarial resistance.
“AMI RAVREDA’s contribution has benefited Bolivia by making possible studies on resistance to antimalarial drugs, monitoring of insecticide effectiveness, and implementation of rapid assessment tests, among others. The project’s recent accomplishments have been very well received. ”

Viterman Ali Espinoza, Chief Strategist for Monitoring and Control of Malaria and Dengue, Bolivian Ministry of Health and Sports
AMI has successfully built capacity in all partner countries, allowing them to collect and use practical information to improve malaria control. As part of its capacity-building efforts, the initiative has established a venue and a mechanism through which AMI partner countries can effectively share experiences and expertise among themselves. Through this network of South–South collaboration, partner countries that have made greater advances in medicine efficacy testing, diagnostic quality management, medicine quality assessment, and vector control provide training and TA to their neighbors (see examples in Box 4). The initiative’s accomplishments are intended to be replicable outside of the subregion and, as a result of increased partner country capacity, Latin American and Caribbean countries outside of the subregion have also benefited from South–South collaboration. Through this approach, AMI has addressed subjects that benefit from a multidisciplinary approach and those that affect more than one country.

Most notably, all AMI partner countries have now rigorously assessed the efficacy of antimalarial medicines and have used the information gleaned from this efficacy testing to redefine treatment policies, ultimately adopting effective ACTs for the treatment of uncomplicated *P. falciparum* malaria. In ongoing medicine efficacy surveillance, AMI partner countries

<table>
<thead>
<tr>
<th>Provider</th>
<th>Recipient</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>Guyana</td>
<td>Information systems; <em>in vivo</em> medicine efficacy testing</td>
</tr>
<tr>
<td>Brazil</td>
<td>Suriname, Guyana</td>
<td>Entomology</td>
</tr>
<tr>
<td>Brazil</td>
<td>Guyana, Colombia</td>
<td><em>In vitro</em> medicine efficacy testing</td>
</tr>
<tr>
<td>Peru</td>
<td>Guyana</td>
<td>Diagnostic quality</td>
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<tr>
<td>Peru</td>
<td>Ecuador, Bolivia</td>
<td>Molecular markers</td>
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<td>Bolivia</td>
<td><em>In vitro</em> medicine efficacy testing</td>
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<td>Suriname</td>
<td>Medicine quality</td>
</tr>
<tr>
<td>Suriname</td>
<td>Guyana</td>
<td>Microscopy</td>
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**BOX 4. EXAMPLES OF SOUTH–SOUTH COLLABORATION FACILITATED BY AMI**

**Collaboration among AMI Partner Countries**

**Collaboration between AMI and Non-AMI Countries**

<table>
<thead>
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<th>Topic</th>
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</thead>
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<tr>
<td>Ecuador</td>
<td>Nicaragua, Honduras</td>
<td>Medicine efficacy studies</td>
</tr>
<tr>
<td>Guyana</td>
<td>Jamaica, Bahamas</td>
<td>Diagnosis</td>
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</table>

continue to monitor changes in medicine efficacy to inform future treatment policies. This is, perhaps, the initiative’s most profound direct improvement of malaria control in the Amazon Basin subregion.

In addition, the initiative has succeeded on a number of other fronts:

- AMI partner countries have improved their QA/QC systems for malaria diagnosis. Diagnoses are made more quickly and accurately, allowing for more timely treatment with high-quality, effective medicines.
- Partner countries have improved their capacity to ensure and control the quality of effective antimalarial medications through tools including the use of portable laboratories for ongoing medicine quality assessments and through improved analytical techniques.
- Through improvements in antimalarial procurement supply chain management, dispensing and prescribing practices, and use, AMI partner countries have increased the availability of treatment and likely improved patient adherence to treatment regimens.
- The increase in entomological knowledge and its application is expected to result in the use of more selective, targeted, and effective vector control throughout the subregion.

- AMI has assisted countries (Peru, Suriname, and Brazil) with training in molecular epidemiology.

AMI’s progress to date should (i) slow the emergence and spread of antimalarial-resistant parasites; (ii) improve the capacity of each partner country in the Amazon Basin subregion to identify antimalarial resistance and to alter treatment regimens accordingly; (iii) improve the accuracy of diagnosis and ensure the integration of diagnostic QA/QC systems throughout the healthcare systems of AMI partner countries; (iv) ensure that high-quality antimalarial medications are available, properly prescribed, and appropriately used by the patients who need them; (v) promote the adoption of integrated vector control strategies; and (vi) slow the development of insecticide resistance in vector mosquitoes.

However, the most crucial gauge of AMI’s impact must be represented in terms of lives saved and illness averted. Although malaria remains a significant public health problem in Latin American and the Caribbean as a whole and in the Amazon in particular, malaria morbidity and mortality have declined considerably since AMI’s inception in 2001. (See Table 6).

### TABLE 6. CHANGES IN MALARIA MORBIDITY AND MORTALITY IN AMI PARTNER COUNTRIES SINCE AMI’S INCEPTION

<table>
<thead>
<tr>
<th>Country</th>
<th>No. of confirmed cases</th>
<th>Change (%)</th>
<th>No. of deaths</th>
<th>Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolivia</td>
<td>15,765</td>
<td>9,748</td>
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<td>Brazil</td>
<td>388,303</td>
<td>315,630</td>
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<tr>
<td>Colombia</td>
<td>231,272</td>
<td>79,230</td>
<td>-65.74%</td>
<td>58</td>
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<tr>
<td>Ecuador</td>
<td>108,903</td>
<td>4,986</td>
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<tr>
<td>Guyana</td>
<td>27,122</td>
<td>11,815</td>
<td>-56.44%</td>
<td>—</td>
</tr>
<tr>
<td>Peru</td>
<td>78,544</td>
<td>44,409</td>
<td>-43.46%</td>
<td>25</td>
</tr>
<tr>
<td>Suriname</td>
<td>16,003</td>
<td>2,086</td>
<td>-86.96%</td>
<td>23</td>
</tr>
<tr>
<td>Total</td>
<td>865,912</td>
<td>467,904</td>
<td>-45.96%</td>
<td>248</td>
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</tbody>
</table>

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40 Source: PAHO 2008b.

Figure 4 shows changes in morbidity in AMI partner countries in the context of the RBM and MDG targets—a 50 percent reduction in the number of malaria cases by 2010 and a 75 percent reduction in the number of malaria cases by 2015, respectively (from a 2000 baseline). Although some individual countries may require increased attention to substantially reduce malaria morbidity and mortality, the decline in illness and deaths attributable to malaria in the Amazon Basin subregion as a whole is encouraging. Furthermore, Bolivia, Ecuador, Guyana, and Suriname have already exceeded the RBM goal (with reductions in the number of cases from 2000 to 2007 of 54, 92, 51, and 94 percent, respectively), and Ecuador and Suriname have reached the MDG target, having already achieved a reduction in the number of cases of more than 75 percent from 2000 to 2007.

Although it is difficult to causally link specific interventions to reductions in the malaria burden, the decline in malaria morbidity and mortality in the AMI partner countries suggests that investments in malaria control and prevention in the Amazon Basin subregion and elsewhere in the Americas—including the investments made through AMI and associated initiatives—are producing positive results.

To reach the MDG target of a 75 percent reduction in malaria cases by 2015, as well as other mandates of...
WHO and PAHO member states, the countries of the Amazon Basin subregion must continue to make progress, and the improvements in malaria control already documented must be sustained over the long term.

According to a recent external review (see summary in Appendix A), some of AMI’s greatest accomplishments include the initiative’s success in (i) creating a “culture of information-based decision-making in the region,” (ii) creating “an effective and widely accepted mechanism that has cemented a subregional approach to using standardized protocols and procedures for solving common problems,” and (iii) providing “tech strengthening of local counterparts through training and direct participation in research and other activities that has built their competence and self-confidence.”

These impacts will help ensure the sustainability of AMI’s approach and of the recent reductions in the malaria burden of the Amazon Basin subregion.

David Spitz, PAHO-WHO

*After experiencing symptoms of malaria, children wait for a checkup at the Riberalta Health Center, Beni, Bolivia, 2008.*

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AMI has strengthened health systems and laboratories in partner countries.
“This accreditation establishes our laboratory as an international resource, consolidating our technical expertise, expanding our reach, and contributing to the sustained development of Peru and the region in the health sector. The country will benefit from the testing of drugs for conformity to technical specifications and international standards, thanks to the outstanding professional work done by the Drug Quality and Control National Center, the Amazon Malaria Initiative (AMI), and the South America Infectious Diseases Initiative (SAIDI).”

Ruben Tabuchi, General Director, National Center and Drug Quality Control, Peru
Despite the initiative’s considerable achievements to date, malaria continues to pose a serious public health challenge in the Amazon Basin subregion. AMI’s next steps to address this challenge will (i) ensure the sustainability of antimalarial medicine resistance surveillance and systems by which treatment policies reflect the knowledge gained from surveillance; (ii) include the use of molecular markers in medicine resistance surveillance; (iii) further improve the accuracy of and access to malaria diagnosis; (iv) ensure the implementation by AMI partner countries of effective, sustainable antimalarial medicine QA/QC systems; (v) further improve the access to and use of malaria treatment; (vi) build the capacity of AMI partner countries to engage in integrated vector management strategies that use effective, selective vector control tools in priority localities; (vii) ensure that the AMI approach and results are communicated effectively to a variety of audiences; (viii) help national malaria control programs to evolve in response to changes in malaria epidemiology and its determinants; and (ix) explore possibilities for supporting similar efforts in malaria-endemic countries in Mesoamerica. More specifically, AMI will accomplish the following goals, broken down by theme:

**ANTIMALARIAL MEDICINE RESISTANCE**

- Promote the incorporation of efficacy and resistance surveillance as a permanent component of each country’s national malaria control program, integrating all available tools but based primarily on the use of *in vivo* therapeutic efficacy tests following WHO standards adapted for use in the region.
- Encourage AMI partner countries to follow recommendations regarding the effective use of therapeutic efficacy tests in low-transmission conditions.
- Support further training in the use of the *in vitro* methodology standardized by RAVREDA–AMI for the detection of variations in medicine susceptibility and facilitate the integration of such monitoring into the surveillance agendas of the national malaria control programs.
- Support the use of molecular markers for resistance monitoring, especially in low-transmission conditions where therapeutic efficacy testing is not feasible.
- Facilitate continued adjustments to malaria treatment policies, as needed, based on evidence from medicine resistance surveillance.

**DIAGNOSTIC QUALITY ASSURANCE AND ACCESS TO DIAGNOSIS**

- Support the improvement of the supply chain of laboratory materials and consumables to ensure that laboratories have the materials required to perform the tests.
- Better define the respective roles of microscopy and RDTs in malaria diagnosis.
- Further improve the quality of microscopy by:
  - promoting the standardization of training in microscopy at the national level, the implementation of proficiency testing procedures, and a laboratory certification process and
  - strengthening the current approach to microscopy QA and performance monitoring.
- Support the development of national guidelines for the management and use of RDTs for malaria diagnosis.
- Support the development of national systems for the QC of RDTs at the time of procurement.
- Support the development of mechanisms by which to monitor the quality of RDT diagnosis at the point of care.
• Monitor the appropriateness and usefulness of the QA and QC strategies supported by AMI and make adjustments if necessary.

• Ensure that clinicians adhere to test results when evaluating febrile patients.

• Expand efforts promoting improvements in QA/QC systems for malaria diagnosis to Central America, where most treatment is currently based on presumptive (clinical) diagnosis rather than laboratory diagnosis.

**ANTIMALARIAL MEDICINE QUALITY**

• Continue strengthening the technical capacity of OMCLs to ensure compliance with compendia and international standards.

• Assist partner countries in strengthening the capabilities of DRAs in good manufacturing practices, assessment of manufacturers, and dossier evaluation.

• Contribute to fully integrating into the responsibilities of DRAs (and other stakeholders) the QA/QC of antimalarial medicines during procurement, distribution, and routine post-marketing surveillance using OMCLs and/or portable laboratories.

• Foster South–South collaborations among the OMCLs for technical assistance and training and for providing services as reference laboratories.

• Ensure the availability of monographs and reference standards for the QC of antimalarial medicines used in AMI countries.

• Address the availability and quality of antimalarial medicines distributed informally and through the private sector by:
  - assessing the prevalence and quality of antimalarials available outside of official distribution mechanisms to provide evidence-based information on substandard or counterfeit medicines available through illegal commerce,
  - raising awareness of the risk of illegal commerce in antimalarials, and
  - supporting the implementation of corrective actions to deter such commerce.

• Promote the dissemination of regional QC data as a component of good governance practices.

**ANTIMALARIAL MEDICINE ACCESS AND USE**

All AMI partner countries have improved the availability of antimalarial medicines in health facilities. Nevertheless, considerable variation remains among countries, with countries variously showing strengths or weaknesses in quantification and planning, storage systems and inventory management, or practices to improve adherence to treatment. Future AMI efforts in this line of work will address a number of weaknesses in the partner countries:

• Encourage and support the use and improvement of quantification methods such that partner countries consider lead times in the procurement process and an adequate safety stock to avoid stock-outs and supply crises.

• Assist partner countries in ensuring an adequate supply of some medicines, such as those used to treat severe cases or pregnant women, perhaps by promoting joint purchases through an international agency.

• Promote the development by AMI countries of standardized procedures for managing the supply of medicines and consumables for malaria diagnosis and treatment. Such standardization will allow for:
  - the replication and extension of successful practices when filling technical and management positions and
  - monitoring to assess medicine supply management in the health facilities and at other points in the supply chain.

**VECTOR CONTROL, INSECTICIDE RESISTANCE, AND ENTOMOLOGY**

• Promote the use of the bottle bioassay as part of active insecticide resistance surveillance, specifically by encouraging the regular collection and analysis of information to guide decision-making processes in the area.
• Contribute to improving the capacity for the M&E of ITN control and prevention programs through:
  - ITN coverage surveys to evaluate the distributions of ITNs that have taken place in Amazon countries and to guide future ITN distributions,
  - monitoring of the physical condition and insecticide content of ITNs distributed to allow for a better understanding of net durability in the region, and
  - estimates of the duration of protection provided by bed nets and the frequency of bed net replacement required.
• Strengthen vector surveillance systems to provide meaningful and accurate information to guide vector control activities, specifically by developing and evaluating innovative, cost-effective data collection approaches (e.g., the use of window-exit traps for vector surveillance).
• Promote comprehensive vector control plans, taking into consideration both entomological and malaria case epidemiological information.
• Improve regional capacity to ensure the quality of insecticides and ITNs.

COMMUNICATION AND INFORMATION DISSEMINATION
AMI’s approach and findings will be widely and effectively communicated to a variety of audiences in the next year and beyond. Effective communication to both technical and nontechnical audiences will help raise awareness of the challenges posed by malaria in the Amazon Basin subregion and disseminate AMI’s results and lessons learned within and outside of the subregion. This in turn will aid future malaria control activities and decision-making and will promote the sustainability of AMI’s interventions. The communication and information dissemination activities to be completed in the next year include the following:
• Develop a communication action kit for the national malaria control programs with standardized information that can be adapted for each country.
• Launch and promote the AMI Web site to make information on AMI’s lines of work widely accessible to key audiences.
• Engage in email- and Internet-based promotion of a virtual library of resources accessible on the initiative’s Web site.
• Package and disseminate the inventory of all AMI–funded published or presented materials and resources (see Appendix B) and provide it to other countries in Latin America and the Caribbean.
• Develop a comprehensive dissemination plan to mobilize resources in support of the institutionalization of AMI’s lines of work.
• Develop a comprehensive press kit (including a press release, media advisory, pitching letter, updated AMI fact sheet, and boilerplate language on AMI interventions) to communicate AMI activities, success stories, achievements, and impacts in the region to the international media and to local media in the AMI partner countries.
• Engage in media pitching efforts to describe AMI’s goals and accomplishments.
• Assist countries in developing and disseminating scientific and nontechnical publications describing AMI’s interventions and success stories and translate such publications when appropriate.
• Develop articles, letters to the editor, and opinions (op–eds) based on journal articles and reports that can be offered to local, national, and international news media outlets as well as foundation newsletters.
• Produce and disseminate a documentary to communicate AMI’s successes in implementing and institutionalizing the initiative’s interventions.
• Create a network of communicators within the AMI partner countries by identifying key representatives from the MOHs and other health-related agencies and institutions to strengthen the institutionalization of AMI’s lines of work at the country level.
• Establish key alliances between the public and private sectors to support the effective dissemination of AMI materials and resources to international funding organizations, donors and investors, multilateral and bilateral financial and technical institutions, policymakers, the private sector, professional and scientific communities, and public and elected officials.

• Organize Malaria Day in the Americas events in Washington, DC, and in several AMI countries in 2009; generate significant media coverage of the events; disseminate informational materials to target audiences; and arrange for speaking opportunities for AMI partners.

• Produce and disseminate materials to promote AMI events, including the Steering Committee meeting scheduled for September 9–11, 2009, in Washington, DC.

• Continue to identify diverse venues—such as conferences, seminars, and international meetings—where AMI partners may participate and present AMI–related work to further promote the initiative’s approach and to encourage the use of its findings.

• Collaborate with partner countries’ national malaria control programs to assess their needs regarding media and communication skills and to provide information or training if needed.
APPENDIX A.
EXTERNAL REVIEW SUMMARY

Integrated vector control management is key to controlling malaria.
“The Government of Ecuador and the Ministry of Health are grateful for this recognition and are committed to building on the achievements in malaria to meet the Millennium Development Goals by 2010. The Government made a large investment against endemic disease in the country in 2008 and the results are obvious. Thanks to the strategic partnership between the Ministry of Health and PAMAFRO, a 60% reduction in mortality and hospitalization has been successfully achieved. Ecuador accepts with gratitude this award recognizing efforts to combat malaria.”

Elizabeth Moreano, alternate OEA representative from Ecuador, speaking about the prize awarded at Malaria in the Americas 2009
An external review of AMI was completed in July 2007 and serves as an interim assessment of AMI’s accomplishments by early 2007. Based on interviews with representatives from partner countries as well as in-country PAHO liaisons, USAID officials, and technical partners, the review showed that AMI demonstrates considerable flexibility in the development of plans and activities, capitalizing on the expertise and experience of partners without duplication of effort. AMI also displays flexibility and responsiveness to individual country needs and, to the extent possible, adopts a bottom-up approach.

Respondents were overwhelmingly positive regarding AMI’s accomplishments to date, specifically pointing out the initiative’s contributions to treatment, diagnosis, medicine management and quality, and entomology. In addition, “several respondents considered the leading AMI contribution to their country to be the creation of a culture of information-based decision-making that had permitted a change to more rational and effective science-based treatment regimens.”

Other benefits of AMI, according to respondents, included the following:

- The advantages of the collaboration of multiple technical partner organizations greatly outweigh any limitations in terms of complexity and a slightly longer planning process.
- The roles of the technical partners are clearly defined and complementary, resulting in a systems approach for the resolution of public health problems (according to partner country respondents).
- A wide range of high-quality technical services have been made available to partner countries through AMI (according to partner country respondents).
- AMI’s subregional approach is well suited to a problem that crosses borders.
- The subregional approach has facilitated South–South collaboration and motivated each partner country to make improvements.

Findings from this review suggest that AMI partner countries have adopted many of the AMI–supported policies, tools, and methods as well as the philosophy of evidence-based decision-making. In addition, “human resources have been strengthened in a number of technical areas, including research, laboratory skills, medicine management, and entomology.”

Respondents emphatically agreed with the continuation of USAID support to AMI. In future, respondents advocated for more of the same support from AMI conducted in the same manner. However, respondents recommended improvements in the initiative, suggesting that AMI should:

- focus more on insecticide susceptibility, vector behavior and incrimination, and stratification and focalization of vector control measures;
- emphasize management of the medical supply chain and medicine quality monitoring;
- systematically document its many outcomes and success stories;
- more regularly publish research results in journals;
- ensure more proactive and up-to-date information dissemination and make better use of the Internet for this purpose;
- use information, education, and communication strategies to mobilize community participation and to improve patient adherence;

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45 Terrell and Brenner 2007, p. 20.

• reinforce the management of malaria control programs;  
• incorporate a containment goal with targets; and  
• increase its focus on policy dialogue and sustainability, developing specific policy instruments to enhance the sustainability of its achievements.
Effective communication between health professionals, patients, and the community is needed to ensure good adherence to medication and to reduce the development of medicine resistance.

APPENDIX B.
ANNOTATED BIBLIOGRAPHY OF AMI AND RELATED PRODUCTS
APPENDIX B.
ANNOTATED BIBLIOGRAPHY OF AMI AND RELATED PRODUCTS

TECHNICAL REPORTS AND TRAINING MANUALS


This document is a generic research protocol for studies determining the efficacy and safety of mefloquine and mefloquine–artesunate combination therapy for the treatment of uncomplicated Plasmodium falciparum malaria. It is intended to be adapted for use in different countries, departments, provinces, and states. In addition to the protocol itself, appendices provide drug dosage tables, a case report form, definitions of parasitological response, and consent and assent forms.


A study performed by Management Sciences for Health/Strengthening Pharmaceutical Systems Program in Ecuador between December 2008 and the first week of March 2009 documented existing drug prescription and dispensing practices performed by health services in Ecuador, especially those in the country that contribute to reinforcing treatment adherence using antimalarial combination therapy. The study also documented current antimalarial drug prescription and dispensing practices at Servicio Nacional de Erradicación de la Malaria and Public Health Ministry Operational Units and assessed the impact of experiences that promote adherence to antimalarial treatment, with an effort to determine the impact of written instructions for patients on such adherence.


The countries that compose the Amazon Basin have undertaken various activities to improve the supply of medicines. However, no document consolidates information on the state of medicine supply management or summarizes the achievements made to date. From October 2007 to July 2008, the Strengthening Pharmaceutical Systems Program conducted short visits to Brazil (October 2007), Bolivia and Ecuador (January 2008), Guyana (March 2008), Peru (April 2008), Colombia (May 2008), and Suriname (July 2008) to learn about the state of antimalarial supply management, the improvements introduced in the system as a result of the technical assistance by the Amazon Malaria Initiative, and the problems that must still be addressed in the next few years. This document collects the principal findings of those visits.

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In 2007 and 2008, the Strengthening Pharmaceutical Systems (SPS) program, implemented by Management Sciences for Health, performed quick evaluations in seven countries including the Amazon Basin countries, Nicaragua, and Guatemala. These evaluations showed a periodic lack of antimalarial supplies for treating “special cases” of malaria. In this context, “special cases” of malaria are defined as severe cases where treatment has failed, as well as malaria cases during pregnancy. The number of malaria cases has decreased significantly in the majority of these countries resulting in a significant reduction in “special cases” of the disease. This has also led to fewer local providers being interested in selling the small quantities of antimalarials that are necessary to treat such cases. The SPS program decided to document the problem in Amazon Malaria Initiative countries and Central America, and presented preliminary results at the opportunity afforded by a regional meeting that took place in Guatemala, on November 2007, to discuss antimalarial supply management in Central America.


In May 2008, Management Sciences for Health/Strengthening Pharmaceutical Systems organized a regional workshop to analyze common management problems in the antimalarial drug supply chain. National teams of participating countries compiled a preliminary draft for standard antimalarial drug supply management procedures and put forth specific technical assistance requests to improve drug management. In Ecuador, storage systems are one of the main weaknesses in the supply of antimalarial drugs. This report presents an evaluation of Servicio Nacional de Erradicación de la Malaria storage systems in Guayaquil and Machala, as well as findings, identified problems, and short-term proposals for improvement.

The U.S. Agency for International Development Mission in the Dominican Republic is supporting antimalarial medication and medical supply management. With the support of partner organizations such as the Amazon Malaria Initiative (AMI), including the Pan American Health Organization (PAHO) and Management Sciences for Health (MSH), an oversight form was developed and tested in a pilot program (in coordination with the Social Protection Ministry and the National Health Institute) during August and November 2008. This oversight form demonstrated the feasibility of obtaining useful information (not available through other sources) for resolving problems at local and departmental levels. The results were formally discussed with higher officials of the national malaria control program and the Social Protection Ministry, who then evaluated the extent of the form’s application in the rest of the country. AMI (through MSH and PAHO) will continue providing whatever technical assistance may be required to institutionalize this practice.


Assessments were made to determine the consistency of the attributes for each of the proposed indicators, together with its corresponding collection instrument, within the context of the objectives for applying instruments for the Study of Antimalarial Drug Use (EUM) and EUM indicators used. As described in this report, the authors found that the indicators that need development are those related to (i) EESS efficiency for antimalarial treatment management and oversight (TAM); (ii) percentages of TAM stoppage within EESS; (iii) availability of national technical norms (TN) and/or Standard Malaria Treatment Guidance (SMTG) at healthcare facilities; (iv) correct TAM prescription adherence by healthcare personnel according to TN and SMTG; (v) EESS compliance in prescribing TAM correctly according to TN and SMTG; (vi) adequate and correct dispensing of TAM according to each prescription; (vii) TAM adherence based on information given during prescription and avoiding lost opportunities; (viii) ability of healthcare providers to give out information regarding the use of TAM medications; (ix) ability of healthcare providers for identifying a severe or complicated malaria alert; (x) ability of healthcare providers for advising patients regarding clinical signs of severe malaria or malaria emergency, and referral to other levels of treatment; (xi) therapeutic error tracking by healthcare providers, and the state of total patient adherence to antimalarial treatment.


This report describes the First Technical Coordination Meeting of RAVREDA and AMI, which took place in Santa Cruz, Bolivia, March 19–20, 2002. The meeting was attended by representatives from the Pan American Health Organization (PAHO), World Health Organization, U.S. Agency for International Development, the Centers for Disease Control and Prevention (CDC), and the eight Amazon countries participating in RAVREDA and AMI. During the two-day meeting, participants shared and discussed general project-related issues (e.g., objectives, priorities, expected results, and partners’ roles) as well as activities of the regional workplans of PAHO and CDC, country workplans for the first year, policy reform regarding antimalarial drug treatment schemes, and research priorities.

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The purpose of the recommendations in this guide, which is based on recent experiences with antimalarial drug efficacy studies in South America, was to complement the World Health Organization guidelines and standardized protocols for in vivo drug efficacy studies. This guide, and the generic protocols described therein, should contribute to the successful implementation of in vivo studies and a surveillance system for antimalarial drug resistance in the Americas. The guide describes such steps as the preparation of the protocol, study site selection, training of the study team, patient enrollment and follow-up, and specific laboratory practices.


This document describes the activities that took place during a multiday training in laboratory procedures for measuring serum levels of antimalarials, which was supported by the Amazon Network for the Surveillance of Antimalarial Drug Resistance and the Amazon Malaria Initiative under CDC’s technical leadership. This training was in response to the demonstrated need for regional capacity building for measuring chloroquine serum levels in patients with therapeutic failure in order to complement future monitoring activities for patient response to this product. The workshop was held in Belém, Pará, Brazil, in 2006, with the support of the Ministry of Health and the Instituto Evandro Chagas and the participation of professionals from Bolivia, Brazil, Colombia, Ecuador, Peru, and Guyana.


This document’s objective is to establish guidance for the use of in vitro testing within the context of the Amazon Network for the Surveillance of Antimalarial Drug Resistance and the Amazon Malaria Initiative (RAVREDA–AMI), as a complement to in vivo efficacy evaluation studies.

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In October 2004, Management Sciences for Health's Rational Pharmaceutical Management Plus (RPM Plus) Program carried out the program: “Management of Drugs and Essential Supplies for Malaria Control Programs in the Amazon Basin,” to further the ability of Amazonian countries to effectively implement and handle antimalarial drugs with respect to selection, acquisition, distribution, and use. A workshop was organized as a follow-up for this effort (in coordination with RPM Plus and the Pan American Health Organization, and with the support of the Social Protection Ministry of Colombia); to discuss progress made regarding plans made at the end of an earlier workshop in Lima; and to review implementation details for the Pharmaceutical Management for Malaria—PMM Assessment Tool, which sets the methodology for evaluating various aspects for the management of antimalarial drugs, in particular, availability and usage patterns. This report describes the outcomes of this workshop.


Adherence to treatment schemes is a critical factor for effective malaria treatment. The Amazon Network for the Surveillance of Antimalarial Drug Resistance and the Amazon Malaria Initiative have been promoting adherence evaluations to encourage better antimalarial drug prescription and supply policies in various countries. This document, which was created to guide the planning and execution of such studies by the control programs in the region, includes methodology considerations that were established during a working meeting that took place in Caracas in April 2005. The guide gives recommendations regarding methodology for performing studies, as well as planning guidance within a more general working framework geared toward care, prescription, and dispensing of antimalarial drugs. The document contains protocol samples for malaria treatment adherence evaluations for *P. falciparum* and *P. vivax*.


The first component of the overall strategy for malaria control is access to diagnosis and timely, adequate treatment. The current systems of quality control in the diagnosis of malaria in the Amazon countries are, in general, inefficient and expensive. However, the existing structure and available resources in the laboratory networks of the region can be optimized to set up quality management systems that (i) better respond to advances in the health services, including the expansion of access to treatment, and (ii) furnish reliable information to health authorities. This report describes guidelines developed in 2004 by a technical advisory group for the implementation and maintenance of a quality management system in the laboratory networks of the Amazon region for the microscopic diagnosis of malaria.

The variety of eco-epidemiological scenarios for the transmission of malaria in the Amazon region determines the difference in contagion dynamics as well as efficacy factors for vector control action, which, in turn, present challenges for cost-effective intervention planning. In this context, a strategy is proposed, based on the basic principles of the Roll Back Malaria Partnership, that “translates” the elements of this initiative that would be adapted for decentralization and integration of malaria programs within healthcare services. The working methodology presented here focuses on actions related to vector control. The strategy is guided by a stratification paradigm, from the point of view of control, the need to strengthen local decision-making and executive capacity, and the need to generate standard information that will contribute to decision-making at higher levels. This proposal arises within the technical cooperation activities that are part of the Amazon Network for the Surveillance of Antimalarial Drug Resistance and the Amazon Malaria Initiative. The implementation of this strategy will enable greater efficacy in handling available resources, and, in particular, for a more rational use of insecticides.


This annex provides guidance regarding entomological activities that should be performed at entomological study locations, within the framework of the “Strategy for rationalizing the decision-making process in malaria vector control in the countries of the Amazon Region.” It is not viable or cost-effective to intervene with vector control in all transmission areas at a municipal or high-transmission area level. Therefore, this strategy proposes concentrating all vector control efforts in places with the highest disease loads, and where action would have the greatest impact. Vector control priority areas will be stratified, from the eco-epidemiological point of view, to then select a representative site among them and perform an entomological study.


Within the framework of the Amazon Network for the Surveillance of Antimalarial Drug Resistance (RAVREDA) and the Amazon Malaria Initiative, efforts have been made to promote a strategy that would make interventions for malaria vector control more cost-effective. During the early months of 2006, and under the coordination of RAVREDA in the Pan American Health Organization (PAHO), advances were made to develop the main documents containing the strategy. Annex 7 provides guidance regarding epidemiological analyses which should be routinely done before and after any control actions, and Annex 11 normalizes entomological activity. Both the strategy and the annexes were presented at the VI Annual Meeting of RAVREDA in Quito, Ecuador, in April 2006. The proposal was well received by malaria program representatives from countries attending the meeting and, following the proposals made in San Jose, a meeting with Central American countries was scheduled for the middle of 2006 to define methodology details for entomological activities. In this regard, the PAHO Unit for Transmissible Diseases organized a meeting in Panama City, to define the last few methodology details and to agree to an implementation plan for the second half of 2006. This report describes the outcomes of the Panama City meeting.
This document describes a strategy developed and promoted by the Amazon Network for the Surveillance of Antimalarial Drug Resistance (RAVREDA) and the Amazon Malaria Initiative (AMI) intended to improve the approach to malaria vector control in the Amazon region. The objective of RAVREDA–AMI is to facilitate the institutionalization of a more efficient and rational approach to malaria vector control decisions and to make systematic and more conclusive the practice of entomology by the national malaria control programs of the region.


This document describes efforts by the Amazon Network for the Surveillance of Antimalarial Drug Resistance and the Amazon Malaria Initiative (AMI) to improve the availability of antimalarials and their use by prescribers and patients. AMI technical partners developed an approach with four phases: (i) sensitization, in which national malaria control programs were encouraged to review matters related to drug access and use and to put the topic on the agendas of the ministries of health; (ii) the identification of problems related to the access to and use of antimalarials through such means as adherence studies; (iii) the promotion of measures to improve access and use, including through activities meant to strengthen the forecasting of pharmaceutical needs and strategies to improve patient adherence to treatment regimens; and (iv) the monitoring of drug management and compliance with prescription and dispensing procedures in health care.


Recently, within the framework of the Amazon Network for the Surveillance of Antimalarial Drug Resistance (RAVREDA) and the Amazon Malaria Initiative (AMI), evaluation of antimalarial drug access and use has been promoted through a methodology designed by Management Sciences for Health's Rational Pharmaceutical Management Plus program, showing the significant problems in the countries of the region. This methodology proved beneficial for timely evaluations, but it is not adequate as a tool for routine monitoring of services. In terms of RAVREDA–AMI, a vacuum has been identified within malaria control programs in the region, and a simple methodology has been developed for monitoring the availability of antimalarial drugs and diagnostic supplies as well as compliance with official norms for malarial vigilance and treatment. This tool completes a package of useful tools for improving the management of control programs, together with other instruments provided by the regional initiative for quality management regarding diagnostics, medications, and adherence evaluations. An approach proposal and annexes with document samples are included here. Also included is a didactic text for field workers explaining the epidemiological and biological reasons for following diagnostic, treatment, and monitoring procedures, and illustrating the consequences of not controlling these in a good manner, in terms of malaria transmission, patient suffering, and resistance dissemination.

Within the Amazon Malaria Initiative, and with technical help from the Pan American Health Organization and Management Sciences for Health's Rational Pharmaceutical Management Plus Program, an instrument was developed for antimalarial supply management and for the use of antimalarial drugs and supplies. It was translated and adapted to the particular needs of the countries that share the Amazon Basin. This instrument now is used in some countries, but not in a formal or systematized way. The intention is that this instrument will be applied in the whole country after an initial pilot test to determine its usefulness and applicability at larger scales. The instrument's initial application has not been systematized within an operational framework to allow for assessment. This guide includes instructions for performing pilot test assessments.


Report not final.


The Amazon Malaria Initiative (AMI) partner committee proposed sharing drug supply management experiences from the AMI countries with Central American countries in a subregional workshop that took place in November 2008 in Guatemala City. The meeting had the participation of technical teams from all Central American Isthmus countries, as well as technical cooperation organizations. To prepare for the workshop, the Management Sciences for Health/Strengthening Pharmaceutical Systems Program gathered information regarding drug supply management in two phases. The first phase was a quick evaluation regarding the state of antimalarial drug supply in seven Central American countries, which took place from July to October 2008. The second phase took place during a workshop in Guatemala City on November 11–13, 2008, where representatives from each of the participating countries were interviewed to complete and validate the information obtained during the field data gathering trips. The results of these quick evaluations and representative consultations are described in this document.


This manual provides guidance in good laboratory practices, dissolution, high-performance liquid chromatography, and the use of the U.S. Pharmacopeia–National Formulary. It was provided to personnel from the official medicine control laboratories of Bolivia, Brazil, Ecuador, Guyana, Peru, Suriname, and Venezuela.


With descriptions of sampling methodologies and the use of portable laboratories, this manual was provided to personnel from Bolivia and Ecuador.


This manual was designed to be used in training of trainers regarding sampling methodologies and the use of portable laboratories. It was provided to personnel in Bolivia, Brazil, Colombia, Ecuador, Guyana, Suriname and Venezuela.
Provided to personnel from Bolivia’s official medicine control laboratory, this manual describes
good laboratory practices, the use of the U.S. Pharmacopeia–National Formulary General
Notices, high-performance liquid chromatography, dissolution, and UV testing.

This manual describes good laboratory practices, the use of the U.S. Pharmacopeia–National
Formulary General Notices, high-performance liquid chromatography, dissolution, and UV
testing. It was provided to personnel from Peru’s official medicine control laboratory.

This manual provides guidance on sampling methodologies and the use of portable
laboratories. It was provided to personnel from Bolivia and Peru.

This manual includes two components. The first describes good laboratory practices, the use of the U.S.
Pharmacopeia–National Formulary General Notices, high-performance liquid chromatography, dissolution,
and UV testing and was provided to the Food and Drug Department (FDD), Guyana’s official medicine control
laboratory and a Guyanese pharmaceutical manufacturer (New GPC Inc.). The second component provides
guidance on sampling methodologies and the use of portable laboratories and was provided to personnel from
FDD, New GPC Inc., and Guyana’s malaria control program as well as personnel from Suriname.

This manual, which provides guidance on gas chromatography, the headspace apparatus, and residual solvent analysis, was
provided to official medicine control laboratory personnel from Brazil, Colombia, Ecuador, Guatemala, Panama, and Peru.

This manual describes good laboratory practices, compliance with compendial requirements, dissolution, high-
performance liquid chromatography, and UV techniques and was provided to personnel from the official
medicine control laboratories of Brazil, Colombia, Ecuador, Guatemala, Honduras, and Panama.

SELECTED TRIP REPORTS, ACTIVITY REPORTS,
PROGRESS REPORTS, AND WORK PLANS

Links Media. 2008. Links Media’s participation in the VII Reunion Técnica de Iniciativa Amazonica contra la Malaria
(AMI) and Iniciativa contra las Enfermedades Infecciosas en America del Sur (SAIDI), Lima, Peru, April 7–18. Submitted
to the U.S. Agency for International Development. Gaithersburg, MD: Links Media.
From April 7 to 18, 2008, Links Media staff traveled to Lima, Peru, to participate in the VII Technical Meeting of AMI,
followed by meetings of the SAIDI Steering Committee. The objective of the meetings was to offer technical assistance and
information dissemination guidance to the attendees of each meeting. Activities included: (i) providing technical assistance in
the coordination of AMI’s information dissemination activities; (ii) managing the dissemination activities planned to place AMI
and malaria control on the public agenda; (iii) informing the U.S. Agency for International Development about the activities,
progress, goals, opportunities, and next steps for AMI and SAIDI; and (iv) compiling media coverage of the meetings.

Links Media. 2008. Earned media report, VII Technical Meeting of the Amazon Malaria Initiative, April
This report describes the media coverage obtained for the VII Technical Meeting
of the Amazon Malaria Initiative, Lima, Peru, April 8–10.
This report describes Links Media’s activities, achievements, and results as a strategic partner in the Amazon Malaria Initiative (AMI), leading communication and outreach activities. During the period October 2007 to September 2008, Links Media provided technical assistance to AMI technical partners regarding information dissemination activities; conducted news media outreach for AMI events; provided translation services; and began the development of key materials—including reports, technical articles, and a project Web site—to convey critical information about current AMI activities to various audiences.

On November 6 and 7, 2008, two panel discussions were held in Lima, Peru, to mark Malaria Day in the Americas. The National Medical Board of Peru organized the panel “Malaria in the Americas: A Disease Without Borders” on November 6th. On November 7th, the Congress of the Republic of Peru hosted the panel discussion, “The Control of Malaria is a Social Responsibility.” The report includes an earned media report as an annex.

In March 2009, Links Media staff participated in the VIII Annual Meeting of the Amazon Malaria Initiative (AMI) and the Amazon Network for the Surveillance of Antimalarial Drug Resistance in Bogotá, Colombia. Participants discussed efforts to control malaria in the region, proposed AMI activities for the future, discussed the initiative’s strategic approach for the coming years, and identified roles and responsibilities for upcoming projects and products. Links Media presented the AMI dissemination and communication strategy, which is intended to leverage existing and new materials, maximize venues for diffusion, and strategically create new linkages for disseminating information in a timely, consistent, and efficient manner to pivotal international and in-country audiences.

The Amazon Malaria Initiative is currently preparing strategic plans for each of its components. The “Access and Use of Medicines” component proposes the institutionalization of the interventions that have been implemented in the past few years, as well as others that will be implemented in the short and medium terms. The purpose of this trip to Bolivia and Ecuador was to find out the progress made to date regarding drug management and to make agreements regarding the implementation of short-term activities within the frameworks of the strategic and annual plans.

The Amazon Malaria Initiative is currently preparing strategic plans for each of its components. The “Access and Use of Medicines” component proposes the institutionalization of the interventions implemented during previous years. The main goal of this visit was to assess the progress to date in pharmaceutical management and to reach an agreement with local counterparts on the activities that will be implemented during the remainder of 2008.
The Amazon Malaria Initiative (AMI) is currently developing strategic plans for each of its components. The current “Access and Use of Medications” component proposes the institutionalization of interventions that have been implemented in the past few years, as well as others that will be implemented in the short and medium terms. The purpose of this trip was to determine the progress made to date regarding drug supply management and to participate in the VII Technical Meeting of AMI and the Amazon Network for the Surveillance of Antimalarial Drug Resistance.


Management Sciences for Health, the Pan American Health Organization, and U.S. Pharmacopeia (Amazon Malaria Initiative partners responsible for the initiative’s “Drug Access and Use” component) organized a workshop to design integrated systems for supply management and drug quality control. The national teams developed a technical procedures proposal, which will be the basis for institutionalizing current and future interventions and will serve as guidance for technical assistance activities.


To date, the Rational Pharmaceutical Management Plus Program and the Strengthening Pharmaceutical Systems (SPS) Program have carried out baseline assessments in all Amazon Malaria Initiative (AMI) countries except for Suriname. These baseline assessments are critical to identifying potential areas for intervention and evaluating AMI’s overall impact on malaria in the region. Moreover, in May 2008, Suriname participated in an AMI regional workshop to strengthen procurement and drug quality systems for malaria medicines. A key product from this workshop is the development of a manual of standardized procedures for the management of malaria medicines in each country. Throughout FY2008, SPS will be following up on progress and providing technical assistance in each country. The purpose of this trip was to analyze with local counterparts the pharmaceutical management of the national malaria program to develop a detailed program for SPS technical assistance.


In May 2008, the Management Sciences for Health/Strengthening Pharmaceutical Systems Program organized a regional workshop to analyze common management problems in the antimalarial drug supply chain. The national teams of participating countries compiled a preliminary draft for standard antimalarial drug supply management procedures and put forth specific technical assistance requests to improve drug management. The purpose of this trip to Ecuador and Peru was to (i) determine the progress made to date regarding the agreements made during the regional workshop and (ii) make agreements regarding the implementation of short-term activities within the framework of the strategic and annual plans.

Guyana has been an active member of the Amazon Malaria Initiative (AMI) since its inception; national partners have worked with AMI to develop tools and implement activities to improve the access to and use of antimalarials. Moreover, in May 2008, Guyana participated in an AMI regional workshop to strengthen procurement and drug quality systems for malaria medicines. A key product from this workshop is the development of a manual of standardized procedures for the management of malaria medicines in each country. Throughout FY2009, SPS will be following up on progress and providing technical assistance in each country. The purpose of this trip was to follow up on SPS AMI activities and develop a detailed program for future SPS technical assistance.


In May 2008, the Management Sciences for Health/Strengthening Pharmaceutical Systems Program organized a regional workshop to analyze common problems in the management of the antimalarial drug supply chain. The national teams of participating countries compiled a preliminary draft for standard antimalarial drug supply management procedures and put forth specific technical assistance requests to improve drug management. The purpose of this trip to Colombia was to (i) determine the progress made to date regarding the agreements made during the regional workshop and (ii) make agreements regarding the implementation of short-term activities within the framework of the strategic and annual plans.


In May 2008, the Management Sciences for Health/Strengthening Pharmaceutical Systems Program organized a regional workshop to analyze common problems in the management of the antimalarial drug supply chain. The national teams of participating countries compiled a preliminary draft for standard antimalarial drug supply management procedures and put forth specific technical assistance requests to improve drug management. The purpose of this trip to Bolivia was to (i) determine the progress made to date regarding the agreements made during the regional workshop and (ii) make agreements regarding the implementation of short-term activities within the framework of the strategic and annual plans.


Through several partners, the Amazon Malaria Initiative, financed by the U.S. Agency for International Development, has provided technical assistance for epidemic control in countries that share the Amazon Basin: Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, and Suriname. Virtually all of these countries have experienced a dramatic reduction in malaria cases in the past few years. In several countries, incidents are concentrated in various population groups with limited access to health services. Several factors have contributed to this epidemiological situation: adoption of artemisinin-based compounds for the treatment of *P. falciparum* in all countries; introduction of mosquito nets impregnated with long-lasting insecticide; more efficient management of national malaria programs; a focus on populations with higher risk factors, and so on. Despite this desirable situation, challenges still exist if these subregional countries intend to consolidate the achievements made to date and avoid future outbreaks and epidemics. During this trip, a standard questionnaire was developed and validated for documenting current and potential problems that could emerge in these countries as a result of the reduction of malaria incidence, especially regarding drug supply management and the manner in which these countries will sustain the disease’s current behavior. The trip included the central, intermediate, and local levels and included interviews of those responsible for the national malaria programs at different levels as well as national and international experts.
The current work plan within the “Drug Access and Use” component of the Amazon Malaria Initiative (AMI) proposes institutionalization of interventions implemented in the past few years and of others that will be implemented in the short and medium terms. One of the objectives during the visit to Colombia was to participate in the VIII Technical Meeting of AMI.

A series of changes in national program management have occurred in the past few years (stemming from new public health trends and the modernization of Peru). These changes have resulted in positive and negative impacts in the supply of drugs, materials, and supplies that are used for the management of priority diseases. No concrete studies exist regarding the supply of reactive laboratory materials for controlling malaria, but the stakeholders agree that there are deficiencies that affect public health services. In this regard, it is necessary to develop a study that can determine the current supply situation, identify the problems faced, and formulate operational recommendations. The Management Sciences for Health/Strengthening Pharmaceutical Systems Program will support the Ministry of Health in developing a study of the state of the provision of antimalarial materials and laboratory supplies in Peru.

This report describes the activities and accomplishments of the Pan American Health Organization during FY2008 in addressing the mission and objectives of the Amazon Malaria Initiative.


This document outlines the agreement between the Pan American Health Organization and the U.S. Agency for International Development for the collaboration between the Amazon Network for the Surveillance of Antimalarial Drug Resistance and the Amazon Malaria Initiative.


This document outlines the agreement between the Pan American Health Organization and the U.S. Agency for International Development for the collaboration between the Amazon Network for the Surveillance of Antimalarial Drug Resistance and the Amazon Malaria Initiative.


This proposal describes the activities and related budget for the AMI project to be implemented over the two-year period of 2003–2004 and to be completed by September 30, 2004. It provides access to the workplans for regional and national activities as well as for the organizations working together on the project.


This report describes sentinel site visits to Ecuador and Peru as well as participation by the U.S. Pharmacopeia in the Amazon Malaria Initiative and the Amazon Network for the Surveillance of Antimalarial Drug Resistance Steering Committee meetings in Belem, Brazil.


This report describes training provided by the U.S. Pharmacopeia/Drug Quality and Information Program in good laboratory practices, dissolution, high-performance liquid chromatography, and use of the U.S. Pharmacopeia–National Formulary to personnel from the official medicine control laboratories of Bolivia, Brazil, Ecuador, Guyana, Peru, Suriname, and Venezuela.


Staff from the U.S. Pharmacopeia/Drug Quality and Information Program participated in the Amazon Malaria Initiative and Amazon Network for the Surveillance of Antimalarial Drug Resistance Steering Committee meetings in Paramaribo, Suriname, as described in this report.
The purpose of this trip was to conduct an assessment of the Centro Nacional de Control de Calidad, Peru’s official medicine control laboratory.

The purpose of this trip was to provide training to personnel in Ecuador and Bolivia on sampling methodologies and the use of Global Pharma Health Fund e.V. Minilabs®.

This report describes training for trainers provided for personnel in Bolivia, Brazil, Colombia, Ecuador, Guyana, Suriname, and Venezuela on sampling methodologies and the use of portable laboratories.

The purpose of this trip was to provide training on good laboratory practices, the U.S. Pharmacopeia–National Formulary General Notices, high-performance liquid chromatography, dissolution, and UV testing to personnel from CONCAMYT–Instituto Nacional de Laboratorios de Salud (Bolivia’s official medicine control laboratory).

The purpose of this trip was to provide training on good laboratory practices, the U.S. Pharmacopeia–National Formulary General Notices, high-performance liquid chromatography, dissolution, and UV testing to personnel from the Centro Nacional de Control de Calidad (Peru’s official medicine control laboratory).

This report describes the methods and results of an on-site audit of the laboratory quality management system of the Centro Nacional de Control de Calidad (Peru’s official medicine control laboratory) against the ISO/IEC 17025:2005 standard.

The purpose of this trip was to conduct advanced training on high-performance liquid chromatography to personnel from CONCAMYT–Instituto Nacional de Laboratorios de Salud (Bolivia’s official medicine control laboratory).

U.S. Pharmacopeia/Drug Quality and Information Program staff provided training on sampling methodologies and the use of portable laboratories to personnel in Bolivia and Peru.

This report describes the participation of U.S. Pharmacopeia/Drug Quality and Information Program staff in the Amazon Malaria Initiative and Amazon Network for the Surveillance of Antimalarial Drug Resistance Steering Committee meetings in Quito, Ecuador.


U.S. Pharmacopeia/Drug Quality and Information Program staff attended a technical meeting on the quality of malaria medicines at the Facultad de Farmacia de la Universidad Federal de Minas Gerais (School of Pharmacy of the Federal University of Minas Gerais) in Belo Horizonte, Brazil. They also conducted an assessment of four laboratories in the states of Minas Gerais and Pará to evaluate capability in providing quality control support for malaria medicines, within the Amazon Malaria Initiative and the Amazon Network for the Surveillance of Antimalarial Drug Resistance.


This report describes training provided to Guyana’s Food and Drug Department (FDD), and official medicine control laboratory and a Guyanese pharmaceutical manufacturer (New GPC Inc.) in good laboratory practices, the U.S. Pharmacopeia–National Formulary General Notices, high-performance liquid chromatography, dissolution, and UV testing. Training on sampling methodologies and the use of portable laboratories was also provided to personnel in Guyana (FDD, New GPC Inc., and Guyana’s malaria program) and Suriname.


This report describes the provision of a training workshop on the proper use of a high-performance liquid chromatograph recently procured with funding from the U.S. Agency for International Development. The training activities continued the training program begun with CONCAMYT’s staff in good laboratory practices, specifically notebook documentation; high-performance liquid chromatography (HPLC) troubleshooting; and general use of the U.S. Pharmacopeia–National Formulary, concentrating on the proper interpretation of the Uniformity of Dosage Units <905> General Chapter. Amazon Malaria Initiative technical partners also oversaw maintenance performed by an expert on Shimadzu HPLC systems to fix the Shimadzu HPLC system of CONCAMYT–Instituto Nacional de Laboratorios de Salud (Bolivia’s official medicine control laboratory).


This report describes the participation of the U.S. Pharmacopeia/Drug Quality and Information Program staff in the Steering Committee meetings of the Amazon Malaria Initiative and the Amazon Network for the Surveillance of Antimalarial Drug Resistance in Campos de Jordão, Brazil.


The purpose of this trip was to meet with Peruvian partners—the Centro Nacional de Control de Calidad (CNCC) of the Dirección General de Medicamentos, Insumos y Drogas (Peru’s drug regulatory agency) and Peru’s national malaria control program—to discuss and advance the project’s work. Amazon Malaria Initiative technical partners also assessed the CNCC regarding ISO 17025:2005 accreditation.

This report describes meetings with the Dirección General de Medicamentos, Insumos, y Drogas (DIGIMED) to (i) revise the U.S. Pharmacopeia/Drug Quality and Information Program’s South American Infectious Diseases Initiative Peru work plan activities for 2008; (ii) assess progress and give recommendations to the Centro Nacional de Control de Calidad (CNCC) regarding ISO accreditation; (iii) finalize sampling and testing protocols for selected antibiotic and antituberculosis medications in DISA Callao; (iv) improve the coordination of activities between CNCC and DIGIMED; and (v) assess progress in the quality assurance and quality control of antimalarials within the context of the Amazon Malaria Initiative.


This report describes a trip by U.S. Pharmacopeia/Drug Quality and Information Program staff to Bolivia to (i) install and train personnel from CONCAMYT–Instituto Nacional de Laboratorios de Salud (INLASA; Bolivia’s official medicine control laboratory) on the Karl Fisher instrument for water content analysis, (ii) assess CONCAMYT–INLASA to improve its laboratory quality management system, and (iii) meet with partners in Bolivia—CONCAMYT–INLASA, Unidad de Medicamentos y Tecnología en Salud (Bolivia’s drug regulatory agency), and the national malaria control program—to discuss and advance the project’s work.


The purpose of this trip was to participate in the Amazon Malaria Initiative and Amazon Network for the Surveillance of Antimalarial Drug Resistance Steering Committee meetings in Lima, Peru.


The purpose of this trip was to deliver the Regional Workshop to Improve the Management of Supply and Quality Assurance Systems for Malaria to relevant personnel from all Amazon Malaria Initiative partner countries. This workshop was organized and delivered by the U.S. Pharmacopeia/Drug Quality and Information Program, Management Sciences for Health/Strengthening Pharmaceutical Systems Program, and the Pan American Health Organization.


The purpose of this trip was to deliver the Regional Workshop on Gas Chromatography, Headspace Apparatus, and Residual Solvent Analysis to personnel from the official medicine control laboratories of Brazil, Colombia, Ecuador, Guatemala, Panama, and Peru.


The purpose of this trip was to provide regional training on good laboratory practices, compliance with compendial requirements, dissolution, high-performance liquid chromatography, and UV techniques to personnel from the Instituto Nacional de Higiene y Medicina Tropical “Leopoldo Izquieta Pérez” (INHMT), Ecuador’s official medicine control laboratory (OMCL), and personnel from the OMCLs of Brazil, Colombia, Guatemala, Honduras, and Panama. The U.S. Pharmacopeia/Drug Quality and Information Program staff also assessed INHMT working conditions to improve its laboratory quality management system and worked with in-country partners (INHMT, Servicio de Control de Enfermedades Transmitidas por Vectores Artrópodos, and the Ministerio de Salud Pública) to program and advance post-marketing surveillance activities using portable laboratories.
The purpose of this trip was to deliver the Regional Workshop to Improve the Management of Supply and Quality Assurance Systems for Malaria to relevant personnel from selected Central American countries (Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama). This workshop was organized and delivered by the U.S. Pharmacopeia/Drug Quality and Information Program, the Management Sciences for Health/ Strengthening Pharmaceutical Systems Program, and the Pan American Health Organization. Amazon Malaria Initiative technical partners also conducted a rapid assessment of the quality management system at the Laboratorio Nacional de Salud, Guatemala’s official medicine control laboratory.

The purpose of this trip to Bolivia was to: (i) assess CONCAMYT–Instituto Nacional de Laboratorios de Salud (INLASA; Bolivia’s official medicine control laboratory) to improve its laboratory quality management system; (ii) discuss the advances made regarding quality assurance and quality control of antimalarial medicines with the national malaria control program and the Pan American Health Organization (PAHO); and (iii) review and coordinate work related to post-marketing surveillance activities with Unidad de Medicamentos y Tecnología en Salud (Bolivia’s drug regulatory agency), CONCAMYT–INLASA, and PAHO–Bolivia.

This report describes the participation of U.S. Pharmacopeia/Drug Quality and Information Program staff in the Amazon Malaria Initiative and Amazon Network for the Surveillance of Antimalarial Drug Resistance Steering Committee meetings in Bogotá, Colombia.

**JOURNAL ARTICLES**


In 2002, mefloquine–artesunate (MQ–AS) combination therapy was adopted as the first-line treatment for uncomplicated Plasmodium falciparum malaria in the Amazon region of Peru. Although MQ resistance has yet to be reported from the Peruvian Amazon, it has been reported from other countries in the Amazon Region. The authors examined the in vivo efficacy and pharmacokinetic parameters through day 56 of three commercial formulations of MQ given in combination with AS. Thirty-nine adults with P. falciparum mono-infection were randomly assigned to receive AS with one of the three commercial formulations of MQ. All three formulations had similar pharmacokinetics; in addition, the pharmacokinetics seen in this Peruvian population were similar to reports from other ethnic groups. All patients rapidly cleared their parasitemia with no evidence of recrudescence by day 56. Continued surveillance is needed to ensure that patients continue to receive optimal therapy.

Recent studies indicated that sensitive parasites could increase in frequency in a population when drugs are removed, suggesting that the life span of affordable antimalarial drugs could be expanded. The authors studied 97 samples from Bolivar State, Venezuela, an area where sulfadoxine–pyrimethamine (SP) has not been used for eight years due to its ineffectiveness. They characterized point mutations in two genes that have been implicated in resistance to SP, dihydrofolate reductase (dhfr) and dihydropteroate synthase (dhps). They also assayed neutral microsatellite markers around the dhfr (chromosome 4) and dhps (chromosome 8) genes and on chromosomes 2 and 3 to track the origin and spread of resistant alleles. They found that drug-resistant SP mutants are fixed in the population. Two genotypes were present in the samples, dhfr(50R/51I/108N) dhps(437G/540E/581G) (90.7%) and dhfr(51I/108N) dhps(437G/581G) (9.3%). They show a single microsatellite haplotype for all of the dhfr and dhps alleles, and the alleles at the microsatellite loci are different from those present in Africa. Thus, in these samples from Venezuela, there is a single origin for both dhfr and dhps SP-resistant alleles, and these alleles originated independently of those characterized from Africa. Furthermore, this is the first report of a “hitchhiking effect” on the genetic variation around dhps due to selection by SP using an extensive set of microsatellite markers. The results indicate that, in areas where gene flow is limited, the fixation of drug-resistant parasites in the population is stable, even after drug selection is relaxed.


National malaria control programs must deal with the complex process of changing national malaria treatment guidelines, often without guidance on the process of change. There is a paucity of literature describing successful malaria treatment policy changes to help guide control programs through this process. The authors sought to understand the wider context in which national malaria treatment guidelines were formulated in a specific country (Peru). Using qualitative methods, they completed a retrospective analysis of the process of change in Peru’s anti-malarial treatment policy from the early 1990s to 2003. They found that, although not perfectly or fully implemented by 2003, the change in malaria treatment policy in Peru occurred very quickly compared with that of other countries. Health authorities in Peru identified a problem, collected the data necessary to justify the change, used political will to their favor, approved the policy, and moved to improve malaria control in their country. As such, they offer an excellent example for other countries contemplating or embarking on policy changes.


The authors found that the frequency of alleles with triple mutations conferring sulfadoxine–pyrimethamine (SP) resistance in the Peruvian Amazon Basin has declined (16.9% for dhfr and 0% for dhps compared to 47% for both alleles in 1997) five years after SP was replaced as the first-line treatment for *Plasmodium falciparum* malaria. Microsatellite analysis showed that the dhfr and dhps alleles are of common origin.
BRIEF REPORTS, GRAPHICS, AND FACT SHEETS


This diagram shows the protocol, step-by-step, for in vivo efficacy testing of mefloquine and mefloquine–artesunate in the treatment of uncomplicated Plasmodium falciparum malaria from day 0 (day of enrollment) to day 28 (the final day of follow-up).


This fact sheet describes the malaria burden in the Americas, impediments to malaria control, and the mission, objectives, approach, and accomplishments of the Amazon Malaria Initiative.


This fact sheet describes challenges in malaria control and the role of Management Sciences for Health in fighting malaria in Africa, Asia and the Near East, and Latin America and the Caribbean.


Amazon Malaria Initiative (AMI) technical partners have engaged in efforts to promote the institutionalization of procedures for managing the supply of antimalarials in the Amazon Basin. This brief report describes these efforts as well as the progress made by several AMI partner countries in improving the management of pharmaceutical supply systems.


Amazon Malaria Initiative (AMI) technical partners have engaged in efforts to promote the institutionalization of procedures for managing the supply of antimalarials in the Amazon Basin. This brief report describes these efforts as well as the progress made by several AMI partner countries in improving the management of pharmaceutical supply systems.


Amazon Malaria Initiative (AMI) technical partners have developed an instrument for the supervision of the supply system for antimalarial medicines and commodities and have engaged in activities to test its utility. This brief report describes the results of pilot tests of the instrument conducted in several AMI partner countries.


Amazon Malaria Initiative (AMI) technical partners have developed an instrument for the supervision of the supply system for antimalarial medicines and commodities and have engaged in activities to test its utility. This brief report describes the results of pilot tests of the instrument conducted in several AMI partner countries.
This two-page status report describes the burden of malaria in the Americas, strategic approaches and interventions in malaria control, the mobilization of resources in the fight against malaria, and reductions in malaria morbidity and mortality from 2000 to 2007. The report also discusses the goals of the Amazon Malaria Initiative, the Amazon Network for the Surveillance of Antimalarial Drug Resistance, and the objectives of Malaria Day in the Americas.


This two-page status report describes the burden of malaria in the Americas, strategic approaches and interventions in malaria control, the mobilization of resources in the fight against malaria, and reductions in malaria morbidity and mortality from 2000 to 2007. The report also discusses the goals of the Amazon Malaria Initiative, the Amazon Network for the Surveillance of Antimalarial Drug Resistance, and the objectives of Malaria Day in the Americas.


This two-page status report describes the burden of malaria in the Americas, strategic approaches and interventions in malaria control, the mobilization of resources in the fight against malaria, and reductions in malaria morbidity and mortality from 2000 to 2007. The report also discusses the goals of the Amazon Malaria Initiative, the Amazon Network for the Surveillance of Antimalarial Drug Resistance, and the objectives of Malaria Day in the Americas.


This fact sheet describes the challenges of controlling malaria among migratory workers and the outcome of a pilot test of a rapid diagnosis and treatment strategy in Bolivia conducted through the Amazon Malaria Initiative.

**OTHER PRINTED MATERIALS**


**SELECTED PRESENTATIONS**

**PRESENTATIONS AT THE VIII TECHNICAL MEETING OF THE AMAZON MALARIA INITIATIVE**


This presentation describes regional goals for the reduction of malaria morbidity and mortality in the Americas, progress toward achieving regional goals in the Americas, the challenge posed by antimalarial resistance, the goals and strategies of the Amazon Malaria Initiative (AMI) and the Amazon Network for the Surveillance of Antimalarial Drug Resistance (RAVREDA), changes in drug treatment policies and the number of cases of malaria in the Amazon after the introduction of artemisinin-based combination therapies, the interactions between RAVREDA–AMI and other initiatives, and the current challenges in the fight against malaria in the Amazon.


This presentation describes progress to date regarding vector insecticide susceptibility surveillance and the determination of the effectiveness of specific vector control approaches.

This presentation describes (i) workshops and other activities intended to provide training in the measurement of blood levels of antimalarials as a way to determine the cause of treatment or prophylactic failure and (ii) the results of a comparison of methods for assessing antimalarial blood levels.

Cerón Rodríguez, V. 2009. *Clima, cambio climático y malaria: Proyecto INAP “la experiencia Colombiana”.* (Climate, climate change, and malaria: INAP project “the Colombian experience.”) Presented on behalf of the Instituto Nacional de Salud at the VIII Technical Meeting of the Amazon Malaria Initiative, Bogotá, Colombia, March 17–20. (In Spanish.)

This presentation describes the objectives of the Piloto Nacional Integrado de Adaptación (INAP, a climate change adaptation project of the Instituto de Hidrología, Meteorología y Estudios Ambientales in Colombia) with respect to human health, the selection criteria used to choose five pilot municipalities, the components of a decision-making tool, the means by which to achieve social support for the project, and INAP’s challenges and opportunities.

Chang Neyra, O.J. 2009. *Iniciativa Amazónica contra la Malaria: Enfoque de AMI y RAVREDA frente a los cambios epidemiológicos en la región y la transición hacia situaciones de eliminación.* (Amazon Malaria Initiative: AMI–RAVREDA’s focus on addressing epidemiological changes in the region and the transition to elimination status.) Presented on behalf of the U.S. Agency for International Development at the VIII Technical Meeting of the Amazon Malaria Initiative, Bogotá, Colombia, March 17–20. (In Spanish and English.)

This presentation describes the malaria burden in the Americas, including changes over time in the number of cases, revisions of the standardized protocols for drug efficacy testing, and factors affecting the evolution of resistance to antimalarials (including transmission intensity).


This presentation addresses the need to improve understanding of the climate–environment–disease interaction (for malaria and other diseases) and to use the knowledge obtained from recent advances in climate science in climate-sensitive development sectors to more effectively manage risks to vulnerable populations.

Green, M.D. 2009. *A rapid colorimetric field test to determine levels of deltamethrin on PermaNet® surfaces.* Presented on behalf of the Centers for Disease Control and Prevention at the VIII Technical Meeting of the Amazon Malaria Initiative, Bogotá, Colombia, March 17–20. (In English and Spanish.)

This presentation describes the development and testing of a field assay for measuring insecticide levels on the surface of bed nets as well as results of studies using this assay and next steps in this area.


A recent study used the enzyme-linked immunosorbent assay, an in vitro technique, to evaluate the resistance of P. falciparum to antimalarials, as described in this presentation.

Links Media. 2009. *Necesidades de comunicación y diseminación.* (Communication and dissemination needs.) Presented at the VIII Technical Meeting of the Amazon Malaria Initiative, Bogotá, Colombia, March 17–20. (In Spanish.)

This presentation describes the objectives of communication as a component of the Amazon Malaria Initiative, progress to date in achieving communication goals, and planned communication activities.
Management Sciences for Health. 2009. Mejoramiento de las condiciones de almacenaje de medicamentos antimaláricos de Guayaquil y Machala del Ministerio de Salud de Ecuador. (Improved storage conditions of antimalarial medicines by the Ecuadorian Ministry of Health in Guayaquil and Machala.) Presented at the VIII Technical Meeting of the Amazon Malaria Initiative, Bogotá, Colombia, March 17–20. (In Spanish.)

This presentation describes (i) improvements in the storage conditions of antimalarial medicines; (ii) improvements in the systems for managing the supply and quality assurance of medicines; and (iii) an ongoing study of prescription practices and adherence to treatment in Ecuador.

Management Sciences for Health. 2009. Asistencia técnica en gestión de suministro de medicamentos e insumos para el control de la malaria. (Technical assistance in supply chain management of medicines and supplies for controlling malaria.) Presented at the VIII Technical Meeting of the Amazon Malaria Initiative, Bogotá, Colombia, March 17–20. (In Spanish.)

This presentation provides an overview of the current status of the supply chain management of malaria medicines and supplies in Amazon countries, support activities provided by Amazon Malaria Initiative partners in improving medicine supply chain management in the previous 12 months, and planned activities for the next 12 months.

Ministerio de la Protección Social, República de Colombia. 2009. Acceso y uso de antimaláricos en Colombia. (Access to and use of antimalarials in Colombia.) Presented at the VIII Technical Meeting of the Amazon Malaria Initiative, Bogotá, Colombia, March 17–20. (In Spanish.)

This presentation addresses efforts by the Ministerio de la Protección Social to assess and improve (i) the management of public health supplies and consumables; (ii) malaria diagnosis and treatment; and (iii) prescription, dispensation, and adherence to treatment in Colombia.

Ministerio de Salud del Perú. 2009. Eficacia de tres esquemas diferentes de primaquina para la prevención de recaídas de malaria por P. vivax en la región Amazónica del Perú. (Efficacy of three different primaquine regimens for preventing recurrence of P. vivax malaria in the Amazon region of Peru.) Presented at the VIII Technical Meeting of the Amazon Malaria Initiative, Bogotá, Colombia, March 17–20. (In Spanish.)

A recent study assessed the efficacy of the antimalarial drug primaquine administered over 5, 7, or 14 days for the treatment of P. vivax malaria, as described in this presentation.


This presentation describes the preliminary results of studies employing experimental huts in Latin America to evaluate (i) the potential use of this method to evaluate the behavior of vector mosquitoes in response to the use of insecticide-treated bed nets and (ii) the effectiveness of long-lasting insecticide-treated bed nets according to four efficacy indicators and the behavior of Anopheles darlingi.

Montoya, R. 2009. Situación de la Red de Vigilancia de la Resistencia a los Antimaláricos (RAVREDA). (Role of the Amazon Network for the Surveillance of Antimalarial Drug Resistance.) Presented on behalf of the Pan American Health Organization at the VIII Technical Meeting of the Amazon Malaria Initiative, Bogotá, Colombia, March 17–20. (In Spanish.)

This presentation describes the structure of the Amazon Network for the Surveillance of Antimalarial Drug Resistance (RAVREDA), the roles of participating organizations in areas such as drug resistance monitoring and vector control, the results of in vivo drug efficacy tests conducted through RAVREDA, and RAVREDA’s roles in the policy cycle.

This presentation describes the results of a study on (i) the safety and efficacy of Coartem® for the treatment of acute, uncomplicated *P. falciparum* infections and (ii) the impact of Coartem® therapy on gametocytemia.

No author. 2009. *Implementación del uso de toldillos de larga duración (Olyset Net) para la prevención de la malaria en el Departamento del Chocó.* (Implementation of the use of long-lasting bed nets [Olyset Net] for preventing malaria in the Department of Chocó.) Presented at the VIII Technical Meeting of the Amazon Malaria Initiative, Bogotá, Colombia, March 17–20. (In Spanish.)

This presentation describes the results of an intervention and assessment of the effectiveness of long-lasting insecticide-treated bed nets conducted in the Department of Chocó, Colombia, with technical assistance provided by the Amazon Malaria Initiative and the Amazon Network for the Surveillance of Antimalarial Drug Resistance.


This presentation describes a pilot test of the supervision tool in Guyana, including the health facilities visited, the problems identified, outcomes according to several indicators of medicine availability and use, and recommendations for Guyana’s national malaria control program.


This presentation provides (i) an overview of the activities of Amazon Malaria Initiative (AMI) partners in strengthening and supporting the institutionalization of medicine quality assurance and quality control systems and (ii) the results of studies conducted in the AMI partner countries using portable laboratories.


This presentation provides an overview of the standardized protocol, developed by the World Health Organization (WHO), for the assessment of therapeutic efficacy of antimalarial drugs; WHO’s recommended threshold levels of treatment failure that should trigger a change in malaria treatment policy; challenges related to continued resistance monitoring and policy updates; the advantages and disadvantages of in vitro tests and molecular markers for drug resistance monitoring; and recommendations for countries targeting malaria elimination.


This presentation describes the Global Malaria Action Plan (GMAP), its targets and ultimate goal to eliminate malaria, its three-part strategy to achieve its targets, the malaria burden in four regions of the world, and the costs and benefits of the GMAP.


This presentation provides an overview of the results of studies assessing the frequency, origins, and geographical distribution of antimalarial-resistant genotypes among Plasmodium falciparum in Brazil, Peru, and Venezuela as well as changes in the frequency of drug-resistant genotypes after the drug’s removal.
Primaquine double dose for seven days is inferior to single dose treatment for fourteen days in preventing *P. vivax* relapses in Suriname. Presented at the VIII Technical Meeting of the Amazon Malaria Initiative, Bogotá, Colombia, March 17–20.

This presentation describes the results of a study to determine whether a double dose of primaquine administered over 7 days is as effective as the standard dose administered over 14 days.

World Health Organization, Western Pacific Region. 2009. *Control de calidad de pruebas de diagnóstico rápido de malaria.* (Quality control of rapid diagnostic tests for malaria.) Presented at the VIII Technical Meeting of the Amazon Malaria Initiative, Bogotá, Colombia, March 17–20. (In Spanish.)

This presentation describes the need for and requirements of a system of quality control of rapid diagnostic tests, which are used in malaria diagnosis in areas that are difficult to access.

PRESENTATIONS AT THE VII TECHNICAL MEETING OF THE AMAZON MALARIA INITIATIVE

Cabezas C. 2008. *Eficacia de tres esquemas diferentes de primaquina para la prevención de recaídas de malaria por Plasmodium vivax en la región Amazónica del Perú.* (Efficacy of three different primaquinine regimens for the prevention of malaria relapse with *Plasmodium vivax* in the Amazon region of Peru.) Presented on behalf of the Ministerio de Salud del Perú at the VII Technical Meeting of the Amazon Malaria Initiative, Lima, Peru, April 7–10. (In Spanish.)

As described in this presentation, recent studies aimed to (i) assess the efficacy of three treatment regimens for *P. vivax* malaria in the Peruvian Amazon, (ii) conduct in vitro tests of drug susceptibility and tests using molecular markers to identify polymorphisms conferring antimalarial resistance of parasites in patients with recurring infections, and (iii) genotype parasites isolated from such patients to distinguish between relapse and reinfection.

Centers for Disease Control and Prevention. 2008. *Estudios en apoyo de la lucha contra la malaria.* (Studies in support of the battle against malaria.) Presented at the VII Technical Meeting of the Amazon Malaria Initiative, Lima, Peru, April 7–10. (In English and Spanish.)

This presentation describes methods used in the surveillance of vector resistance to insecticide and efforts to determine the use and effectiveness of insecticide-treated bed nets and other protective measures.


This presentation introduces the meeting, welcomes participants, and provides results and recommendations of a recent external evaluation of the Amazon Malaria Initiative.

Instituto Nacional de Salud (Peru). 2008. *Resistencia de los vectores a los insecticidas.* (Vector resistance to insecticides.) Presented at the VII Technical Meeting of the Amazon Malaria Initiative, Lima, Peru, April 7–10. (In Spanish.)

This presentation describes the results of vector resistance surveillance in Peru.


This presentation describes the approach used by the Amazon Malaria Initiative to improve access to and use of quality-assured antimalarial medicines and supplies, progress to date, and the work plan for coming years.
Marquiño, W. 2008. Propuesta de actividades México y Centroamérica. (Proposal for activities in Mexico and Central America.) Presented on behalf of the Pan American Health Organization at the VII Technical Meeting of the Amazon Malaria Initiative, Lima, Peru, April 7–10. (In Spanish.)

This presentation describes the current status of malaria in Mexico and Central America, changes in the number of cases from 2000 to 2006, factors limiting malaria control in this region, ongoing regional efforts in fighting malaria, and proposed roles for the Amazon Malaria Initiative and the Amazon Network for the Surveillance of Antimalarial Drug Resistance.


As described in this presentation, recent studies aimed to (i) determine how to assess levels of chloroquine and its metabolite desethylchloroquine using blood-spotted filter paper as a means of determining the cause of treatment or prophylactic failure, (ii) perfect the analysis and extraction techniques for this method, (iii) determine the advantages and disadvantages of the reversed phase compared with the normal phase of chloroquine analysis, and (iv) determine how to improve these techniques for use by labs in the Amazon region.

No author. 2008. Diagnostico laboratorial. (Laboratory diagnosis.) Presented at the VII Technical Meeting of the Amazon Malaria Initiative, Lima, Peru, April 7–10. (In English and Spanish.)

This presentation describes activities by Amazon Malaria Initiative partners to improve the management of diagnostic quality and to implement rapid diagnostic tests.

No author. 2008. Evaluation of vector control interventions. Presented at the VII Technical Meeting of the Amazon Malaria Initiative, Lima, Peru, April 7–10. (In English and Spanish.)

This presentation describes plans for studies and pilot projects to assess (i) the entomological efficacy of long-lasting insecticide-treated bed nets in the Amazon region, (ii) the rational use of these nets by national malaria control programs, and (iii) their epidemiological impact.

No author. 2008. Guia para la discusion. (Discussion guide.) Presented at the VII Technical Meeting of the Amazon Malaria Initiative, Lima, Peru, April 7–10. (In Spanish.)

This presentation is intended to guide discussion of progress, challenges, and solutions for each of the lines of work under the Amazon Malaria Initiative.

No author. 2008. Strategic approach to the information and data analysis. Presented at the VII Technical Meeting of the Amazon Malaria Initiative, Lima, Peru, April 7–10.

This presentation describes the objectives and goals of the Amazon Malaria Initiative and the Amazon Network for the Surveillance of Antimalarial Drug Resistance with respect to the use of information and data analysis by national malaria control programs.

No author. 2008. AMI strategic approach. Presented at the VII Technical Meeting of the Amazon Malaria Initiative, Lima, Peru, April 7–10. (In English and Spanish.)

This presentation describes the Amazon Malaria Initiative’s efforts to (i) strengthen vector insecticide resistance monitoring and evaluation and (ii) support countries in improving their capabilities for insecticide quality control and assurance.


This presentation describes the results of a study comparing the efficacy of a 14-day standard dose of primaquine (with chloroquine) to a 7-day double dose (with chloroquine).
Pan American Health Organization. 2008. *Impacto ACTs.* (ACT impact.) Presented at the VII Technical Meeting of the Amazon Malaria Initiative, Lima, Peru, April 7–10. (In Spanish and English.)

This presentation describes the impact—in terms of morbidity and mortality as well as cost—of the introduction of artemisinin-based combination therapies in the Amazon region, challenges faced in measuring the impact, and possible solutions.


This presentation describes the current malaria situation in the Americas and changes in the number of cases from 2000 to 2006, the major lines of work and accomplishments for the Amazon Malaria Initiative and the Amazon Network for the Surveillance of Antimalarial Drug Resistance in the context of other regional and global initiatives and goals, current thinking regarding the feasibility of malaria elimination regionally or globally, challenges facing malaria elimination efforts, and potential means to achieve elimination.

Pan American Health Organization. 2008. *Iniciativa Amazónica contra la Malaria (AMI)/Red Amazónica de Vigilancia de la Resistencia a los Antimaláricos (RAVREDA).* (Amazon Malaria Initiative/Amazon Network for the Surveillance of Antimalarial Drug Resistance.) Presented at the VII Technical Meeting of the Amazon Malaria Initiative, Lima, Peru, April 7–10. (In Spanish.)

This presentation provides an overview of the Amazon Malaria Initiative and the Amazon Network for the Surveillance of Antimalarial Drug Resistance as well as the accomplishments of these initiatives with respect to antimalarial resistance surveillance, access to and use of drugs, quality of diagnosis, medicine quality, vector control and entomology, and information management.

Prihluła, V. 2008. *Acceso y uso de medicamentos: Aseguramiento y control de calidad.* (Access to and use of medication: Safety and Quality Control.) Presented on behalf of the U.S. Pharmacopeia Drug Quality and Information Program at the VII Technical Meeting of the Amazon Malaria Initiative, Lima, Peru, April 7–10. (In Spanish.)

This presentation describes the Amazon Malaria Initiative's approach, accomplishments to date, and future plans in the area of improving antimalarial medicine quality assurance and quality control.


This presentation describes antimalarial resistance and drug efficacy, factors affecting treatment failure, modifications over time to the standardized protocol for the in vivo assessment of drug efficacy recommended by the World Health Organization (WHO), the utility of in vitro and molecular marker approaches to assessing drug efficacy, WHO criteria for the levels of treatment failure that should trigger policy change, and details of the current standardized protocol for in vivo efficacy tests for *P. falciparum* and *P. vivax* malaria.

Sánchez, M. 2008. *Iniciativa Amazónica para la malaria: Diseminación y comunicación.* (Amazon Malaria Initiative: Dissemination and communication.) Presented on behalf of Links Media at the VII Technical Meeting of the Amazon Malaria Initiative, Lima, Peru, April 7–10. (In Spanish.)

This presentation describes the purpose and objectives of information dissemination and communication activities for the Amazon Malaria Initiative.


This presentation describes recent research on declines in drug-resistance alleles in malaria-causing parasites after drug policy changes in the Peruvian Amazon.
OTHER PRESENTATIONS


This presentation provides an overview of malaria in the Americas, including the parasites present in this region; ongoing efforts to combat malaria; specific vector control techniques used; the number of malaria cases broken down by year, country, parasite, age group, gender, and geographic subregion; measures of the costs associated with malaria treatment and control; progress in fighting malaria; and the roles and activities of the Amazon Malaria Initiative and the Amazon Network for the Surveillance of Antimalarial Drug Resistance.


This presentation describes the rationale, development, and progress of the Amazon Malaria Initiative and the Amazon Network for the Surveillance of Antimalarial Drug Resistance.

WEB PAGES AND ONLINE ANNOUNCEMENTS


This web page describes the malaria situation in the Amazon region, the history and accomplishments of the Amazon Network for the Surveillance of Antimalarial Drug Resistance (RAVREDA) and the Amazon Malaria Initiative (AMI), and the contributions of the Centers for Disease Control and Prevention to AMI and RAVREDA.


This web page describes the malaria burden in the Americas and announces a roundtable discussion marking Malaria Day in the Americas, “Malaria en las Américas, una enfermedad sin fronteras,” to take place November 6, 2008.


Through this Web page, the Congreso de la República del Perú announces Malaria Day in the Americas at its facilities.


This Web page describes the public health threat posed by malaria in the Amazon Basin, the objectives of the Amazon Malaria Initiative, and the role and accomplishments of Management Sciences for Health/Rational Pharmaceutical Management Plus Program.


This Web page mentions events to be held in Lima in connection to Malaria Day in the Americas.

Through this Web page, the Ministry of Health of Peru reports statistics and events in connection with Malaria Day in the Americas.


This Web page mentions malaria information and events to be held in Lima in connection with Malaria Day in the Americas.


This Web page provides a brief overview of the Amazon Network for the Surveillance of Antimalarial Drug Resistance and the Amazon Malaria Initiative.


This Web page describes the malaria burden in the Amazon Basin region and challenges in malaria control. The origins, objectives, and early accomplishments of the Amazon Malaria Initiative are highlighted.


This Web page includes a news posting announcing that Peru’s official medicine control laboratory, Centro Nacional de Control de Calidad (CNCC) was awarded ISO/IEC 17025:2005 accreditation, an internationally recognized standard for testing and calibration laboratories. This accomplishment will help ensure the distribution of good-quality pharmaceutical products to the people of Peru.


This Web page describes the problem of antimicrobial resistance in Latin America and the Caribbean and efforts to address this problem through the Amazon Malaria Initiative and the South American Infectious Disease Initiative. The role of U.S. Pharmacopeia in these initiatives, and their collaborations with partner organizations and partner countries, is highlighted.

**NEWS RELEASES AND OTHER MEDIA MATERIALS**


This news release, sent to local and international media, provides Amazon Malaria Initiative facts and information regarding the Amazon Malaria Initiative VII Annual Technical Meeting, held in Peru on April 7–12, 2008.


This document, provided to the media, presents general information regarding the Amazon Malaria Initiative (AMI), the activities of AMI partner countries and the Amazon Network for the Surveillance of Antimalarial Drug Resistance, and the allied efforts of international and local partners supporting the initiative.
This document presents information about the Amazon Malaria Initiative (AMI) as a collaborative effort to control malaria in South America. It describes AMI’s objectives and the role of the U.S. Agency for International Development.

This document presents background information on the Amazon Malaria Initiative as a multisector initiative to combat malaria.

This letter, sent to various local and international media, is intended to promote journalists’ interest in the Amazon Malaria Initiative.

This document provides links to Web pages related to the Amazon Malaria Initiative and malaria.

This news release describes two panel discussions to be held in recognition of Malaria Day in the Americas in 2008. On November 6, the Colegio Médico del Perú will host the roundtable “Malaria in the Americas: Overcoming the Challenges of a Borderless Disease.” On November 7, the Congreso de la República del Peru, the U.S. Agency for International Development, Peru’s Ministry of Health, and the Pan American Health Organization will host a discussion about malaria, borders, and health diplomacy.

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This document, developed for Malaria Day in the Americas (November 6, 2008), presents general information regarding the Amazon Malaria Initiative: its focus, activities, efforts by partner countries and the Amazon Network for the Surveillance of Antimalarial Drug Resistance, and the allied efforts of international and local partners supporting the initiative.
Peru’s official medicine control laboratory, Centro Nacional de Control de Calidad, achieved ISO/IEC 17025:2005 accreditation, an internationally recognized standard for testing and calibration laboratories, for five critical analytical tests. This news release describes the significance of the accreditation for malaria control in the Amazon region and the role of the Amazon Malaria Initiative and the South American Infectious Diseases Initiative in supporting medicine quality assurance and quality control in the region.


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Peru’s National Center for Quality Control achieves internationally recognized accreditation for high standard of operation: Dedicated staff of professionals aid in the distribution of good-quality medicines.


Peru’s official medicine control laboratory, Centro Nacional de Control de Calidad (CNCC), achieved ISO/IEC 17025:2005 accreditation, an internationally recognized standard for testing and calibration laboratories. This news release describes the significance of the accreditation for drug quality in Peru and the contribution of the Amazon Malaria Initiative and the South American Infectious Diseases Initiative in helping the CNCC achieve this. It also highlights an event held on May 21 to recognize this accomplishment.
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This news release describes topics raised during a panel discussion marking Malaria Day in the Americas. Topics included the malaria burden in Latin America and the Caribbean, progress toward controlling the disease, and the accomplishments of the Amazon Malaria Initiative.

**SELECTED MEDIA COVERAGE: NEWSPAPER AND ONLINE NEWS ARTICLES**


This article indicates that Peru is the leader in the treatment of malaria and a model for other Amazon countries. The Ministry of Health has been developing combination therapy proposals to combat the problem since 1998, when more than 50 people died from the disease.


This story mentions events to be held in Lima in connection with Malaria Day in the Americas.


This article provides statistics regarding malaria and the Amazon Malaria Initiative.


This story from a local radio station mentions Malaria Day in the Americas as well as malaria statistics.

Diario del País. 2008. *Casos de malaria mortal se redujeron en 83% desde el año 2000, informa Minsa.* (MINSA reports a reduction of 83% in fatal malaria cases since the year 2000.) November 8, Locales, p. 11. (In Spanish.)

This article provides statistics regarding malaria and the Amazon Malaria Initiative.

This story indicates that a new medicine to combat malaria has been launched by a Brazilian and international initiative. It will be distributed in Latin America and Asia.


As described in this article, the Instituto Nacional de Higiene y Medicina Tropical “Leopoldo Izquieta Pérez” (INHMT) and the U.S. Pharmacopeia Drug Quality and Information Program will hold a workshop on good laboratory practices, dissolution, high-performance liquid chromatography, and UV techniques in Guayaquil, August 25–29, in the “Atilio Macchiavello” Auditorium of INHMT.


This article mentions the meeting of the Amazon Malaria Initiative that will take place in Lima to analyze the main achievements that have been made in the Amazon Basin for reducing mortality and morbidity due to malaria.


This online news site posting of a U.S. Pharmacopeia press release describes the ISO/IEC 17025:2005 accreditation of the Centro Nacional de Control de Calidad (CNCC), Peru’s official medicine control laboratory. The accreditation certifies that CNCC is providing valid and trustworthy data to the Peruvian Ministry of Health, helping to ensure the distribution of good-quality medicines to the country’s citizens.


Investigators identified the process that causes the malaria parasite to adhere to red blood cells. Scientists say that the key is an adhesive substance that stops the malaria parasite from being expelled from the body by the immune system.


In this interview, Dr. Jaime Chang, U.S. Agency for International Development, coordinator of the VII Technical Meeting of the Amazon Malaria Initiative in Lima, stated that the number of malaria cases in participating countries had not increased, but that the ministries of health must monitor efficient programs and promote sectorial cooperation.


This article describes a meeting of the Amazon Malaria Initiative in Lima to analyze achievements and revise future goals. Peru was the first of the participating countries to implement combination therapies for malaria treatment.


As described in this article, a Ministry of Health expert indicated that Loreto has 99% of Peru’s most severe cases of malaria. However, he also mentioned that needed medical attention has decreased every year for the disease.
SELECTED MEDIA COVERAGE: RADIO

In this interview, Dr. Jaime Chang, U.S. Agency for International Development, describes the Amazon Malaria Initiative and the objectives of the VII Technical Meeting of the AMI in Lima, Peru, on April 7–10, 2008.

In this interview, Dr. Luis Miguel Leon, Ministry of Health (Peru), discusses Malaria Day in the Americas.

A local radio station mentions Malaria Day in the Americas as well as malaria statistics.

In this interview, Dr. Luis Miguel Leon, Ministry of Health (Peru), discusses Malaria Day in the Americas.

In this interview, Dr. Jaime Chang, U.S. Agency for International Development, discusses the Amazon Malaria Initiative (AMI) and the upcoming VII Technical Meeting of AMI in Lima.

In this interview, Dr. Luis Miguel Leon, Ministry of Health (Peru), discusses Malaria Day in the Americas.

In this interview, Dr. Luis Miguel Leon, Ministry of Health (Peru), discusses the Amazon Malaria Initiative and the objectives of the VII Technical Meeting of AMI in Lima, Peru, on April 7–10, 2008.

This radio spot announces the VII Technical Meeting of the Amazon Malaria Initiative in Lima.
It includes quotes by Dr. Jaime Chang, U.S. Agency for International Development.

Radio Programas del Perú. 2008. Dr. Jaime Chang. April 9, Programa Ampliación de Noticias con Raul Vargas. (In Spanish.)
In this interview, Dr. Jaime Chang, U.S. Agency for International Development, discusses the Amazon Malaria Initiative (AMI) as well as the objectives of the VII Technical Meeting of AMI in Lima, Peru, on April 7–10, 2008.

In this interview, the Dean of the Medical College of Peru, Julio Castro Gómez, describes an upcoming roundtable discussion on malaria.

In this interview, Dr. Jaime Chang, U.S. Agency for International Development, discusses Malaria Day in the Americas and the events of November 6 and 7, 2008.

In this interview, Dr. César Cabezas, Colegio Médico del Perú malaria specialist, discusses an upcoming roundtable discussion on malaria.
SELECTED MEDIA COVERAGE: TELEVISION

Canal 6–TV Plus. 2008. Dr. Jaime Chang, USAID, y Dr. Gustavo Bretas, OPS, en entrevista con Chema Salcedo. (Chema Salcedo interview with Dr. Jaime Chang, USAID, and Dr. Gustavo Bretas, OPS.) April 8, Programa Fulanos y Menganos. (In Spanish.)

Chema Salcedo interviews Dr. Jaime Chang, U.S. Agency for International Development, and Dr. Gustavo Bretas, Pan American Health Organization (Organización Panamericana de la Salud), during the Fulanos y Menganos television program.

La Receta–Canal 51. 2008. Dr. Luis Miguel León en entrevista con Jaime Terán. (Jaime Terán interview with Dr. Luis Miguel León.) November 5. (In Spanish.)

Jaime Terán interviews Dr. Luis Miguel León, Ministry of Health (Peru), during La Receta on Channel 51.

VIDEOS AND PHOTOS


These photographs are available from the photo archive at the Congreso de la República del Perú.


This video describes the VII Technical Meeting of the Amazon Malaria Initiative, April 8–10, 2008, in Lima, Peru, as well as the goals and accomplishments of the initiative.


This video describes Malaria Day in the Americas, now in its second year, as an opportunity for countries in the region to launch a dynamic campaign against malaria.


This video describes the achievements of the Amazon Malaria Initiative and the Amazon Network for the Surveillance of Antimalarial Drug Resistance in the fight against malaria in Bolivia.


This video shows how Central American countries have been successfully fighting malaria without the use of pesticides, using alternative methods of control and prevention as well as strong community participation.


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