

## **Quantification of Antimalarial Medicines Requirements for Madagascar**

---

Grace Adeya  
Jean Désiré Rakotoson

April 2005

---

Rational Pharmaceutical Management Plus  
Center for Pharmaceutical Management  
Management Sciences for Health  
4301 N. Fairfax Drive, Suite 400  
Arlington, VA 22203  
Phone: 703-524-6575  
Fax: 703-524-7898  
E-mail: [rpmpplus@msh.org](mailto:rpmpplus@msh.org)

Supported by U.S. Agency for International  
Development

This report was made possible through support provided by the U.S. Agency for International Development, under the terms of cooperative agreement number HRN-A-00-00-00016-00. The opinions expressed herein are those of the authors and do not necessarily reflect the views of the U.S. Agency for International Development.

## **About RPM Plus**

The Rational Pharmaceutical Management Plus (RPM Plus) Program, funded by the U.S. Agency for International Development (cooperative agreement HRN-A-00-00-00016-00), works in more than 20 developing countries to provide technical assistance to strengthen drug and health commodity management systems. The program offers technical guidance and assists in strategy development and program implementation both in improving the availability of health commodities—pharmaceuticals, vaccines, supplies, and basic medical equipment—of assured quality for maternal and child health, HIV/AIDS, infectious diseases, and family planning and in promoting the appropriate use of health commodities in the public and private sectors.

This document may be reproduced if credit is given to RPM Plus. Please use the following citation.

## **Recommended Citation**

Adeya, G., and J. D. Rakotoson. 2005. *Quantification of Antimalarial Medicines Requirements for Madagascar*. Submitted to the U.S. Agency for International Development by the Rational Pharmaceutical Management Plus Program. Arlington, VA: Management Sciences for Health.

## **Key Words**

malaria, Madagascar, quantification, artesunate, amodiaquine

## CONTENTS

ACRONYMS .....	v
ACKNOWLEDGMENTS .....	vii
BACKGROUND .....	1
Introduction.....	1
Case Management of Malaria.....	1
Quantification .....	2
Objectives of the Quantification Exercise .....	2
Study Methodology.....	3
Sampling .....	4
Data Collection .....	4
RESULTS .....	7
Findings on Data Quality .....	7
REQUIREMENTS FOR INTERMITTENT PREVENTIVE TREATMENT.....	9
Assumptions.....	9
Methodology.....	9
Results.....	10
REQUIREMENTS FOR THE CASE MANAGEMENT OF UNCOMPLICATED MALARIA	13
Assumptions.....	13
Methodology .....	13
Results.....	14
REQUIREMENTS FOR THE CASE MANAGEMENT OF COMPLICATED MALARIA.....	19
Assumptions.....	19
Methodology .....	19
Results.....	20
DISCUSSION AND RECOMMENDATIONS.....	23
Recommendations.....	25
ANNEX 1. MALARIA MEDICINES AND SUPPLIES SERVICE SUMMARY PRICES FOR ACT COMBINATIONS (2004) .....	27
Artesunate-Amodiaquine .....	27
Coartem.....	27
Artesunate-SP .....	27
Correspondence weight-age (average, Africa) .....	27
ANNEX 2. REQUIREMENTS OF SP FOR IPT BY DISTRICT.....	29

ANNEX 3A. REQUIREMENTS FOR AQ + ASU FOR POPULATION UNDER 5 YEARS ... 33

ANNEX 3B. REQUIREMENTS FOR AQ + ASU FOR POPULATION OVER 5 YEARS ..... 37

## **Tables**

Table 1. Recommended Treatment Doses for AQ-ASU Combination in Madagascar .....	1
Table 2. Data Collection Sites .....	4
Table 3. Estimated Quantity of SP Tablets Required for IPT, 2005–2007.....	10
Table 4. Estimated Cost of SP Tablets Required for IPT, 2005–2007 (USD).....	11
Table 5. Estimated Incidence of Uncomplicated Malaria, Public Health Facilities, 2005–2007	15
Table 6. Estimated Number of AQ-ASU Tablets Required for 2005–2007.....	16
Table 7. Estimated Cost of AQ-ASU Tablets Required in 2005–2007 (USD) .....	17
Table 8. Estimated Incidence of Complicated Malaria, 2005–2007.....	20
Table 9. Estimated Requirements of Quinine 300 mg/ml 2 ml Ampoules, 2005–2007.....	21
Table 10. Estimated Cost of Quinine 300mg/ml 2 ml Ampoules (USD) .....	21
Table 11. Estimated Cost of Purchasing All Required Antimalarial Medicines (USD).....	23
Table 12. Estimated RDT Requirements .....	25

## ACRONYMS

ACT	artemisinin-based combination treatment
ANC	antenatal clinic
AQ	amodiaquine
ASU	artesunate
CHD	Centre Hospitalier de District (district hospital)
CSB	Centre de Santé de Base (community health center)
CQ	chloroquine
IPT	intermittent preventive treatment
MOH	Ministry of Health
QU	quinine
RBM	Roll Back Malaria
RDT	rapid diagnostic test
RPM Plus	Rational Pharmaceutical Management Plus Program [MSH] <i>Service National de la Lutte contre le Paludisme</i> (National Malaria Control Program)
SNLP	
SP	sulfadoxine/pyrimethamine
USD	U.S. dollar



## ACKNOWLEDGMENTS

This assessment was carried out by the Rational Pharmaceutical Management Plus (RPM Plus) Program of Management Sciences for Health in collaboration with the National Malaria Control Program (SNLP) of the Ministry of Health (MOH) in Madagascar. The tools used in the assessment were developed by RPM Plus and were adapted in consultation with the MOH.

Special thanks to—

Dr. Philemon Tafangy, SNLP Coordinator, and the other members of the SNLP

The Director of the Central Medical Store (Salama)

The Chief of the Medical and Social Services in each province

The staff of the district medical stores and the health facilities that were surveyed



## BACKGROUND

### Introduction

Malaria is a major cause of morbidity and mortality in Madagascar. As part of its efforts to reduce the public health impact of malaria, Madagascar is currently revising its National Malaria Policy and will adopt an artemisinin-based combination treatment (ACT) to replace chloroquine (CQ) as the first-line treatment for uncomplicated malaria at health facilities. It also plans to adopt intermittent preventive treatment (IPT) with sulfadoxine/pyrimethamine (SP) as the national policy for the prevention of malaria during pregnancy. Madagascar submitted a proposal to support this transition to the Global Fund to Fight AIDS, Tuberculosis and Malaria during round four. This grant request was successful, and the funding will soon be available to assist in implementing the new policy.

Until 2004, the recommended treatment in Madagascar for those with uncomplicated malaria was CQ. Concern has been rising about the effectiveness of CQ in the country, especially because high resistance to CQ has been documented in all the neighboring countries. Recent studies in Madagascar have found elevated resistance levels to CQ. A 2001 study done by the Institut Malgache de Recherches Appliquées found that the resistance to CQ in Ankazobe District was 39 percent. A study in Sainte Marie Island by the Institute Pasteur in Madagascar that was completed in 2004 found that the resistance to CQ was 36.9 percent.<sup>1</sup> These studies have provided the impetus leading to the change in national policy by the National Malaria Control Program (Service National de la Lutte contre le Paludisme, or SNLP) and its Roll Back Malaria (RBM) partners.

### Case Management of Malaria

Madagascar has adopted the RBM target for its malaria case management activities. The goal is that 60 percent of those with malaria should have access to appropriate and affordable effective treatment within 24 hours of the appearance of symptoms.

The revised national policy recommends the continued use of CQ for home-based case management of malaria and a combination of amodiaquine (AQ) and artesunate (ASU) to manage cases of malaria that present at health facilities. The recommended doses of the AQ-ASU combination are listed in Table 1.

**Table 1. Recommended Treatment Doses for AQ-ASU Combination in Madagascar**

Age	Artesunate 50 mg	Amodiaquine 153 mg
2–11 months	½ tablet	½ tablet
1–6 years	1 tablet	1 tablet
7–13 years	2 tablet	2 tablet
> 14 years	4 tablet	4 tablet

<sup>1</sup> Madagascar National Malaria Control Policy, January 2005.

The recommended medicine for the management of severe or complicated malaria in the health facilities is parenteral quinine (QU) followed by AQ-ASU tablets. Quinine tablets are the recommended treatment for the case management of malaria during pregnancy.

The prevention of malaria during pregnancy through intermittent preventive treatment (IPT) is also one of the key intervention areas for the SLNP and its RBM partners. The national goal is to ensure that 60 percent of pregnant women receive at least two doses of sulfadoxine/pyrimethamine during the prenatal period to prevent malaria during the pregnancy.

## **Quantification**

There are two main methods for quantification: the consumption method and the morbidity method. It is usually preferable to compare the results obtained by using both methods to obtain the best estimate of the requirements.

### ***Consumption Method***

This method uses the historical consumption data for each medicine, adjusted for stock-outs, to estimate its future consumption within the same population. This method also requires that the projected use of the drug remain the same. Where possible, this method is preferred for quantification.

### ***Morbidity Method***

This method uses the epidemiological data for each health condition to quantify the future requirements of the required medicines. The morbidity method is useful where a new medicine is to be used to treat a new or preexisting condition, or where poor-quality consumption data exist, for example, where there has been inaccurate or incomplete record keeping or where there were repeated stock-outs of the required medicines.

## **Objectives of the Quantification Exercise**

The introduction of IPT with SP for the prevention of malaria in pregnancy in Madagascar and the change in treatment policy to a combination of amodiaquine + artesunate for the case management of malaria have created a need to appropriately quantify the potential demand for these medicines to ensure that they will be regularly available in the primary health facilities, particularly in the public sectors. RPM Plus worked with the SNLP in 2004 to carry out this exercise.

## **Study Methodology**

RPM Plus planned to use both consumption and morbidity methods to quantify the antimalarial requirements for each district for the three-year period beginning with 2005. Data were collected using data collection instruments that had been developed previously by RPM Plus and that were adapted for use in Madagascar. The tools were developed for use at the national, regional, district, and facility levels of the health systems. The analysis was done using the data collected from the regional level; the data collected from other levels were used to validate the regional data. The following tools were used—

- National Attendance Questionnaire
- National Consumption Questionnaire
- Regional Attendance Questionnaire
- District Attendance Questionnaire
- District Consumption Questionnaire
- Facility Attendance Questionnaire
- Facility Consumption Questionnaire

Using these tools, retrospective data were collected for a three-year period beginning in 2001, including the following—

- Population data
  - Total national population
  - Population distribution by region and district
  - Total population under five years of age, by region and by district where available
  - Pregnant women as a percentage of the population, by region and by district where available
- Antenatal attendance rates, regional/district/facility (depending on availability)
- Morbidity data
  - Annual incidence of malaria
    - In total population
    - In children under five years of age
    - In pregnant women
  - Number of outpatient visits at health facilities attributable to malaria
- Consumption data—current data on use of antimalarials for case management and for the prevention of malaria in pregnancy (SP, CQ, QU)
  - From Salama (central medical store)
  - From district depots
  - From health facilities

These data were used to calculate the number of treatment episodes for each health problem and the quantity of recommended medicines needed to manage each health problem.

## Sampling

Data were collected from the national level and from the country's six provinces. In each province, districts were stratified depending on whether they were largely urban or rural, and one district from each stratum was sampled. In each district, three health facilities were randomly sampled—including one district hospital (CHD) and one community health center (Centre de Santé de Base, or CSB). The sampled districts and health facilities are listed in Table 2.

**Table 2. Data Collection Sites**

Province	District	CHD	CSB
Antananarivo	Ankazobe	CHD Ankazobe	CSB2 Ankazobe CSB2 Ambohitromby
	Soavinandriana	CHD Soavinandriana	CSB2 Soavinandriana CSB2 Ampefy
Fianarantsoa	Ambohimahasoa	CHD Ambohimahasoa	CSB2 Ambohimahasoa CSB2 Ambohimahasoa
	Ifanadiana	CHD Ifanadiana	CSB2 Ranomafana CSB2 Ifanadiana
Toliara	Sakaraha	CHD Sakaraha	CSB2 Sakaraha CSB2 Mahaboboka
	Taolagnaro	CHD Taolagnaro	CSB2 Taolagnaro CSB2 Ranopiso
Toamasina	Soanierana Ivongo	CHD Soanierana Ivongo	CSB2 Soanierana Ivongo CSB2 Antanifotsy
	Mahanoro	CHD Mahanoro	CSB2 Mahanoro CSB2 Betsizaraina
Mahajanga	Ambato Boeni	CHD Ambato Boeni	CSB2 Ambato boeni CSB2 Tsaramasoandro
	Mampikony	CHD Mampikony	CSB2 Mampikony CSB2 Ambohitoaka
Antsiranana	Antalaha	CHD Antalaha	CSB2 Antalaha CSB2 Ampahana
	Ambanja	CHD Ambanja	CSB2 Ambanja CSB2 Antranokarany

## Data Collection

A team of six data collectors, including a study coordinator, was recruited from the Ministry of Health (MOH) to collect the data in the field. A one-day training of the data collectors on how to use the data collection instruments and how to carry out the data collection took place at the

SNLP offices within the MOH. Each data collector was responsible for the data collection in one province. The data collection instruments were finalized after the training.

Given the vast distances involved in traveling around the country, the data collection was done in two phases. The first phase took place in September 2004 and focused on the data collection at the national and regional levels. Data collection at these two levels could not be completed at that time because the fieldwork period coincided with the national measles immunization campaign, which meant that most of the key personnel to be interviewed were not available.

The second phase of the data collection was done in November 2004, after the end of the measles campaign. Any regional and national level data that had not been obtained during the first phase were collected at this time. The data from the sampled districts and health facilities were also collected at this time.

Consumption data were collected from only the national-level central medical store (Salama) and the district depots located in the sampled districts. Madagascar has no regional medical stores, and Salama sells directly to the district stores.

The interview targets at the regional level were the Chief of Medical and Social Services and the individual responsible for health statistics. In their absence, the director of the provincial department of health or the provincial malaria coordinator could be interviewed. At the district level, the store manager of the district depot and the individual responsible for health statistics in the district were to be interviewed, and in their absence the district medical inspector or technical coordinator could be interviewed.



## RESULTS

Though Madagascar plans a phased implementation of the IPT policy and the ACT policy, starting in a few districts and gradually scaling up nationally, no decision has been made on which districts will be selected for the initial implementation. Therefore, in doing this quantification exercise, the main assumption made was that 100 percent of the eligible population in each district will receive the recommended treatment. This assumption will need to be adjusted depending on SNLP's final decision about implementation. Other assumptions made during the analysis are discussed later in this report.

The results presented here depend not only on the assumptions made, but also on the quality of the data used in the analysis. The challenges identified with respect to the quality of data used are discussed in the following section.

### Findings on Data Quality

1. Population data. The most recent national census in the country was done in 1993. The population figures used are estimated on the basis of the 1993 census population and the estimated annual growth rate since then. The use of these estimates in the analysis introduces a bias that is difficult to quantify, so no adjustments were made for this potential bias.
2. Consumption data. The consumption data collected were incomplete at all levels of the health system surveyed.
  - The central store, Salama, is a nongovernmental agency that sells essential medicines to both the public sector and the private sector (the mission sector). Salama maintains a record of annual consumption of the medicines it distributes, but the only figures available combined the sales to both the private and public sectors and it was not possible to separate the two.
  - The records in the district depots and the health facilities were incomplete, and none of those facilities surveyed was able to provide an estimate of the annual consumption and procurements of the antimalarials included on the essential medicines list.

Because of the deficiencies in the consumption data, they were not useful in the quantification. The analysis described in this report relied on the morbidity data alone to estimate the requirements.

3. Procurement data. As with the consumption data, information on the procurement period, lead time to delivery, pipelines of antimalarials, and quantities of antimalarials were not readily available in most of the sites. To determine the actual quantities to purchase for each of the drugs considered here, this information is required—particularly for SP and QU, which are already in use.

4. Morbidity data. The morbidity data collected from the national level and the regional level were both fairly accurate. Data collected from at each level is mailed to the next level every six months, that is, health facility data are sent to the district, district data sent to the province, and provincial data sent to the national level. The national level was found to be receiving 70–90 percent of the required reports from the lower levels of the health system.

## REQUIREMENTS FOR INTERMITTENT PREVENTIVE TREATMENT

An analysis of the estimated requirements of SP for IPT was done for each district, and the provincial and national requirements were obtained by adding together all the district requirements. Antenatal clinic (ANC) registration numbers and ANC attendance numbers for 2001, 2002, 2003 and population data for 2001<sup>2</sup> were collected and used to estimate the quantities of SP required for IPT for 2005–2007.

No major changes were seen in the number of ANC registrants and ANC attendance over the three-year period under review. The average number of visits per ANC registrant remained the same over the three-year period for each of the districts and also for the provinces.

### Assumptions

1. Each pregnant woman attending ANC will receive two doses of SP during her pregnancy, consistent with the national policy.
2. Each dose of SP for IPT consists of three tablets.
3. IPT will be provided to pregnant women in all the provinces.
4. Of the pregnant women attending ANC, 100 percent are expected to receive IPT.
5. Population of growth of 2.8 percent per year will remain stable and continue until 2007.
6. The number of ANC registrants as a percentage of the population will remain stable and continue until 2007.
7. The estimated unit cost for SP is U.S. dollars (USD) 0.0026 per tablet. This was the unit cost for the sale of SP at Salama in 2003. It was also assumed that this cost will remain stable until 2007.

### Methodology

The following methodology was used to conduct the analysis—

1. The average number of visits per ANC registrant was calculated for each year by dividing the ANC attendance numbers by the number of ANC registrants, and an average over the three-year period obtained. An analysis of the data found that the each pregnant woman attends ANC at least twice during her pregnancy. This attendance was consistent for all six provinces.

---

<sup>2</sup> Population figures were available only for this year from the regional and district offices.

2. Using the 2001 population figures, the estimated population was calculated for 2005, 2006, and 2007.
3. The proportion of ANC registrants as a percentage of the population in 2001 was calculated.
4. The estimated number of ANC registrants in 2005, 2006, 2007 was calculated by multiplying the estimated population in those years (from step 2) by the proportion calculated in step 3.
5. The SP requirements for each district were calculated by multiplying the number of ANC registrants (step 4) by the average number of visits during the pregnancy (step 1) and estimated costs for these requirements were calculated.

## Results

At least one million SP tablets will be required each year to meet the IPT needs in the country. A list of the estimated SP requirements for IPT by district are included in Annex 2. Table 3 summarizes the requirements by province.

In the absence of additional information, no adjustments have been made for any SP already in stock in the medical stores and health facilities, or for any SP already on order and not yet delivered.

**Table 3. Estimated Quantity of SP Tablets Required for IPT, 2005–2007**

Province	SP for IPT Requirements (2 doses)			Total
	2005	2006	2007	2005–2007
Antananarivo	298,677	307,040	315,637	921,355
Fianarantsoa	270,160	277,724	285,500	833,384
Toamasina	173,812	178,679	183,682	536,174
Mahajanga	115,366	118,596	121,917	355,879
Toliary	108,469	111,506	114,629	334,605
Antsiranana	83,547	85,886	88,291	257,724
<b>National</b>	<b>1,050,032</b>	<b>1,079,432</b>	<b>1,109,657</b>	<b>3,239,120</b>

Table 4 provides an estimate of the cost of purchasing the required SP for each province (a summary of the estimated cost by district is included in Annex 2). Approximately USD 27,000 is required each year to meet the SP for IPT requirements of the population.

**Table 4. Estimated Cost of SP Tablets Required for IPT, 2005–2007 (USD)**

<b>Province</b>	<b>Estimated Costs (USD)</b>			<b>Total</b>
	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2005–2007</b>
Antananarivo	7,945	8,167	8,396	24,508
Fianarantsoa	6,152	6,324	6,501	18,977
Toamasina	4,623	4,753	4,886	14,262
Mahajanga	2,856	2,936	3,018	8,809
Toliary	2,673	2,748	2,825	8,247
Antsiranana	2,222	2,285	2,349	6,855
<b>National</b>	<b>26,472</b>	<b>27,213</b>	<b>27,975</b>	<b>81,659</b>



## **REQUIREMENTS FOR THE CASE MANAGEMENT OF UNCOMPLICATED MALARIA**

An analysis was done of the estimated requirements for AQ and ASU tablets for the public health facilities in each district and province. The number of cases of malaria seen at the public health facilities, the number of outpatient consultations, and population data (by age group) for the years 2001, 2002, 2003 were collected and used to estimate the quantities of the combination required for 2005–2007.

### **Assumptions**

1. Each episode of uncomplicated malaria in a child under five years of age will be treated with one tablet each of AQ 153 mg base and ASU 50 mg base. No separate data were collected for the 0–11 months age group, and given the small proportion of the population in that group, estimating one tablet of each drug for each episode of malaria found in the group should not result in a significant overestimation of the need.
2. Each episode of uncomplicated malaria in a person older than five years of age will be treated with three tablets each of AQ 153 mg base and ASU 50 mg base. This dose was an average of the two tablets recommended for the 6–14 years age group and the four tablets recommended for those 15 and over. No separate data were collected for each of these groups.
3. Each treatment dose would be taken for three days.
4. Diagnostic criteria for uncomplicated malaria remain the same in the surveyed years (2001–2003) as in the years for the quantification (2005–2007).
5. Uptake of the new policy is estimated at 100 percent in 2005, 100 percent in 2006, and 100 percent in 2007.
6. Population growth of 2.8 percent per year will remain stable and continue until 2007.
7. The estimated unit cost for AQ-ASU is USD 1.50 for the complete treatment course for individuals over five years of age and USD 0.50 for a complete treatment course for individuals under five years of age. This pricing is based on the price list provided by the Malaria Medicines and Supplies Service (see Annex1 for the summary price list).

### **Methodology**

The following methodology was used to conduct the analysis—

1. The incidence of malaria for each year surveyed was calculated by dividing the number of cases of malaria in each region for each of the two age groups with the estimated total population for that age group for the year in question.
2. The 2001 population figures were used to estimate the population for the subsequent years.
3. The median annual incidence rate for uncomplicated malaria seen in the public health facilities over the three years was calculated.
4. The expected incidence of malaria in the public health facilities in the subsequent years and their AQ-ASU requirements were calculated using the estimated population and the median incidence rate as calculated above.

## **Results**

Tables 5–7 present a summary of the requirements for AQ-ASU for each of the six regions for the individuals younger than five years and those older than five years. A summary of the estimated requirements by district are included in Annex 3.

As expected in a country with endemic malaria, the burden of malaria falls mainly on children under five years of age. The median incidence rate for the country was 8 percent in those over five years of age and 36 percent in those under five years of age. Incidence rates vary among the provinces, which is consistent with the differing malaria epidemiology in the country. Using the median incidence rates, the estimated incidence of malaria in the public health facilities was calculated and the results for each province are summarized in Table 5.

**Table 5. Estimated Incidence of Uncomplicated Malaria, Public Health Facilities, 2005–2007**

Province	Estimated Incidence			Total
	2005	2006	2007	2005–2007
<b>Population over 5 years</b>				
Antananarivo	5,069,503	5,211,449	5,357,370	15,638,322
Fianarantsoa	3,104,393	3,191,316	3,280,673	9,576,381
Toamasina	2,569,329	2,641,270	2,715,226	7,925,826
Mahajanga	1,795,763	1,846,044	1,897,733	5,539,540
Toliary	2,949,069	3,031,643	3,116,529	9,097,242
Antsiranana	1,597,862	1,642,602	1,688,594	4,929,058
<b>National (&gt;5 pop)</b>	<b>17,085,919</b>	<b>17,564,324</b>	<b>18,056,125</b>	<b>52,706,368</b>
<b>Population under 5 years</b>				
Antananarivo	1,368,941	1,407,271	1,446,674	4,222,886
Fianarantsoa	725,559	745,875	766,760	2,238,194
Toamasina	709,041	728,895	749,304	2,187,240
Mahajanga	460,113	472,996	486,240	1,419,349
Toliary	551,113	566,544	582,407	1,700,065
Antsiranana	402,984	414,268	425,867	1,243,119
<b>National (&lt;5 pop)</b>	<b>4,217,752</b>	<b>4,335,849</b>	<b>4,457,252</b>	<b>13,010,853</b>
<b>Total population</b>				
Antananarivo	6,438,444	6,618,720	6,804,044	19,861,208
Fianarantsoa	3,829,952	3,937,191	4,047,432	11,814,575
Toamasina	3,278,371	3,370,165	3,464,530	10,113,065
Mahajanga	2,255,876	2,319,040	2,383,973	6,958,889
Toliary	3,500,182	3,598,187	3,698,937	10,797,306
Antsiranana	2,000,846	2,056,869	2,114,462	6,172,177
<b>National</b>	<b>21,303,670</b>	<b>21,900,173</b>	<b>22,513,378</b>	<b>65,717,221</b>

Based on the estimated incidence of uncomplicated malaria as summarized in Table 5, the AQ-ASU requirements were calculated and are summarized in Table 6. The estimated cost of the AQ-ASU requirements is summarized in Table 7. On average, approximately USD 26 million will be required each year to purchase the estimated AQ-ASU requirements.

**Table 6. Estimated Number of AQ-ASU Tablets Required for 2005–2007**

Province	Estimated AQ-ASU Requirements			Total
	2005	2006	2007	2005–2007
<b><i>Population over 5 years</i></b>				
Antananarivo	45,625,528	46,903,042	48,216,328	140,744,897
Fianarantsoa	27,939,534	28,721,841	29,526,053	86,187,429
Toamasina	23,123,963	23,771,434	24,437,034	71,332,432
Mahajanga	16,161,865	16,614,397	17,079,600	49,855,861
Toliary	26,541,624	27,284,790	28,048,764	81,875,177
Antsiranana	14,380,754	14,783,415	15,197,350	44,361,519
<b>National (&gt;5 pop)</b>	<b>153,773,268</b>	<b>158,078,919</b>	<b>162,505,129</b>	<b>474,357,316</b>
<b><i>Population under 5 years</i></b>				
Antananarivo	4,106,822	4,221,813	4,340,023	12,668,658
Fianarantsoa	2,176,678	2,237,625	2,300,279	6,714,582
Toamasina	2,127,124	2,186,684	2,247,911	6,561,719
Mahajanga	1,380,339	1,418,989	1,458,720	4,258,048
Toliary	1,653,339	1,699,632	1,747,222	5,100,194
Antsiranana	1,208,953	1,242,803	1,277,602	3,729,358
<b>National (&lt;5 pop)</b>	<b>12,653,255</b>	<b>13,007,546</b>	<b>13,371,757</b>	<b>39,032,558</b>
<b><i>Total population</i></b>				
Antananarivo	49,732,349	51,124,855	52,556,351	153,413,555
Fianarantsoa	30,116,213	30,959,467	31,826,332	92,902,011
Toamasina	25,251,088	25,958,118	26,684,945	77,894,151
Mahajanga	17,542,204	18,033,385	18,538,320	54,113,909
Toliary	28,194,963	28,984,422	29,795,986	86,975,371
Antsiranana	15,589,706	16,026,218	16,474,952	48,090,877
<b>National</b>	<b>166,426,522</b>	<b>171,086,465</b>	<b>175,876,886</b>	<b>513,389,874</b>

**Table 7. Estimated Cost of AQ-ASU Tablets Required in 2005–2007 (USD)**

Province	Estimated Cost			Total
	2005	2006	2007	2005–2007
<b><i>Population over 5 years</i></b>				
Antananarivo	7,604,255	7,817,174	8,036,055	23,457,483
Fianarantsoa	3,830,882	3,938,147	4,048,415	11,817,445
Toamasina	3,853,994	3,961,906	4,072,839	11,888,739
Mahajanga	2,504,607	2,574,736	2,646,829	7,726,173
Toliary	3,152,136	3,240,396	3,331,127	9,723,660
Antsiranana	2,396,792	2,463,902	2,532,892	7,393,586
<b>National (&gt;5 pop)</b>	<b>23,342,667</b>	<b>23,996,262</b>	<b>24,668,157</b>	<b>72,007,086</b>
<b><i>Population under 5 years</i></b>				
Antananarivo	684,470	703,635	723,337	2,111,443
Fianarantsoa	293,626	301,848	310,299	905,773
Toamasina	354,521	364,447	374,652	1,093,620
Mahajanga	214,116	220,111	226,274	660,502
Toliary	242,692	249,488	256,473	748,653
Antsiranana	201,492	207,134	212,934	621,560
<b>National (&lt;5 pop)</b>	<b>1,990,917</b>	<b>2,046,663</b>	<b>2,103,970</b>	<b>6,141,550</b>
<b><i>Total population</i></b>				
Antananarivo	8,288,725	8,520,809	8,759,392	25,568,926
Fianarantsoa	4,124,509	4,239,995	4,358,715	12,723,218
Toamasina	4,208,515	4,326,353	4,447,491	12,982,358
Mahajanga	2,718,723	2,794,848	2,873,103	8,386,674
Toliary	3,394,829	3,489,884	3,587,601	10,472,313
Antsiranana	2,598,284	2,671,036	2,745,825	8,015,146
<b>National</b>	<b>25,333,584</b>	<b>26,042,925</b>	<b>26,772,127</b>	<b>78,148,636</b>



## REQUIREMENTS FOR THE CASE MANAGEMENT OF COMPLICATED MALARIA

An analysis of the estimated requirements for parenteral quinine was done for each region. The number of cases of complicated malaria seen at the public health facilities, the number of outpatient consultations, and population data for the years 2001, 2002, 2003 were collected and used to estimate the quantities of the quinine required for 2005–2007. The data were available from only the national level; therefore, only regional-level requirements are provided and no district-level analysis has been done.

### Assumptions

1. Each episode of complicated malaria will be treated with a loading dose of 20 mg/kg of parenteral quinine to be followed by 10 mg/kg every eight hours.
2. Intravenous (IV) quinine will be used during the first 48 hours only.
3. The estimated weight for all those over five years of age is 60 kg and for those under five years is 20 kg.
4. Population growth of 2.8 percent per year will remain stable and continue until 2007.
5. The estimated unit cost for QU 300 mg/ml in a 2 ml ampoule is USD 0.017, which is the median price in the Management Sciences for Health *International Drug Price Indicator Guide* for 2003.

### Methodology

The following methodology was used to conduct the analysis—

1. The incidence of malaria for each of the surveyed years was calculated by dividing the number of cases of malaria in each region, for each of the two age groups, with the estimated population for that age group for the year in question.
2. The 2001 population figures were used to estimate the population for the subsequent years.
3. The median incidence rate for the three years was calculated.
4. The expected incidence of malaria in the subsequent years and their QU requirements were calculated using the estimated population and the median incidence rate as calculated.

## Results

Tables 8–10 present a summary of the requirements for QU for each of the six regions for the individuals less than five years of age and those older than five years.

The incidence of complicated malaria in the public health facilities was fairly low, although again the burden was higher in children less than five years of age as compared to the rest of the population. The median incidence rate for children under five was 0.32 percent, and the median incidence rate for those over five years was 0.12 percent.

Table 8 summarizes the estimated incidence of complicated malaria for each of the country's provinces for 2005–2007, assuming no change in the incidence rates. Using this estimated incidence, approximately 135, 000 2 ml ampoules of QU 300 mg/ml will be required to meet the case management needs (Table 9).

**Table 8. Estimated Incidence of Complicated Malaria, 2005–2007**

Province	Estimated Incidence			Total
	2005	2006	2007	2005–2007
<b>Population over 5 years</b>				
Antananarivo	1,285	1,321	1,358	3,965
Fianarantsoa	2,880	2,961	3,044	8,885
Toamasina	1,758	1,807	1,858	5,423
Mahajanga	4,284	4,404	4,527	13,214
Toliary	4,351	4,473	4,598	13,422
Antsiranana	1,519	1,561	1,605	4,685
<b>National (&gt;5 pop)</b>	<b>16,077</b>	<b>16,527</b>	<b>16,989</b>	<b>49,593</b>
<b>Population under 5 years</b>				
Antananarivo	1,519	1,561	1,605	4,685
Fianarantsoa	2,433	2,502	2,572	7,507
Toamasina	728	749	769	2,246
Mahajanga	1,381	1,419	1,459	4,259
Toliary	1,050	1,079	1,109	3,238
Antsiranana	847	871	895	2,614
<b>National (&lt;5 pop)</b>	<b>7,958</b>	<b>8,181</b>	<b>8,410</b>	<b>24,550</b>
<b>Total population</b>				
Antananarivo	2,804	2,882	2,963	8,650
Fianarantsoa	5,314	5,462	5,615	16,392
Toamasina	2,486	2,556	2,627	7,669
Mahajanga	5,664	5,823	5,986	17,473
Toliary	5,401	5,552	5,707	16,660
Antsiranana	2,366	2,432	2,500	7,299
<b>National</b>	<b>24,035</b>	<b>24,708</b>	<b>25,400</b>	<b>74,142</b>

**Table 9. Estimated Requirements of Quinine 300 mg/ml 2 ml Ampoules, 2005–2007**

Province	Estimated Requirements			Total
	2005	2006	2007	2005–2007
Antananarivo	12,540	12,891	13,252	38,683
Fianarantsoa	25,840	26,563	27,307	79,710
Toamasina	14,004	14,396	14,799	43,199
Mahajanga	33,207	34,137	35,092	102,436
Toliary	32,907	33,828	34,775	101,510
Antsiranana	12,608	12,961	13,324	38,894
<b>National</b>	<b>131,105</b>	<b>134,776</b>	<b>138,550</b>	<b>404,432</b>

The estimated cost of purchasing the required quinine is summarized in Table 10. Approximately USD 2,300 will be required each year to meet the estimated needs.

**Table 10. Estimated Cost of Quinine 300mg/ml 2 ml Ampoules (USD)**

Province	Estimated Cost			Total
	2,005	2,006	2,007	2005–2007
Antananarivo	213	219	225	658
Fianarantsoa	439	452	464	1,355
Toamasina	238	245	252	734
Mahajanga	565	580	597	1,741
Toliary	559	575	591	1,726
Antsiranana	214	220	227	661
<b>National</b>	<b>2,229</b>	<b>2,291</b>	<b>2,355</b>	<b>6,875</b>

The use of parenteral quinine will necessitate the procurement of intravenous dextrose solutions and giving sets. Those supplies and their costs have not been included in this quantification exercise.



## DISCUSSION AND RECOMMENDATIONS

The estimates given in this report have not been adjusted to take into account the quantities of the medicines already in stock in the medical stores and health facilities, or the medicines already ordered and not yet received; nor have adjustments been made to take into account the available financing to purchase these medicines. Insufficient information was available to make these adjustments. Those adjustments need to be made before these estimates are used to make ordering decisions. As presented, the estimates are useful mainly for budgetary purposes.

The estimated budget for the purchase of SP for IPT, AQ-ASU, and parenteral quinine for the three years beginning 2005 is summarized in Table 11. Most of this budget is for the purchase of AQ-ASU, which is used for more cases and costs more per unit than the other two medicines.

**Table 11. Estimated Cost of Purchasing All Required Antimalarial Medicines (USD)**

Province	Estimated Cost			Total
	2005	2006	2007	2005–2007
Antananarivo	8,296,604	8,528,909	8,767,718	25,593,230
Fianarantsoa	4,130,884	4,246,548	4,365,452	12,742,884
Toamasina	4,213,214	4,331,184	4,452,457	12,996,854
Mahajanga	2,722,043	2,798,261	2,876,612	8,396,916
Toliary	3,397,967	3,493,110	3,590,918	10,481,995
Antsiranana	2,600,643	2,673,461	2,748,318	8,022,422
<b>Total</b>	<b>25,361,355</b>	<b>26,071,473</b>	<b>26,801,474</b>	<b>78,234,301</b>

The accuracy of these estimates is affected by several factors, including but not limited to the following—

1. The quality of the data. The limitations of the data used in the assessment are discussed in the first section of this report.
2. The uptake of the new policies. SP for IPT has recently been introduced in the country and national scale-up will take place in 2005. The use of AQ-ASU in public health facilities has only recently been adopted and implementation of this policy has not yet begun. The uptake of these policies depends not only on the availability of the medicines but also on their acceptance by the health care providers and their clients. This analysis assumes 100 percent uptake, but this assumption may be an overestimate if any barriers limit acceptance of the policy.
3. Use of public health facilities. The analysis assumes that the rate of use of the public health facilities will remain the same. Anecdotal evidence from African countries that have changed their malaria treatment policy to ACTs suggests that the numbers of persons with malaria seeking treatment in public health facilities increases after the

implementation of the policy begins. The availability of an effective antimalarial at a lower price than would be found in the private sector may be the driving force for this increase. Monitoring of the use of the public health facilities may be required in the first few months after implementing the new policy to identify any increase in the public health facility usage and to quantify the rate of increase and adjust the required quantities of the antimalarial medicines as required.

4. Impact of effective treatment on the incidence of malaria seen at the public health facilities. Although the analysis assumes that the incidence of malaria will remain the same over the three-year period, the availability and use of effective antimalarial treatment may reduce the incidence of malaria by reducing the number of cases of malaria seen at the health facilities that are the result of resistance to CQ. The proportion of the cases seen that were repeat visits as a result of treatment failures was not available from the data collected.
5. Impact of other malaria control interventions. Increased use of home-based management of malaria strategies, insecticide-treated nets, and other vector-reduction strategies as outlined in the draft national malaria control policy may reduce the prevalence of malaria and thus reduce the number of cases seen in the health facilities.
6. The use of rapid diagnostic tests (RDTs) or microscopy to confirm the diagnosis of malaria. The draft national malaria policy recommends that RDTs or microscopy be used to confirm the diagnosis of malaria for all suspected cases in the non-endemic areas and for all suspected cases in the population over five years of age in the endemic areas. Assuming that only 30 percent of the population under five and 100 percent of the population over five are tested using the RDTs, the estimated quantities of the tests required are listed in Table 12. The use of RDTs and microscopy may affect the estimates by—
  - a. Decreasing the quantities of AQ-ASU required—Clinical diagnosis of malaria, which is the current standard, overestimates the number malaria cases, particularly in the targeted groups, and would therefore reduce the quantity and cost of the ACTs required. The rate of false positive diagnosis in Madagascar is unclear at this time, so no adjustments were made to the estimates or subsequent decrease in cost.
  - b. The costs of using RDTs and/or microscopy—Several types of RDTs are available in the market with prices ranging from USD 0.45 to USD 2.60 per test and a median cost per test of USD 1.00. Given the estimated quantities in Table 12, the cost of purchasing the RDTs is approximately USD 19 million each year for the three years.

**Table 12. Estimated RDT Requirements**

Province	Estimated Requirements			Total
	2005	2006	2007	2005–2007
Antananarivo	5,480,185	5,633,630	5,791,372	16,905,188
Fianarantsoa	3,322,061	3,415,078	3,510,700	10,247,839
Toamasina	2,782,042	2,859,939	2,940,017	8,581,998
Mahajanga	1,933,797	1,987,943	2,043,605	5,965,345
Toliary	3,114,403	3,201,607	3,291,252	9,607,261
Antsiranana	1,718,757	1,766,882	1,816,355	5,301,993
Total	18,351,244	18,865,079	19,393,301	56,609,624

### Recommendations

1. Given the limitations previously discussed, the figures obtained in this analysis are probably valid for only the first year or two. The consumption of antimalarials should be monitored and the estimates revised in the first year using the consumption data as needed.
2. A cost-benefit analysis of the recommended use of RDTs and microscopy may need to be done before national implementation. Available data indicate the additional costs of using the RDTs may create a barrier to access to the recommended treatment.
3. The pharmaceutical management systems at the medical stores, particularly the information management systems, need to be strengthened to provide valid and regular consumption data that can be used for future quantification of needs and procurement.



**ANNEX 1. MALARIA MEDICINES AND SUPPLIES SERVICE  
SUMMARY PRICES FOR ACT COMBINATIONS (2004)**

**Artesunate-Amodiaquine**

<b>Age</b>	<b>Artesunate (50 mg tablets)</b>	<b>Amodiaquine (153 mg tablets)</b>	<b>USD</b>
Infant (<1 year)	3 half tabs	3 half tabs	0.5
1–6 years	3 tabs	3 tabs	0.5
7–11 years	6 tabs	6 tabs	0.9
12+ years	12 tabs	12 tabs	1.5

**Coartem**

<b>Age</b>	<b>Coartem</b>	<b>USD</b>
< 2 years	20+120	0.9
3–7 years	40+240	1.4
8–11 years	60+360	1.9
12+ years	80+480	2.4

**Artesunate-SP**

<b>Age</b>	<b>Artesunate (50 mg tablets)</b>	<b>SP (500+25mg tablets)</b>	<b>USD</b>
Infant (<1 year)	3 half tabs	1 half tab	1
1–5 years	3 tabs	1 tab	1
6–12 years	6 tabs	2 tabs	1.5
13+ years	12 tabs	3 tabs	1.9

**Correspondence weight-age (average, Africa)**

<b>Age</b>	<b>Weight (kg)</b>
< 4 months	5–6
4–11 months	7–10
1–2 years	11–14
3–4 years	15–18
5–7 years	19–24
9–10 years	25–35
11–13 years	36–50
14+ years	50



## ANNEX 2. REQUIREMENTS OF SP FOR IPT BY DISTRICT

	SP for IPT Requirements (2 doses)			Total
	2005	2006	2007	2005–2007
<b>National Total</b>	<b>1,050,032</b>	<b>1,079,432</b>	<b>1,109,657</b>	<b>3,239,120</b>
<b>Antananarivo Province</b>	<b>298,677</b>	<b>307,040</b>	<b>315,637</b>	<b>921,355</b>
Ambatolampy	15,915	16,361	16,819	<b>49,094</b>
Ambohidratrimo	17,908	18,409	18,925	<b>55,241</b>
Andramasina	14,994	15,414	15,846	<b>46,254</b>
Anjozorobe	12,755	13,112	13,480	<b>39,347</b>
Ankazobe	6,148	6,320	6,497	<b>18,965</b>
Antananarivo-atsimondrano	15,822	16,265	16,721	<b>48,808</b>
Antananarivo-avaradrano	7,013	7,209	7,411	<b>21,632</b>
Antananarivo-renivohitra	47,331	48,656	50,019	<b>146,006</b>
Antanifotsy	16,794	17,264	17,747	<b>51,805</b>
Antsirabe i	15,349	15,779	16,221	<b>47,350</b>
Antsirabe ii	18,326	18,839	19,366	<b>56,531</b>
Arivonimamo	21,979	22,595	23,228	<b>67,802</b>
Betafo	22,553	23,184	23,833	<b>69,570</b>
Faratsiho	6,269	6,445	6,625	<b>19,339</b>
Fenoarivo-afovoany	3,236	3,327	3,420	<b>9,983</b>
Manjakandriana	19,245	19,784	20,338	<b>59,367</b>
Miarinarivo	14,932	15,350	15,779	<b>46,060</b>
Soavinandriana	14,254	14,653	15,064	<b>43,972</b>
Tsiroanomandidy	7,854	8,074	8,300	<b>24,228</b>
<b>Fianarantsoa Province</b>	<b>270,160</b>	<b>277,724</b>	<b>285,500</b>	<b>833,384</b>
Ambalavao	20,584	21,161	21,753	<b>63,498</b>
Ambatofinandrahana	13,000	13,364	13,738	<b>40,102</b>
Ambohimahasoa	18,026	18,531	19,050	<b>55,606</b>
Ambositra	17,150	17,630	18,124	<b>52,904</b>
Befotaka	1,020	1,049	1,078	<b>3,146</b>
Fandriana	16,524	16,986	17,462	<b>50,972</b>

*Quantification of Antimalarial Medicines Requirements for Madagascar*

	SP for IPT Requirements (2 doses)			Total
	2005	2006	2007	2005–2007
Farafangana	18,516	19,035	19,568	57,119
Fianarantsoa i	10,892	11,197	11,510	33,598
Fianarantsoa ii	31,971	32,866	33,786	98,624
Iakora	2,444	2,513	2,583	7,540
Ifanadiana	10,556	10,852	11,156	32,564
Ihosy	9,654	9,924	10,202	29,781
Ikalamavony	7,063	7,260	7,464	21,787
Ikongo	11,978	12,313	12,658	36,949
Ivohibe	1,858	1,910	1,963	5,731
Manakara-atsimo	13,069	13,435	13,811	40,315
Manandriana	9,584	9,852	10,128	29,564
Mananjary	14,977	15,397	15,828	46,201
Midongy-atsimo	2,410	2,477	2,546	7,433
Nosy-varika	9,284	9,544	9,811	28,638
Vangaindrano	17,882	18,383	18,897	55,162
Vohipeno	6,668	6,855	7,047	20,570
Vondrozo	5,050	5,192	5,337	15,579
<b>Toamasina Province</b>	<b>173,812</b>	<b>178,679</b>	<b>183,682</b>	<b>536,174</b>
Ambatondrazaka	13,902	14,291	14,691	42,883
Amparafaravola	12,916	13,277	13,649	39,842
Andilamena	5,254	5,401	5,552	16,208
Anosibe an-ala	5,605	5,762	5,923	17,289
Antanambao-manampotsy	3,196	3,286	3,378	9,860
Brickaville	16,819	17,290	17,774	51,883
Fenoarivo-atsinanana	17,108	17,587	18,080	52,776
Mahanoro	3,411	3,507	3,605	10,523
Mananara-avaratra	17,971	18,474	18,991	55,436
Maroantsetra	7,469	7,678	7,893	23,039
Marolambo	17,807	18,306	18,819	54,932
Moramanga	1,277	1,312	1,349	3,938
Sainte marie	7,837	8,056	8,282	24,176
Soanierana-ivongo	7,396	7,603	7,816	22,815
Toamasina i	10,450	10,743	11,043	32,236

*Annex 2. Requirements of SP for IPT by District*

	SP for IPT Requirements (2 doses)			Total
	2005	2006	2007	2005–2007
Toamasina ii	6,203	6,377	6,556	19,136
Vatomandry	7,914	8,136	8,363	24,413
Vavatenina	11,278	11,593	11,918	34,789
<b>Mahajanga Province</b>	<b>115,366</b>	<b>118,596</b>	<b>121,917</b>	<b>355,879</b>
Ambato-boeni	12,428	12,776	13,133	38,337
Ambatomainty	1,621	1,666	1,713	5,000
Analalava	6,972	7,167	7,368	21,507
Antsalova	2,249	2,312	2,376	6,936
Antsohihy	5,904	6,069	6,239	18,211
Bealanana	8,263	8,494	8,732	25,489
Befandriana-avaratra	9,943	10,222	10,508	30,672
Besalampy	1,186	1,219	1,254	3,659
Kandreho	667	686	705	2,059
Maevatanana	7,381	7,588	7,800	22,770
Mahajanga i	8,000	8,224	8,454	24,679
Mahajanga ii	2,543	2,614	2,687	7,845
Maintirano	4,607	4,736	4,868	14,211
Mampikony	5,862	6,027	6,195	18,085
Mandritsara	10,809	11,111	11,423	33,343
Marovoay	7,073	7,271	7,474	21,817
Mitsinjo	2,654	2,728	2,805	8,187
Morafenobe	951	978	1,005	2,934
Port-berger (boriziny)	8,247	8,478	8,716	25,441
Soalala	1,505	1,548	1,591	4,644
Tsaratana	6,501	6,683	6,870	20,053
<b>Toliary Province</b>	<b>108,469</b>	<b>111,506</b>	<b>114,629</b>	<b>334,605</b>
Amboasary-atsimo	5,228	5,374	5,525	16,127
Ambvombe-androy	5,929	6,096	6,266	18,291
Ampanihy	9,200	9,457	9,722	28,379
Ankazoabo-atsimo	3,088	3,175	3,264	9,527
Bekily	5,586	5,743	5,904	17,233

*Quantification of Antimalarial Medicines Requirements for Madagascar*

	SP for IPT Requirements (2 doses)			Total
	2005	2006	2007	2005–2007
Beloha	3,035	3,120	3,207	<b>9,362</b>
Belon i tsiribihina	7,033	7,230	7,432	<b>21,695</b>
Benenitra	1,173	1,206	1,240	<b>3,620</b>
Beroroha	1,235	1,270	1,305	<b>3,810</b>
Betioky-atsimo	11,298	11,614	11,940	<b>34,852</b>
Betroka	3,583	3,683	3,786	<b>11,052</b>
Mahabo	4,193	4,311	4,431	<b>12,935</b>
Manja	2,956	3,039	3,124	<b>9,119</b>
Miandrivazo	6,150	6,322	6,499	<b>18,971</b>
Morombe	5,085	5,227	5,373	<b>15,685</b>
Morondava	5,445	5,598	5,755	<b>16,798</b>
Sakaraha	1,958	2,013	2,069	<b>6,040</b>
Taolanaro	10,328	10,617	10,914	<b>31,859</b>
Toliary i	7,998	8,222	8,452	<b>24,673</b>
Toliary ii	3,436	3,532	3,631	<b>10,599</b>
Tsihombe	4,531	4,658	4,788	<b>13,977</b>
<b>Antsiranana Province</b>	<b>83,547</b>	<b>85,886</b>	<b>88,291</b>	<b>257,724</b>
Antsiranana i	3,816	3,923	4,033	<b>11,771</b>
Antsiranana ii	5,377	5,528	5,683	<b>16,588</b>
Ambanja	10,573	10,869	11,173	<b>32,614</b>
Ambilobe	11,265	11,580	11,904	<b>34,749</b>
Antalaha	8,927	9,177	9,434	<b>27,539</b>
Andapa	10,498	10,792	11,094	<b>32,384</b>
Nosy-be	3,098	3,185	3,274	<b>9,558</b>
Sambava	16,860	17,332	17,817	<b>52,009</b>
Iharana (vohemar)	13,133	13,501	13,879	<b>40,513</b>

### ANNEX 3A. REQUIREMENTS FOR AQ + ASU FOR POPULATION UNDER 5 YEARS

	AQ + ASU Estimated Requirements (Population < 5 years)			Total 2005–2007
	2005	2006	2007	
<b>National Total</b>	<b>12,653,255</b>	<b>13,007,546</b>	<b>13,371,757</b>	<b>39,032,558</b>
<b>Antananarivo Province</b>	<b>4,106,822</b>	<b>4,221,813</b>	<b>4,340,023</b>	<b>12,668,658</b>
Ambatolampy	125,297	128,806	132,412	<b>386,515</b>
Ambohidratrimo	151,328	155,565	159,921	<b>466,813</b>
Andramasina	79,980	82,220	84,522	<b>246,721</b>
Anjozorobe	103,417	106,313	109,290	<b>319,019</b>
Ankazobe	85,670	88,069	90,535	<b>264,274</b>
Antananarivo-Atsimondrano	180,161	185,206	190,392	<b>555,759</b>
Antananarivo-Avaradrano	1,203,732	1,237,436	1,272,085	<b>3,713,253</b>
Antananarivo-Renivohitra	579,553	595,781	612,463	<b>1,787,797</b>
Antanifotsy	160,086	164,568	169,176	<b>493,831</b>
Antsirabe i	98,833	101,600	104,445	<b>304,878</b>
Antsirabe ii	194,586	200,035	205,636	<b>600,256</b>
Arivonimamo	158,741	163,185	167,755	<b>489,681</b>
Betafo	192,241	197,624	203,158	<b>593,023</b>
Faratsiho	97,010	99,726	102,519	<b>299,255</b>
Fenoarivo-Afovoany	82,186	84,487	86,853	<b>253,525</b>
Manjakandriana	126,921	130,474	134,128	<b>391,523</b>
Miarinarivo	112,136	115,275	118,503	<b>345,914</b>
Soavinandriana	96,240	98,935	101,705	<b>296,880</b>
Tsiroanomandidy	278,703	286,507	294,529	<b>859,739</b>
<b>Fianarantsoa Province</b>	<b>2,176,678</b>	<b>2,237,625</b>	<b>2,300,279</b>	<b>6,714,582</b>
Ambalavao	114,660	117,871	121,171	<b>353,702</b>
Ambatofinandrahana	66,719	68,587	70,507	<b>205,812</b>
Ambohimahaso	107,339	110,345	113,435	<b>331,119</b>
Ambositra	131,746	135,435	139,227	<b>406,409</b>

*Quantification of Antimalarial Medicines Requirements for Madagascar*

	AQ + ASU Estimated Requirements (Population < 5 years)			Total
	2005	2006	2007	2005–2007
Befotaka	17,178	17,659	18,154	<b>52,991</b>
Fandriana	100,239	103,045	105,931	<b>309,215</b>
Farafangana	149,241	153,420	157,716	<b>460,378</b>
Fianarantsoa I	79,816	82,051	84,348	<b>246,215</b>
Fianarantsoa ii	233,436	239,972	246,692	<b>720,100</b>
Iakora	25,043	25,744	26,465	<b>77,252</b>
Ifanadiana	93,134	95,742	98,423	<b>287,299</b>
Ihosy	88,998	91,490	94,052	<b>274,541</b>
Ikalamavony	41,709	42,877	44,077	<b>128,663</b>
Ikongo	87,716	90,172	92,697	<b>270,586</b>
Ivohibe	24,796	25,490	26,204	<b>76,491</b>
Manakara-atsimo	169,142	173,878	178,746	<b>521,766</b>
Manandriana	47,329	48,654	50,016	<b>145,999</b>
Mananjary	160,627	165,124	169,748	<b>495,498</b>
Midongy-atsimo	22,888	23,529	24,188	<b>70,605</b>
Nosy-varika	115,541	118,776	122,102	<b>356,420</b>
Vangaindrano	151,404	155,643	160,001	<b>467,047</b>
Vohipeno	75,063	77,165	79,326	<b>231,554</b>
Vondrozo	72,913	74,955	77,053	<b>224,921</b>
<b>Toamasina Province</b>	<b>2,127,124</b>	<b>2,186,684</b>	<b>2,247,911</b>	<b>6,561,719</b>
Ambatondrazaka	172,028	176,845	181,797	<b>530,671</b>
Amparafaravola	134,128	137,884	141,744	<b>413,756</b>
Andilamena	137,628	141,481	145,443	<b>424,551</b>
Anosibe an-ala	258,686	265,929	273,375	<b>797,990</b>
Antanambao-Manampotsy	38,630	39,711	40,823	<b>119,165</b>
Brickaville	125,726	129,247	132,866	<b>387,839</b>
Fenoarivo-Aatsinanana	155,886	160,251	164,738	<b>480,876</b>
Mahanoro	134,661	138,431	142,307	<b>415,399</b>
Mananara-Avaratra	68,874	70,802	72,785	<b>212,461</b>
Maroantsetra	110,707	113,807	116,994	<b>341,509</b>
Marolambo	90,144	92,668	95,262	<b>278,074</b>
Moramanga	176,451	181,392	186,471	<b>544,313</b>
Sainte Marie	12,788	13,146	13,515	<b>39,449</b>

*Annex 3A. Requirements for AQ + ASU for Population under 5 Years*

	AQ + ASU Estimated Requirements (Population < 5 years)			Total
	2005	2006	2007	2005–2007
Soanierana-Ivongo	66,705	68,573	70,493	205,771
Toamasina I	127,031	130,588	134,245	391,865
Toamasina II	113,524	116,703	119,971	350,198
Vatomandry	102,213	105,075	108,017	315,305
Vavatenina	101,313	104,150	107,066	312,528
<b>Mahajanga Province</b>	<b>1,380,339</b>	<b>1,418,989</b>	<b>1,458,720</b>	<b>4,258,048</b>
Ambato-boeni	96,330	99,027	101,800	297,157
Ambatomainty	16,568	17,032	17,508	51,108
Analalava	77,772	79,950	82,189	239,911
Antsalova	22,367	22,993	23,637	68,998
Antsohihy	80,514	82,769	85,086	248,369
Bealanana	81,957	84,252	86,611	252,819
Befandriana-Avaratra	122,416	125,844	129,368	377,628
Besalampy	26,708	27,456	28,225	82,388
Kandreho	9,177	9,434	9,698	28,308
Maevatanana	90,169	92,694	95,289	278,152
Mahajanga I	117,590	120,882	124,267	362,739
Mahajanga II	59,409	61,072	62,782	183,264
Maintirano	44,562	45,810	47,093	137,465
Mampikony	61,546	63,270	65,041	189,857
Mandritsara	141,878	145,851	149,935	437,664
Marovoay	106,106	109,077	112,132	327,315
Mitsinjo	41,993	43,169	44,378	129,540
Morafenobe	16,430	16,890	17,363	50,684
Port-Berger (Boriziny)	71,202	73,196	75,245	219,643
Soalala	21,878	22,491	23,120	67,489
Tsaratana	73,765	75,831	77,954	227,550
<b>Toliary Province</b>	<b>1,653,339</b>	<b>1,699,632</b>	<b>1,747,222</b>	<b>5,100,194</b>
Toliary I	103,656	106,558	109,542	319,756
Manja	113,825	117,012	120,288	351,125
Beroroha	133,628	137,370	141,216	412,215

*Quantification of Antimalarial Medicines Requirements for Madagascar*

	AQ + ASU Estimated Requirements (Population < 5 years)			Total
	2005	2006	2007	2005–2007
Morombe	45,964	47,251	48,574	<b>141,788</b>
Ankazoabo-Atsimo	93,736	96,361	99,059	<b>289,156</b>
Betioky-Atsimo	39,518	40,624	41,762	<b>121,904</b>
Ampanihy	41,339	42,497	43,687	<b>127,522</b>
Morondava	22,980	23,624	24,285	<b>70,889</b>
Mahabo	30,039	30,881	31,745	<b>92,665</b>
Belon I Tsiribihina	125,208	128,714	132,318	<b>386,240</b>
Miandrivazo	105,638	108,595	111,636	<b>325,869</b>
Sakaraha	60,623	62,320	64,065	<b>187,009</b>
Beloha	45,775	47,056	48,374	<b>141,205</b>
Tsihombe	64,907	66,724	68,593	<b>200,224</b>
Taolanaro	71,813	73,823	75,890	<b>221,526</b>
Ambvombe-Androy	64,260	66,059	67,909	<b>198,229</b>
Betroka	46,598	47,903	49,244	<b>143,746</b>
Bekily	157,561	161,972	166,507	<b>486,040</b>
Amboasary-Atsimo	89,085	91,580	94,144	<b>274,808</b>
Toliary li	155,236	159,583	164,051	<b>478,870</b>
Benenitra	41,950	43,125	44,332	<b>129,407</b>
<b>Antsiranana Province</b>	<b>1,208,953</b>	<b>1,242,803</b>	<b>1,277,602</b>	<b>3,729,358</b>
Antsiranana I	171,153	175,946	180,872	<b>527,971</b>
Antsiranana li	167,429	172,117	176,936	<b>516,481</b>
Ambanja	131,248	134,923	138,701	<b>404,872</b>
Ambilobe	93,284	95,896	98,581	<b>287,762</b>
Antalaha	107,367	110,374	113,464	<b>331,205</b>
Andapa	153,791	158,098	162,524	<b>474,413</b>
Nosy-Be	135,966	139,773	143,686	<b>419,425</b>
Sambava	110,011	113,091	116,257	<b>339,359</b>
Iharana (Vohemar)	138,703	142,587	146,579	<b>427,870</b>

### ANNEX 3B. REQUIREMENTS FOR AQ + ASU FOR POPULATION OVER 5 YEARS

	AQ + ASU Estimated Requirements (Population > 5 years)			Total
	2005	2006	2007	2005–2007
<b>National Total</b>	<b>153,773,268</b>	<b>158,078,919</b>	<b>162,505,129</b>	<b>474,357,316</b>
<b>Antananarivo Province</b>	<b>45,625,528</b>	<b>46,903,042</b>	<b>48,216,328</b>	<b>140,744,897</b>
Ambatolampy	1,965,937	2,020,983	2,077,571	<b>6,064,492</b>
Ambohidratrimo	2,278,843	2,342,650	2,408,245	<b>7,029,738</b>
Andramasina	1,262,098	1,297,437	1,333,765	<b>3,893,300</b>
Anjozorobe	1,450,084	1,490,687	1,532,426	<b>4,473,197</b>
Ankazobe	1,197,350	1,230,876	1,265,340	<b>3,693,567</b>
Antananarivo-Atsimondrano	2,713,777	2,789,762	2,867,876	<b>8,371,415</b>
Antananarivo-Avaradrano	1,963,944	2,018,934	2,075,464	<b>6,058,343</b>
Antananarivo-Renivohitra	8,581,345	8,821,622	9,068,628	<b>26,471,595</b>
Antanifotsy	2,519,658	2,590,208	2,662,734	<b>7,772,600</b>
Antsirabe I	1,516,806	1,559,277	1,602,937	<b>4,679,020</b>
Antsirabe li	3,036,133	3,121,145	3,208,537	<b>9,365,816</b>
Arivonimamo	2,427,918	2,495,900	2,565,785	<b>7,489,603</b>
Betafo	2,826,438	2,905,578	2,986,935	<b>8,718,951</b>
Faratsiho	1,506,632	1,548,818	1,592,185	<b>4,647,635</b>
Fenoarivo-Afovoany	1,185,731	1,218,931	1,253,061	<b>3,657,724</b>
Manjakandriana	1,922,790	1,976,628	2,031,973	<b>5,931,391</b>
Miarinarivo	1,687,012	1,734,248	1,782,807	<b>5,204,067</b>
Soavinandriana	1,405,354	1,444,704	1,485,156	<b>4,335,215</b>
Tsiroanomandidy	4,177,677	4,294,652	4,414,902	<b>12,887,230</b>
<b>Fianarantsoa Province</b>	<b>27,939,534</b>	<b>28,721,841</b>	<b>29,526,053</b>	<b>86,187,429</b>
Ambalavao	1,725,083	1,773,386	1,823,040	<b>5,321,509</b>
Ambatofinandrahana	1,025,214	1,053,920	1,083,430	<b>3,162,563</b>
Ambohimahasoa	1,626,417	1,671,957	1,718,772	<b>5,017,146</b>
Ambositra	1,940,456	1,994,788	2,050,642	<b>5,985,886</b>
Befotaka	206,292	212,068	218,006	<b>636,367</b>

*Quantification of Antimalarial Medicines Requirements for Madagascar*

	AQ + ASU Estimated Requirements (Population > 5 years)			Total
	2005	2006	2007	2005–2007
Fandriana	1,567,939	1,611,842	1,656,973	<b>4,836,755</b>
Farafangana	1,774,226	1,823,904	1,874,973	<b>5,473,103</b>
Fianarantsoa I	230,324	236,773	243,402	<b>710,499</b>
Fianarantsoa II	3,567,129	3,667,008	3,769,685	<b>11,003,822</b>
Iakora	275,638	283,355	291,289	<b>850,283</b>
Ifanadiana	1,184,061	1,217,215	1,251,297	<b>3,652,573</b>
Ihosy	1,035,675	1,064,674	1,094,485	<b>3,194,834</b>
Ikalamavony	510,728	525,029	539,730	<b>1,575,487</b>
Ikongo	954,031	980,744	1,008,205	<b>2,942,980</b>
Ivohibe	295,003	303,263	311,754	<b>910,019</b>
Manakara-Atsimo	2,072,257	2,130,281	2,189,929	<b>6,392,467</b>
Manandriana	739,090	759,784	781,058	<b>2,279,933</b>
Mananjary	2,023,469	2,080,127	2,138,370	<b>6,241,966</b>
Midongy-Atsimo	232,262	238,765	245,450	<b>716,477</b>
Nosy-Varika	1,501,859	1,543,911	1,587,140	<b>4,632,910</b>
Vangaindrano	1,760,024	1,809,304	1,859,965	<b>5,429,292</b>
Vohipeno	879,019	903,632	928,933	<b>2,711,584</b>
Vondrozo	813,339	836,112	859,523	<b>2,508,974</b>
<b>Toamasina Province</b>	<b>23,123,963</b>	<b>23,771,434</b>	<b>24,437,034</b>	<b>71,332,432</b>
Ambatondrazaka	2,287,795	2,351,853	2,417,705	<b>7,057,354</b>
Amparafaravola	1,947,042	2,001,559	2,057,603	<b>6,006,203</b>
Andilamena	115,944	119,190	122,527	<b>357,661</b>
Anosibe An-Ala	187,775	193,033	198,438	<b>579,246</b>
Antanambao-Manampotsy	435,448	447,640	460,174	<b>1,343,262</b>
Brickaville	1,558,318	1,601,951	1,646,806	<b>4,807,075</b>
Fenoarivo-Atsinanana	2,136,780	2,196,610	2,258,115	<b>6,591,505</b>
Mahanoro	1,901,478	1,954,719	2,009,451	<b>5,865,648</b>
Mananara-Avaratra	941,942	968,316	995,429	<b>2,905,687</b>
Maroantsetra	1,526,054	1,568,783	1,612,709	<b>4,707,546</b>
Marolambo	1,107,263	1,138,267	1,170,138	<b>3,415,668</b>
Moramanga	2,104,630	2,163,560	2,224,139	<b>6,492,329</b>
Sainte Marie	157,566	161,978	166,513	<b>486,056</b>
Soanierana-Ivongo	899,925	925,123	951,027	<b>2,776,075</b>

*Annex 3B. Requirements for AQ + ASU for Population over 5 Years*

	AQ + ASU Estimated Requirements (Population > 5 years)			Total
	2005	2006	2007	2005–2007
Toamasina I	1,746,666	1,795,573	1,845,849	<b>5,388,087</b>
Toamasina II	1,505,239	1,547,385	1,590,712	<b>4,643,336</b>
Vatomandry	1,211,757	1,245,686	1,280,566	<b>3,738,009</b>
Vavatenina	1,352,342	1,390,208	1,429,134	<b>4,171,683</b>
<b>Mahajanga Province</b>	<b>16,161,865</b>	<b>16,614,397</b>	<b>17,079,600</b>	<b>49,855,861</b>
Ambato-Boeni	1,015,968	1,044,415	1,073,658	<b>3,134,041</b>
Ambatomainty	187,870	193,131	198,538	<b>579,539</b>
Analalava	821,945	844,959	868,618	<b>2,535,523</b>
Antsalova	271,943	279,558	287,385	<b>838,887</b>
Antsohihy	974,681	1,001,972	1,030,027	<b>3,006,680</b>
Bealanana	939,475	965,781	992,823	<b>2,898,079</b>
Befandriana-Avaratra	1,515,252	1,557,679	1,601,294	<b>4,674,224</b>
Besalampy	336,512	345,934	355,620	<b>1,038,067</b>
Kandreho	115,608	118,845	122,173	<b>356,626</b>
Maewatanana	1,008,042	1,036,268	1,065,283	<b>3,109,593</b>
Mahajanga I	1,423,279	1,463,131	1,504,099	<b>4,390,509</b>
Mahajanga II	675,496	694,410	713,854	<b>2,083,760</b>
Maintirano	494,345	508,186	522,416	<b>1,524,947</b>
Mampikony	746,084	766,975	788,450	<b>2,301,509</b>
Mandritsara	1,773,895	1,823,564	1,874,623	<b>5,472,082</b>
Marovoay	1,138,763	1,170,648	1,203,427	<b>3,512,838</b>
Mitsinjo	487,656	501,310	515,347	<b>1,504,312</b>
Morafenobe	192,741	198,137	203,685	<b>594,563</b>
Port-Berger (Boriziny)	908,090	933,516	959,655	<b>2,801,260</b>
Soalala	253,118	260,205	267,491	<b>780,813</b>
Tsaratanana	881,102	905,773	931,135	<b>2,718,010</b>
<b>Toliary Province</b>	<b>26,541,624</b>	<b>27,284,790</b>	<b>28,048,764</b>	<b>81,875,177</b>
Toliary I	1,417,682	1,457,377	1,498,184	<b>4,373,243</b>
Manja	1,688,462	1,735,739	1,784,340	<b>5,208,542</b>
Beroroha	1,913,454	1,967,031	2,022,108	<b>5,902,592</b>
Morombe	516,940	531,414	546,294	<b>1,594,648</b>

*Quantification of Antimalarial Medicines Requirements for Madagascar*

	AQ + ASU Estimated Requirements (Population > 5 years)			Total
	2005	2006	2007	2005–2007
Ankazoabo-Atsimo	1,180,103	1,213,146	1,247,114	<b>3,640,364</b>
Betioky-Atsimo	603,560	620,460	637,833	<b>1,861,854</b>
Ampanihy	510,515	524,809	539,504	<b>1,574,827</b>
Morondava	257,852	265,072	272,494	<b>795,417</b>
Mahabo	372,769	383,207	393,937	<b>1,149,913</b>
Belon I Tsiribihina	1,577,618	1,621,791	1,667,202	<b>4,866,611</b>
Miandrivazo	1,307,153	1,343,753	1,381,378	<b>4,032,283</b>
Sakaraha	807,596	830,208	853,454	<b>2,491,258</b>
Beloha	550,800	566,222	582,076	<b>1,699,098</b>
Tsihombe	795,891	818,176	841,085	<b>2,455,151</b>
Taolanaro	916,271	941,927	968,301	<b>2,826,499</b>
Ambvombe-Androy	810,785	833,487	856,824	<b>2,501,095</b>
Betroka	635,081	652,863	671,143	<b>1,959,087</b>
Bekily	1,988,507	2,044,185	2,101,422	<b>6,134,114</b>
Amboasary-Atsimo	1,061,781	1,091,511	1,122,073	<b>3,275,364</b>
Toliary II	1,884,956	1,937,734	1,991,991	<b>5,814,681</b>
Benenitra	5,743,850	5,904,678	6,070,009	<b>17,718,536</b>
<b>Antsiranana Province</b>	<b>14,380,754</b>	<b>14,783,415</b>	<b>15,197,350</b>	<b>44,361,519</b>
Antsiranana I	2,342,004	2,407,580	2,474,993	<b>7,224,577</b>
Antsiranana II	2,257,494	2,320,704	2,385,683	<b>6,963,881</b>
Ambanja	1,608,485	1,653,523	1,699,822	<b>4,961,830</b>
Ambilobe	1,012,290	1,040,634	1,069,771	<b>3,122,695</b>
Antalaha	1,045,371	1,074,641	1,104,731	<b>3,224,743</b>
Andapa	1,761,117	1,810,428	1,861,120	<b>5,432,665</b>
Nosy-Be	1,851,893	1,903,747	1,957,051	<b>5,712,691</b>
Sambava	1,003,362	1,031,456	1,060,337	<b>3,095,154</b>
Iharana (Vohemar)	1,498,738	1,540,703	1,583,843	<b>4,623,284</b>