



Republic of Kenya

MINISTRY OF PUBLIC HEALTH AND SANITATION

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MINISTRY OF MEDICAL SERVICES, KENYA

**Antimalarial Commodities Requirements for
The Financial Year July 2012 – June 2013**

July 2012

Report prepared by:

The Drug Supply Management Sub-Committee, Division of Malaria Control



MSH/Health Commodities and Services Management

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The contents are the responsibility of the Division of Malaria Control, Ministry of Health, Kenya and partners and do not necessarily reflect the views of USAID or the United States Government.

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ACRONYMS

ACT	Artemisinin-based combination therapy
AL	Artemether –Lumefantrine
AMFm	Affordable Medicines Facility – malaria
AMC	Average monthly consumption
Amp	Ampoule
ANC	Antenatal care
CHAI	Clinton Health Access Initiative
DHAP	DihydroArtemesinin- Piperaquine
DOMC	Division of Malaria Control
DOP	Department of Pharmacy
CMTWG	Case Management Technical Working Group
DSMSC	Drug Supply Management Sub Committee
F&Q	Forecasting and Quantification
GF	Global Fund
GFATM	Global fund to fight AIDS, Tuberculosis, and Malaria
HCSM	Health Commodities & Services Management (program)
HIS	Health information system
IPTp	Intermittent preventive treatment in pregnancy
IM	Intramuscular
IRS	Indoor Residual Spraying
IV	Intravenous
KEMSA	Kenya Medical Supplies Agency
KNBS	Kenya National Bureau of Statistics
LMIS	Logistics Management Information System
LMU	Logistics Management Unit
MEDS	Mission for Essential Drugs and Supplies
MOMS	Ministry of Medical Services
MOPHS	Ministry of Public Health & Sanitation
MOS	Months of Stock
MSH	Management Sciences for Health

NMS	National Malaria Strategy
OPD	outpatient department
PHFs	Peripheral Health Facilities
PMI	(USG) President’s Malaria Initiative
RDTs	Rapid Diagnostic Tests
RPM Plus	Rational Pharmaceutical Management Plus Program
SP	Sulfadoxine-pyrimethamine
SOH	Stock on Hand
SPS	Strengthening Pharmaceutical Systems Program
STGs	standard treatment guidelines
USAID	United States Agency for International Development
WHO	World Health Organization

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This forecasting & quantification (F&Q) exercise was undertaken through a collaborative effort of members of the Drug Supply Management Sub-Committee (DSMSC) of the Case Management Technical Working group, Division of Malaria Control, Ministry of Public Health and Sanitation, Kenya.

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In particular the technical contribution of the DSMSC members listed below is acknowledged and appreciated:-

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EXECUTIVE SUMMARY

Over the past few years, the Division of Malaria Control (DOMC) in collaboration with partners has been carrying out an annual forecasting & quantification exercise to establish the antimalarial commodity requirements for the country.

The quantification exercise is spearheaded by the Drug Supply Management Subcommittee (DSMSC) of the Case Management Technical Working group of the DOMC. This committee comprises the DOMC, Management Sciences for Health (MSH) Health Commodities and Services Management (HCSM) program, Kenya Medical Supplies Agency (KEMSA), the Department of Pharmacy, Department of primary Health Care Services and Clinton Health Access Initiative (CHAI). One of the key functions of the DSMSC is to advise the DOMC on commodity security and supply chain related issues for antimalarial commodities.

The main objective of the exercise this year was to determine the national requirements for antimalarial medicines and diagnostics (specifically Rapid Diagnostic Tests (RDTs)) for the financial year 2012-2013.

In May 2010, the DOMC released the updated national guidelines - *National Guidelines for Diagnosis, Treatment and Prevention of Malaria in Kenya, 2010* in line with the recommendation by WHO for countries to review their malaria treatment guidelines to embrace a universal diagnostic policy for all age groups and across all epidemiologic zones. Consequently, RDTs have been identified as a tool that will help bridge the diagnostic coverage gap in lower level facilities in Kenya. This year's forecasting & quantification exercise, for only the second time, included an estimation of the RDT requirements for the public sector as the country plans to introduce and scale up RDT coverage as from August 2012.

Four data sources were used in the determination of the current country antimalarial commodity requirements:

- 1) Consumption data from the Logistics Management information System (LMIS).
- 2) Patients' data as reported in the LMIS.
- 3) Morbidity data as reported by the Demographic and Health information system (DHIS)

- 4) The detailed AL Gap analysis and forecast for 2011-2016, as computed during the GF round 10 grant application.

The Consumption-based method was applied in quantifying for quinine, while the morbidity-based method was applied for Sulphadoxine Pyrimethamine (SP) and DihydroArtemisinin Piperazine (DHAP).

Key Results from 2012-13 Quantification

Table 1: Summary of antimalarial commodities requirements for FY 2012/2013

Product	Unit	Net Requirement	AMC	Stock at KEMSA	MOS Kemsas	Available from PMI/USAID	Available from GFATM	Available from GOK	Total in Pipeline	MOS Pipeline
		a	b	c	d	e	f	g	h	i
AL 6s	Pack of 6's	5,996,736	499,728	3,603,440	7	891,780	3,922,083	-	4,813,863	10
AL 12s	Pack of 12's	3,327,457	277,288	661,780	2	494,820	2,176,278	-	2,671,098	10
AL 18s	Pack of 18's	1,627,163	135,597	245,380	2	241,976	1,064,224	-	1,306,200	10
AL 24s	Pack of 24's	7,331,375	610,948	2,199,088	4	1,090,252	4,794,985	-	5,885,237	10
Quinine dihydrochloride inj	Amps	3,386,142	282,179	304,600	1	-	-	2,430,600	2,430,600	9
Quinine sulphate 200mg	Tab	6,005,156	500,430	436,000	1	-	-	44,082,000	44,082,000	88
Sulphadoxine / Pyrimethamine	Tin of 1000s	2,055,984	171,332	33,108,000	193	-	-	-	-	-
Dihydroartemesinin/Piperaquine 160mg	Tab	2,946,005	245,500	-	-	-	-	-	-	-
dihydroartemesinin/Piperaquine 320mg	Tab	4,804,558	400,380	-	-	-	-	-	-	-
Artesunate rectal caps 50mg	caps	370,241	30,853	-	-	-	-	-	-	-
Artesunate rectal caps 200mg	caps	102,704	8,559	-	-	-	-	-	-	-
Artesunate injection	60mg vials	3,049,121	254,093	19,013	0	-	-	-	-	-
Rapid Diagnostic tests.	Tests	10,233,410	852,784	1,373,275		800,000	7,400,000	-	8,200,000	10

Foot notes for table 1

- Net requirement from F and Q 2012 -2013
- Average Monthly consumption based on LMIS data
- Stock at KEMSA as at 30th June 2012
- Months of stock at Kemsas as at 30th June 2012
- Quantity in Pipeline from PMI/USAID
- Quantity in Pipeline from GFATM
- Quantity in Pipeline from Government of Kenya.
- Total Quantity of products in Pipeline (e+f+g)
- Total Months of stock of products in pipeline.

Key Conclusions/Recommendations

- Timely procurement of the required Antimalarial commodities and adherence to delivery schedules will ensure a full pipeline and prevent stock outs at the central and facility levels.

- An immediate recommendation is to start procurement of AL formulations under GF AMFm Year 2 funding by latest November 2012 according to the quantification procurement plan to maintain the stock levels at central level at above the minimum recommended stock level of 6 months.
- Currently, all Malaria stocks except for AL 6s are below the recommended six months level.
- A situational analysis of AL stock status for the coming year shows that alternative funding to purchase five months of stock in May 2013 needs to be sought to maintain stock levels at above minimum and prevent a stock out, if any delay were to occur in the GF AMFm Year 2 procurement.

1.0 BACKGROUND

Malaria remains one of the country's key public health concerns and is a leading cause of morbidity and mortality in Kenya. Clinically diagnosed malaria is responsible for 30 percent of outpatient consultations, 15 per cent of hospital admissions and 3-5 per cent of inpatient deaths. In 2007, there were 9.2 million cases of clinically diagnosed malaria reported across health facilities in the country¹.

In 2004, Kenya adopted the new ACT policy with Artemether/Lumefantrine (AL) for treatment of uncomplicated malaria. The first AL consignment was received in country in 2006. Since the adoption of the new treatment policy, the Drug Management subcommittee of the Case Management Technical Working Group of the DOMC has played a primary role in forecasting and quantification as well as monitoring of stock status of antimalarial medicines recommended in the *National Guidelines for Diagnosis, Treatment and Prevention of Malaria for Health Workers in Kenya, 2008*. In 2010, these treatment guidelines were updated to include universal access to malaria diagnosis for all age groups and a second line treatment for uncomplicated malaria.

One of the key strategic interventions of the DOMC as outlined in the National Malaria Strategy (2009-2017) is to provide for prompt and effective treatment of malaria with 100 per cent of fever cases who present to health facilities receiving parasitological diagnosis before treatment by 2013². To improve rational use of malaria medicines, the DOMC adopted a universal diagnostic policy for all age groups. In order to improve diagnostic coverage, the DOMC has advocated for a phased roll-in approach for the introduction of rapid diagnostic test kits and scale-up coupled with strengthening quality assurance for microscopy.

An uninterrupted supply of diagnostics and antimalarial medicines is crucial and beneficial to increasing access to treatment and providing quality care to malaria patients.

In an effort to assure continuous availability of malaria medicines the DOMC in collaboration with partners, have carried out six annual F&Q exercises since 2006 using different quantification approaches. In the initial years, morbidity-based estimates were used since

¹ Ministry of Public Health and Sanitation, Kenya. National Malaria Policy, April 2010

² DOMC/MOPHS. 2009. *National Malaria Strategy 2009–2017*. Nairobi: DOMC/MOPHS.

there were challenges in obtaining the consumption data due to low health facility reporting rates, inaccurate and incomplete reports, a weak Logistics Management Information System (LMIS) for Malaria medicines and lack of inventory management tools at health facilities. However, from June 2009, the DOMC improved the LMIS system that has since provided consumption data for key antimalarial medicines. This data was used to quantify antimalarial Commodities requirements in 2010, 2011 and also in the current year (2012). Where possible, this historical data has also been used to ensure a more robust estimate of the country's Antimalarial needs.

On 17th, 18th and 19th July 2012, the DOMC in collaboration with partners from MSH/HCSM, KEMSA, Department of pharmacy (DOP), Department of primary health Care Services, and Clinton Health Access Initiative, carried out a national quantification exercise to determine the national antimalarial medicines and RDT requirements for FY 12/13. This activity was supported by MSH/HCSM using funds from PMI/USAID.

The key objectives of the exercise were to:

- Determine Antimalarial commodities needs for the financial year July 2012 - June 2013
- Forecast AL medicine requirements for two years, 2012 -2014
- Carry out a gap analysis for Antimalarial commodities for the period 2012 – 2013
- Carry out a situational analysis for AL stock status to identify when the country may be stocked out of AL, for further action
- Develop a delivery schedule for the expected procurements.

2.0 INTRODUCTION

2.1 Scope

This F&Q targeted commodity requirements for the Kenyan public health sector and covered the period July 2012–June 2013. It also served to provide a forecast of antimalarial commodity requirements for a two year period starting July 2012 to June 2014. The selected commodities were as recommended by the National *Guidelines for Diagnosis, Treatment and Prevention of Malaria in Kenya (2010)*.

The national guidelines recommend that all suspected malaria cases be tested for Malaria before treatment. Previously, the guidelines allowed for presumptive treatment of fever in children under the age of five years. In order to improve malaria diagnostics coverage in health facilities countrywide, the DOMC intends to roll out RDTs in the public sector in various malaria zones. The roll out will be carried out in August 2012 and a forecast of RDT requirements for the period July 2012 to June 2015 is provided.

2.2 Malaria standard treatment guidelines

A total of 4 different conditions with specific recommendations for treatment were identified and used for the purposes of this quantification.

Table 2 below provides the breakdown for each specific condition along with the associated treatment regimens.

Table 2: Standard Treatment Guidelines for Malaria

Condition	Treatment	Dosage
1. Uncomplicated malaria (First-line treatment)	Artemether + Lumefantrine 20mg/120mg for patients of weight band 5-14kg (6 tabs)	Taken two times a day for three days at 0, 8, 24, 48, 60 and 72 hours
	Artemether + Lumefantrine 20mg/120mg for patients of weight band 15-24kg (12 tabs)	
	Artemether + Lumefantrine 20mg/120mg for patients of weight band 25-34kg (18 tabs)	
	Artemether + Lumefantrine 20mg/120mg for patients of weight band >35 kg (24 tabs)	
2. Treatment failure in uncomplicated malaria	Dihydroartemesinin piperazine (DHAP) - available in adult and paediatric fixed dose combination tablets	4mg/kg/day Dihydroartemesinin and 18mg/kg/day piperazine taken once a day for 3 days
3. Severe (Complicated) malaria	Quinine dihydrochloride injection	Loading dose of 20mg/kg (max 1200 mg) and then 10mg every 8 hours administered parenterally until the patient can take oral formulation
	Quinine Sulphate tabs (continuation phase)	10 mg/kg every 8 hrs (max 600mg) to complete a total (Parenteral + oral) 7 days of quinine therapy
	Artesunate (All age groups)	2.4 mg/kg to start then at 12 hours and then daily for 6 days
4. Intermittent preventive treatment	Sulphadoxine-Pyrimethamine	3 tablets administered 4 weeks apart for a total of three doses following quickening

3.0 METHODOLOGY

Determining the method of quantification to use is an important part of the quantification process; medicine needs can be estimated using one or a combination of three standard methods: the consumption-based method, the morbidity-based method, and the adjusted consumption method (MSH & WHO, 1997). The method selected is based on data and information available, the number and types of patients receiving services, and the resources available for conducting the exercise.

Table 3 below provides an analysis of the different quantification methods by data and limitations, taking into consideration the Kenyan situation.

Table 3: Comparison of Quantification Methods

Method	Essential Data	Situation analysis for Kenya
1. Consumption	<ul style="list-style-type: none"> Reliable inventory records Records of supplier lead time Projected medicine costs 	<p>The Logistics Management Information System (LMIS) for malaria medicines was implemented in Kenya in June 2009. It has provided useful consumption data on a monthly basis.</p> <p>Since the reporting rates have remained below the recommended 70%, required to give the best estimate, we complemented this data with morbidity data from DHIS.</p>
2. Morbidity	<ul style="list-style-type: none"> Data on population and patient attendances Actual or projected incidence of health problems Standard treatments (ideal, actual) Projected medicine costs 	<p>Morbidity data, comprising information on confirmed and clinical malaria cases, is collected by the Division of HIS, MoPHS.</p> <p>In the previous years, the main limitations of HIS data were: - low reporting rates, lack of adjustment for facility reporting rates and delayed compilation of data by the HIS. But this has improved lately with the introduction of the online platform DHIS 2, and we have witnessed reporting rates of 79%, of the patient morbidity data.</p> <p>Standard Treatment guidelines are available at most public health facilities but Quality of Care Survey results show poor but improving adherence to case management guidelines.</p>

Adapted from: Management Sciences for Health/World Health Organization. 1997. "Quantifying Drug Requirements" in Managing Drug Supply. 2nd ed. West Hartford, CT: Kumarian Press.

3.1 General assumptions

In quantifying the antimalarial commodity requirements, the following general assumptions were applied:-

- The proportion of patients per weight band – based on actual patient numbers data obtained through the LMIS, monitored over a 18 month period is
 - 5-14kg = 33%
 - 15-25kg = 18%
 - 25-34kg = 9%
 - >35kg = 40%.

These above patient ratios have been used where applicable throughout this F&Q.

- The minimum recommended stock level at the central level is set at 6 months of stock (MOS)
- The maximum recommended stock level at the central level is set at 9 MOS.
- Physical count for end June 2012 was used while information on stocks pending with suppliers at the same time was obtained from KEMSA.
- Buffer stock level was set at 6 months, equivalent to recommended minimum stock level at Central level.
- Prices were obtained from either KEMSA or the international price indicator guide.

Each commodity's quantification will be guided by both the general assumptions above as well as any specific ones applicable to the commodity under consideration.

4.0 ARTEMETHER-LUMEFANTRINE

4.1 Treatment regimen

The current recommended first line medicine for uncomplicated malaria is AL given as a 3 day dose depending on the weight of the patient upon diagnosis.

4.2 Methodology

4.2.1 DETERMINING CURRENT ANNUAL AL REQUIREMENTS:

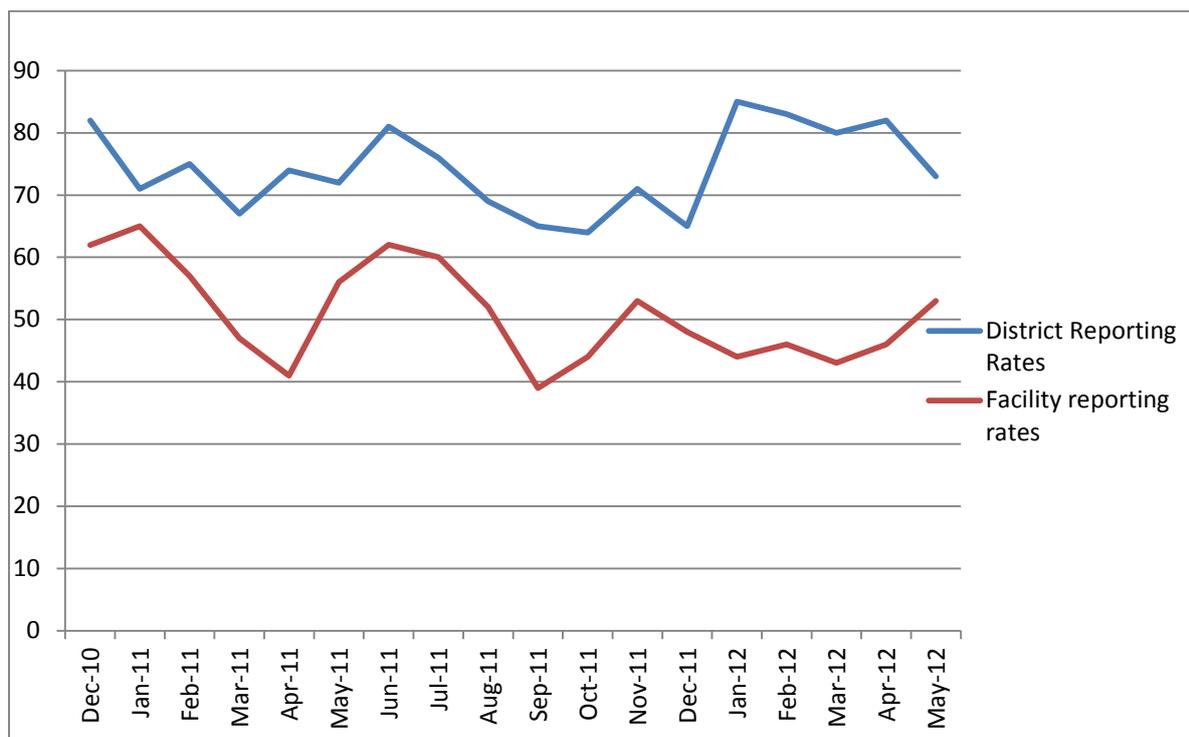
In order to determine the country's current annual consumption of ACTs the Drug management subcommittee evaluated data from a variety of sources namely:

1. Consumption data from the Logistics Management information System (LMIS).
2. Patient's data as reported in the LMIS.
3. Morbidity data as reported by the Demographic and Health information system (DHIS)
4. The detailed AL Gap analysis and forecast for 2011-2016, as computed during the GF round 10 grant application.

4.2.1.1 Consumption data from the Logistics Management Information System (LMIS):

Following the implementation of the LMIS system in June 2009, there was a steady increase in national LMIS reporting rates by health facilities from 11% in 2009 to 62% in June 2011. The reporting rates temporally dropped to 43% in March 2012, before increasing to 53% in May 2012. Figure 1 below shows the trends in reporting rates over the review period.

Figure 1: Facility and District LMIS reporting rates between December 2010 and May 2012



The Key indicators tracked by the LMIS are:

<ul style="list-style-type: none"> National LMIS reporting rates 	<ul style="list-style-type: none"> Aggregated Losses
<ul style="list-style-type: none"> Aggregated adjusted consumption 	<ul style="list-style-type: none"> Aggregated expired stocks
<ul style="list-style-type: none"> Percentage of facilities stocked out for >7 days 	<ul style="list-style-type: none"> Aggregated number of patients on AL.

We looked at the reported adjusted consumption data for the previous 18 months period (Dec 2010 to May 2012)

Table 4: Estimated Annual consumption using LMIS consumption data.

Total Aggregated doses of ACTs dispensed Dec 2010 to May 2012 (18 months) adjusted for reporting rates (a)	Adjusted aggregated doses of ACTs dispensed in 12 months (b)
18,576,414	12,384,276

- a. Obtained from LMIS data over the period Dec 2010 to May 2012. This figure is adjusted for reporting rates in each month over the period.
- b. Calculated as (a)/18 *12 to get the estimated number doses of ACTs dispensed in one year

4.2.1.2: Adjusted number of patients receiving ACTs.

The logistics management information system also collects data on the number of patients receiving ACTs in the facilities on a monthly basis. This data is important because there is a common practice of combining or splitting doses during dispensing, when one or more AL packs are out of stock. (Figure 2 below shows that while over 80% of facilities have ANY ACT pack on stock, the percentage of facilities with ALL AL packs is consistently lower)

Fig 2: Availability of Artemether - Lumefantrine in survey facilities

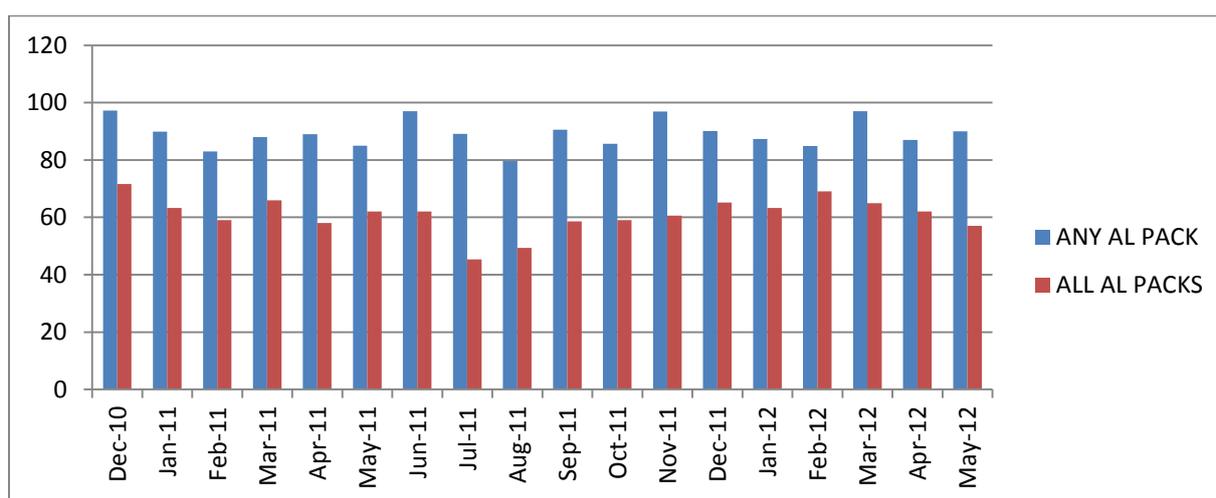


Table 5: Estimated number of patients receiving AL using LMIS

Total no. of patients receiving AL from Dec 2010 to May 2012 (18 months) (a)	Adjusted number of patients receiving AL in 12 months (b)	Average total stock out rate (c)	Projected number of patient receiving AL, adjusted for stock out (d)
15,490,928	10,327,286	11.7%	11,695,680

- a. Obtained from LMIS data over the period December 2010 to May 2012. This figure is adjusted for reporting rates in each month over the period.
- b. Calculated as (a)/18 *12 to get the estimated number of patients receiving AL in one year
- c. Based on data collected through biannual Quality of care surveys conducted in March 2012 and April 2012, and subsequent post survey phone calls, which showed on average a total stock out of AL of 11.7% in public health facilities. The F&Q team therefore assumed that 11.7% patients were not treated, as a result not captured by the LMIS.
- d. Refers to the total number of patients on AL per year, adjusted for stock outs (b/88.3*100).

4.2.1.3: Morbidity data as reported by the Demographic and Health information system (DHIS)

The DHIS data provides the number of all malaria cases that have been treated countrywide, regardless of whether diagnosis had been confirmed or not. In the recent past, a lot of efforts have been put in place to ensure reliable morbidity data reaches the central database. This has included the roll out of an IT based platform at district level, from where all data is entered. For the period under review, the facility reporting rates for patients diagnosed with Malaria in the DHIS was 75.9% and 75.4% for patients under five years and over five years old respectively. The Drug management subcommittee concluded that the data generated from the DHIS offered reliable data with which to make comparisons with other data sources for the purposes of this quantification.

Table 6 below shows the estimated number of malaria cases in the country, with the appropriate adjustments made.

Table 6: DHIS Morbidity Statistics

DHIS Morbidity Data			
Malaria cases	Under fives	Over fives	Totals
Clinical	3,498,885	4,941,268	8,440,153
Confirmed	993,958	1,687,331	2,681,289
	4,492,843	6,628,599	11,121,442
Reporting rates	75.9	75.4	75.7
Corrected for reporting rates	5,919,424	8,791,245	14,710,669

4.2.1.4: The detailed AL Gap analysis and forecast for 2011-2016

During the Global fund round 10 grant application, in 2010, a detailed gap analysis was prepared, and a forecast generated up to 2016 (see annex 1) In this forecast, it was assumed that:

- The population would grow by 2.8% annually as estimated by the Kenya National Bureau of statistics.
- The National target coverage of malaria cases would rise from 65% to 75%.
- There would be a reduction of malaria cases by 20% due to increased net coverage.
- There would be an increase in the availability of diagnostics to 30%, up from 25% 2011 level. Malaria positivity rates were estimated at 50% with a compliance of 60% to test results up from 50% 2011 estimate.
- 80% of all malaria cases would be seen in public health facilities, with the rest being seen in the private and community levels.

The gap analysis and forecast made estimated that, for the year 2012, the ACTs requirements would be 16,722,731 doses.

The Drug management sub-committee considered the estimated annual consumption of ACTs derived using the various methods. The figure below shows the comparison of estimated consumption arrived at using the various methods.

Table 7: Graph comparing all the estimates from the 4 assumption methods

Four Assumptions comparison		
METHOD	Quantity AL	Reporting Rate
Adjusted AL Consumption	12,384,276	51%
Adjusted patients on AL	11,695,680	51%
Malaria cases DHIS	14,710,669	75.60%
Gap analysis from GFR10	16,722,731	N/A

After careful consideration the committee decided to use the figures reported in the DHIS system. This is in light of the high reporting rates from this system. Besides, the figures from all the four methods compared well with each other. Thus it was concluded that the most reliable estimate for malaria cases in 2012 was **14,710,669** cases.

4.2.2 FORECASTING FOR THE YEAR 2012-2013

Starting with an estimated requirement of 14,710,669 for the period 2011-2012, the committee made several assumptions and made a forecast of the 2012-2013 ACTs requirements:

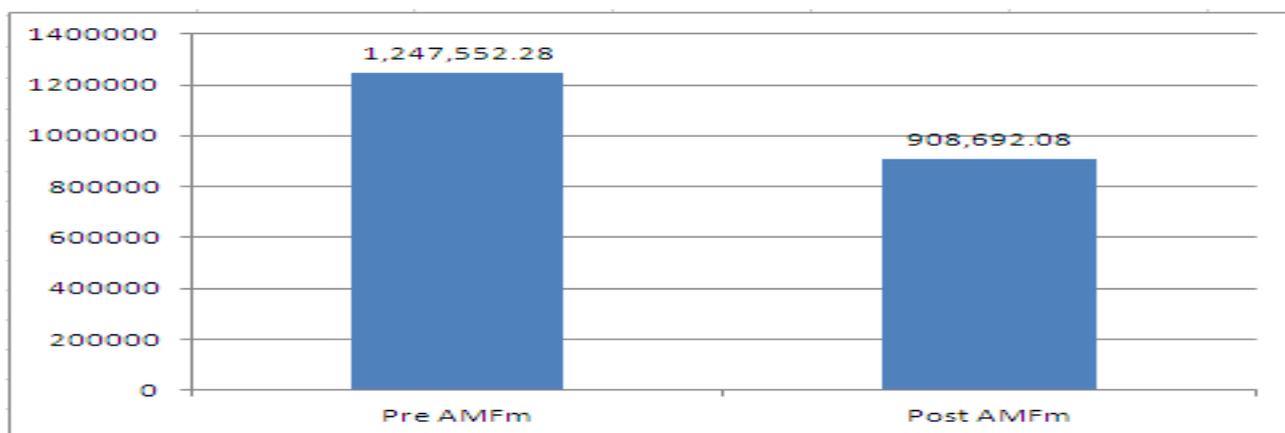
4.2.2.1 Assumptions

- 1) The population will grow at 2.8%, based on the Kenya National Bureau of Statistics
- 2) The decrease in malaria incidence due to universal coverage with vector control interventions (Long lasting Insecticide treated Nets) is estimated at 30%. However, a recent study conducted after the post mass LLIN distribution in the country showed that only 37% of the people with LLINs used them consistently. This was taken into account as well, reducing the extent to which nets coverage decreased malaria incidences.
- 3) The current coverage of the country's health facilities with malaria diagnostics stands at 36.80% (quality of care survey). With the planned roll out of RDTs in the country, it is

estimated that this will rise to 72.80% in the first year and 82.80% in the second year. A test positivity rate of 50% and a test result compliance rate of 50%, up from 40% currently reported (insert reference QoC R3) are applied to determine the extent to which RDTs roll out will decrease the ACTs required in the public sector. In subsequent years, we increase the compliance rate by 10% in each year as a result of targeted health worker trainings and advocacy towards adherence to treatment guidelines.

- 4) Kenya was one of the countries in which the AMFm project was piloted. This initiative increased the access of high quality ACTs in the private sector. An analysis done during the previous quantification exercise showed a 27% decrease in the consumption of ACTs in the public sector, after the introduction of AMFm.

Figure 4: Average number of patients seen 6 months before and after AMFm Implementation.



We estimate that with the likely phase out of the AMFm, there will be a reversal of this trend. We estimate that 50% of these (14%) patients will revert to seeking care in public health facilities. An adjustment was therefore made to capture the expected increase in malaria case compared to 2012 figures.

Based on this, the following template was obtained for calculation of the total patients requiring AL based on DHIS data, (See table 8 below)

4.3: RESULTS:

Table 8: Forecasted malaria cases for the period July 2012 – June 2013

AL	Weight bands	Ratio	Number of doses	Adjustment for population growth(2.8%)	Reduction due to universal net coverage (30%) adjusted for net use (37%)	Reduction due to increase in diagnostics (72.8%) adjusted for 50% compliance and 50% positivity rate	Increase due to reversal of care seeking behaviour after AMFm phase out	Estimated requirements for 2012 - 2013	Six Months buffer stock	Total doses required
Assumptions		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
AL 6s	5 - 14 kgs	32.80%	4,825,099	4,960,202	550,582	902,757	490,961	3,997,824	1,998,912	5,996,736
AL 12s	18 - 20 kgs	18.20%	2,677,342	2,752,307	305,506	500,920	272,423	2,218,305	1,109,152	3,327,457
AL 18s	25 - 34 kgs	8.90%	1,309,250	1,345,909	149,396	244,955	133,218	1,084,775	542,388	1,627,163
AL 24s	35+ kgs	40.10%	5,898,978	6,064,150	673,121	1,103,675	600,230	4,887,583	2,443,792	7,331,375
Total		100.00%	14,710,669	15,122,568	1,678,605	2,752,307	1,496,832	12,188,487	6,094,244	18,282,731

Notes to the table:

- (a) Patient ratios for each weight band obtained from LMIS data over a 18 month period
- (b) Number of doses required, for the period 2011/2012 as per DHIS data.
- (c) ACTs requirements after adjusting for a 2.8% population growth.
- (d) = $c \times 0.3 \times 0.3$ Adjusting the figures in column (c) for reduction of malaria cases due to net use.
- (e) = $d \times 0.728 \times 0.5 \times 0.5$ adjusting the figures in column d for the effects of introducing diagnostics in a large scale in Kenya.
- (f) = $(c-d-e) \times 0.14$ computing the increase of patients seeking care in public health facilities after AMFm
- (g) = $(c-d-e) + f$.
- (h) = $g/12 \times 6$ getting the 6 months buffer stocks
- (i) = $g + h$

Therefore, the total doses required in the country, for the FY 2012/2013 to meet consumption needs and to maintain a full pipeline at the central level is 18,282,731 doses of AL.

4.3.1: Two year forecast of ACTs consumption.

For the two year forecast of AL requirements, the above assumptions were also put into consideration, but the patient numbers were assumed to decrease due to the various adjustments made in the methodology above.

Hence the assumed malaria cases for 2013 – 2015, were taken from this data.

Table 9: Forecast of AL requirements from 2012- 2015

Assumptions from DHIS Data						
Period	Previous year's Malaria cases (Assumption A)	Adjustment for population growth 2.8%(Assumption B)	Reduction due to universal net coverage (30%) adjusted for net use (37%)	Reduction due to increase in diagnostics (72.8%) adjusted for 50% compliance and 50% positivity rate	Increase due to reversal of care seeking behaviour after AmFM phase out	Estimated requirement for preceeding year
2012 - 2013	14,710,669	15,122,568	1,678,605	2,752,307	1,496,832	12,188,487
2013 - 2014	12,188,487	12,529,765	1,390,804	2,280,417	1,240,196	10,098,740
2014 - 2015	10,098,740	10,381,505	1,152,347	1,889,434	1,027,561	8,367,285

Due to the above assumptions, the quantities of ACTs required for 2013 – 2015 will be as shown below:

Table 10: AL Requirements FY 2013 – 2014

AL 2013 - 2014					
	Weight band	Ratio	Number of doses required	Six months buffer stock	Total doses required
AL 6s	5-14 kg	32.80%	3,312,387	1,656,193	4,968,580
AL 12s	15-25 kg	18.20%	1,837,971	918,985	2,756,956
AL 18s	25-34 kg	8.90%	898,788	449,394	1,348,182
AL 24s	35+kg	40.10%	4,049,595	2,024,797	6,074,392
Total		100%	10,098,740	5,049,370	15,148,110

Table 11: AL Requirements FY 2014 – 2015

AL 2014 - 2015					
	Weight band	Ratio	Number of doses required	Six months buffer stock	Total doses required
AL 6s	5-14 kg	32.80%	2,744,469	1,372,235	4,116,704
AL 12s	15-25 kg	18.20%	1,522,846	761,423	2,284,269
AL 18s	25-34 kg	8.90%	744,688	372,344	1,117,033
AL 24s	35+kg	40.10%	3,355,281	1,677,641	5,032,922
Total		100%	8,367,285	4,183,643	12,550,928

4.3.2: STOCK SITUATION AND SUPPLY PLANNING FOR AL**Table 12: Situational Analysis of AL as at 30th July 2012**

Situational Analysis AL								
Product	Forecast quantities (FY 2012 - 2013)	AMC	Stock at KEMSA	MOS Kemsas	Order PMI	Order GF	Total Qty in Pipeline	Months of stock pipeline
AL 6s	5,996,736	499,728	3,603,440	7	891,780	3,922,083	4,813,863	10
AL 12s	3,327,457	277,288	661,780	2	494,820	2,176,278	2,671,098	10
AL 18s	1,627,163	135,597	245,380	2	241,976	1,064,224	1,306,200	10
AL 24s	7,331,375	610,948	2,199,088	4	1,090,252	4,794,985	5,885,237	10

Delivery Schedule for AL for the FY 2012 – 2013

All AL except the AL 6s are below the recommended six months of stock therefore delivery of the first 50%

The second 50% should be staggered with the first 25% expected in three months, and the remaining 25% after six months.

Recommendations

A Review of this report and data will be done by the DSMSC after six months, so as to factor in trends, and current situations that may affect the malaria commodities within the forth coming year.

As per the trend for FY 2013 – 2014 and 2014 – 2015, the amounts of ACTs required in the country will be less due to the interventions that have been put in place.

5.0 Sulphadoxine-pyrimethamine (SP)

5.1 Treatment regimen

The current recommended medicine for IPTp is SP tablets (500mg Sulfadoxine + 25mg Pyrimethamine) given as a dose of three tablets upon presentation of the patient in an Antenatal care clinic. It is administered as three or four doses, each a month apart, after quickening to ensure protection against malaria.

The morbidity-based method combined with demographic estimates was used for quantification of SP for endemic regions only.

5.2 Methodology

From the quantification exercise of July 2011, it was found that LMIS consumption data was inaccurate and could not be used for quantification purposes. This was because after analyzing the data from September 2009 – February 2011, it was found that there was no standard dosage form used to collect the consumption data as both tablets and tins of 1000s were being used. Furthermore, SP is still used for treatment of uncomplicated malaria in some facilities making it difficult to establish the 'real' consumption.

To correct this error in reporting, the DOMC revised the health facility monthly summary report to capture the number of women receiving IPTp so as to make a comparison between patients receiving IPTp and tablets consumed.

Quantification of SP was therefore carried out using Malaria In pregnancy cases found in the DHIS.

5.3 Specific assumptions

1. The amount of Malaria in pregnancy witnessed was 129,184 cases
2. This amount was adjusted for reporting rate bringing the total estimated cases to be 171,332 cases. (See table 6)
3. Each pregnant woman will receive a total of 4 doses, each 1 month apart after quickening (National Malaria STGs, 2010).

5.4 RESULTS

1. *The total number of pregnant women with Malaria adjusted from the DHIS is 171,332.*
2. *The National Malaria Treatment Policy targets four doses of SP (IPT4) to be given to pregnant women during the attendance of ANC clinics in endemic areas.*

The DSMSC used four doses for computation.

Therefore the number of tablets required is:

$$171,332 \times 3 \text{ tablets} \times 4 \text{ doses} = 2,055,984 \text{ tablets}$$

3. *SP for the public sector in Kenya is usually packed in tins of 1,000 tablets; therefore, rounding off to the nearest thousand, the total quantity required will be 2,056 tins.*
4. *6 months' buffer stock for the central level is obtained by multiplying the AMC by 6 months, i.e. Buffer stock = $2,056 \times 6/12 = 1,030$ tins.*

Hence the total requirement for SP = $(2,056 + 1,030) = \mathbf{3086 \text{ tins}}$

The total quantity required for SP for FY12/13 are 3086 Tins of 1000's, however the country is overstocked with SP in the central stores, with over 5 years of stock on hand in KEMSA.

Recommendation: No procurement of SP is required in the current financial year. Close monitoring of movement of existing stocks at KEMSA is required to determine future procurements.

6.0 DIHYDROARTEMESININ PIPERAQUINE (DHAP)

6.1 Treatment Regimen

The recommended second line treatment for uncomplicated malaria in Kenya is Dihydroartemisinin-piperaquine (DHAP). This is currently available as a fixed-dose combination with adult tablets containing 40 mg of dihydroartemisinin and 320 mg of piperaquine, and paediatric tablets containing 20mg dihydroartemisinin and 160mg of piperaquine. It is administered once daily for three days at a dose of 4 mg/kg/day dihydroartemisinin and 18 mg/kg/day for piperaquine, with a therapeutic dose range between 2–10 mg/kg/day of dihydroartemisinin and 16–26 mg/kg/day of piperaquine.

6.2 Methodology

In determining the quantity of DHAP required, it is assumed that the number of treatment failures will be 5% of uncomplicated cases given the 95% efficacy of AL. The number of tablets required per day was determined by computing the median patient weight (for each of the four weight bands) multiplied by the median dose of piperaquine required to achieve therapeutic efficacy (21 mg/kg/dose) and divided by the quantity of piperaquine per tablet (160 mg for the pediatric and 320 mg for the adult tablet). For each of the computed doses, the dosing for Dihydroartemisinin was checked to ensure that it is within the therapeutic dose range (2-10 mg/kg/dose).

6.3 Results

Table 13: Projected requirements for DHAP tablets

QUANTIFICATION OF DIHYDROARTEMESININ/ PIPERAQUINE													
Weight category	Median weight	Ratio of patients seen (%)	Number of doses of AL required	Patients expected to require 2nd line treatment	Number of DHAP tablets per dose	Number of tablets per dose rounded off to nearest tablet	Number of tablets per day	Number of tablets for whole 3 days course	To the nearest tablet	Total number of tablets required	6months Buffer stock	Total Requirements	Packs
160 mg Tablets													
5-14 kgs	10.00	32.80	4,825,099	241,255	1.31	1.50	1.50	4.50	5.00	1,206,274.75	603,137.38	1,809,412.13	603,137
15-25 Kgs	20.00	18.20	2,677,342	133,867	2.63	3.00	3.00	9.00	9.00	1,204,803.90	602,401.95	1,807,205.85	602,402
				375,122								3,616,617.98	1,205,539
320 mg Tablets													
25-34 Kgs	30.00	8.90	1,309,250	65,463	1.97	2.00	2.00	6.00	6.00	392,775.00	196,387.50	589,162.50	196,388
35+ Kgs	60.00	40.10	5,898,978	294,949	3.94	4.00	4.00	12.00	12.00	3,539,386.80	1,769,693.40	5,309,080.20	1,769,693
Total			14,710,669	360,411								5,898,242.70	1,966,081
Total Number of packs													3,171,620

The total number of DHAP tablets required for FY 12/13 including buffer stock is:

- **1,205,539 of 160mg packs of 3 tabs**
- **1,966,081 of the 320 mg packs 3 tabs**

Computation of doses based on packaging needs to be done as the pack size is different per manufacturer, though the normal standard used in 3 Tabs per pack, which is what was used to calculate the packs in table 8 above.

7.0 QUANTIFICATION FOR SEVERE MALARIA

The DSMSC utilised Quinine injection consumption data collected from December 2010 to May 2012 as the basis for the consumption-based quantification of medicines for severe malaria because it was found to be fairly accurate. There are currently three options for the treatment of severe malaria: Quinine, Artesunate and Artemether. New evidence suggests that Artesunate, when used to treat severe malaria, is more effective and leads to reduced mortality from malaria³.

In light of this evidence, the committee quantified for the country's needs for Quinine and Artesunate only for the treatment of the population with severe malaria.

Quinine is procured by KEMSA through government funding and is routinely distributed to all public health facilities.

Artesunate was normally procured through donor funding for epidemic response preparedness, but this will change during the FY 2012 – 2013, as the treatment protocol is expected to change from quinine to Artesunate for the treatment of severe malaria.

7.1 Assumptions

- The weight band ratios for uncomplicated malaria were assumed to also apply for severe malaria.
- Parenteral therapy is given for an average of 3 days
- The average continuation phase for all severe malaria cases is 4 days.
- Once an ampoule is opened, it will be discarded after the first dose is administered
- Quinine and Artesunate will be quantified exclusive of each other because Artesunate is expected to substitute Quinine under the new WHO recommendations. The F&Q team decided to determine what the country would require if either of the two were used for case management.
- Needles, syringes, gloves and other medical commodities required for parenteral administration of antimalarial injections are not included in this quantification. It is assumed that these will be quantified alongside other non pharmaceuticals.

³ Dondorp AM, Fanello CI, Hendriksen IC, Gomes E, Seni A, et al, Artesunate versus quinine in the treatment of severe falciparum malaria in African children (AQUAMAT): an open-label, randomised trial. *Lancet*. 2010 Nov 13; 376(9753):1647-57. E pub 2010 Nov 7.

7.2 Quinine Di-hydrochloride injection

7.2.1 Treatment regimen

Quinine dihydrochloride is indicated for the management of severe malaria and is administered parentally (IV/ IM). In both adults and children, a loading dose of 20 mg per kg is given followed by maintenance dose of 10mg/kg (max 600mg) every 8 hours, until the patient can take oral medication.

7.2.2 Methodology

To quantify the country's requirements of quinine injection, we used consumption data from the LMIS.

The consumption of quinine ampoules (300mg/ml, 2ml ampoules) reported from the LMIS was adjusted for both stock outs and the average reporting rates over the 18 months. Six months of buffer stock was then added to determine the total requirements for the year.

7.2.3: Results

Table 14: Projected doses of Quinine injection ampoules

Total adjusted aggregated consumption of quinine ampoules (18 months) (a)	Annual consumption (b)	six months buffer stock (C)	Total Requirements (d)
2,983,547	1,989,032	994,516	2,983,547

Footnotes for Table 14:

- Total quantity of quinine injection consumed over 18 months period obtained from LMIS data and adjusted for stock-outs and reporting rates.
- Annual consumption computed as (a) / 18 x 12
- Six months of buffer stock computed as (b) X 6/12
- Total estimated country requirements: (d) = (b) + (c)

7.3 Quinine sulphate tablets

7.3.1 Treatment regimen

Quinine sulphate (available as 300mg tablets) is indicated for the continuation phase in the management of severe malaria. In both adults and children, quinine tablets are administered at a dose of 10 mg/kg every 8 hrs (up to a maximum of 600mg daily) to complete 7 days of quinine therapy.

7.3.2 Methodology for quinine sulphate tablets

The consumption data for quinine tablets from the LMIS was found to be unreliable due to use of varied units of issue for reporting (some facilities reported consumption in tins of 1000 tablets while others reported in unit tablets) resulting in inaccurate data.

Therefore, the Quinine Injection consumption was used to derive the expected number of severe malaria cases for the continuation phase – disaggregated by weight band using the ratios previously determined under section 3.1.

This was followed by a computation of the total number of quinine tablets required per weight band assuming a total of four days of oral therapy. The number of severe malaria patient cases estimated by this method was also used in the estimation of requirements for Artemether as well as Artesunate (IV and Rectal).

7.3.3 Results

Table 15: Projected quantities of Quinine Tablets

Weight band category	Ratio	Median weight	Total Estimated annual consumption (ampoules)	Number of cases	Tablets per dose	Total Number of tablets required per case	Quantity required of quinine tablets	Total quantity (including six months buffer stock)
(a)		(b)	(c)	(d)			(e)	(f)
5 - 15kgs	32.80%	10	652,390	108,732	0.5	6	652,390	978,585
15 - 25 kgs	18.20%	20	361,943	60,324	1	12	723,886	1,085,830
25 - 34 kgs	8.90%	30	176,600	19,622	1	12	235,467	353,201
Above 35 kgs	40.10%	60	798,099	79,810	2	24	1,915,437	2,873,156
Total	100.00%		1,989,032				3,527,180	5,290,770

Footnotes for Table 15:

- (a) Weight bands
- (b) Median weight for each weight band
- (c) The total estimated annual consumption of quinine injection based on the ratios per weight band and the respective expected number of ampoules per patient.
- (d) The total number of cases of severe malaria, computed from the average number of ampoules per patient as per recommended dosing schedule. It was assumed that each ampoule was used only once and discarded.
- (e) Total number of tablets required to treat patients as per recommended dosing schedule.
 - a. 5-15kg: were assumed to be taking half a tablet per dose
 - b. 15-25kg and 25-35kg: were assumed to be taking one tablet per dose
 - c. ≥35kg: were assumed to be taking 2 tablets per dose
- (f) The number of tablets in (e) plus six months of buffer stock.

7.4 Artesunate injection

Artesunate can also be used for severe treatment of malaria since it is able to rapidly reduce the parasite load. The administration of Artesunate injection (IM and IV) is easier compared to quinine and therefore easier to use in health facilities without the capacity for IV treatment.

7.4.1 Treatment regimen

Artesunate is administered by the IM/IV route at 2.4 mg/kg to start, then 2.4 mg/kg at 12 hours, 24 hours, and 48 hours. After that it is assumed all patients will be able to tolerate oral medicine.

7.4.2: Methodology

Refer to 7.3.2 above.

7.4.3 Results

Table 16: Requirements of Artesunate 60mg/amp injection ampoules

Weight band (kg)	Median weight	Projected number of severe malaria cases	Number of amps per patient	Total amps	6 Months Buffer stock	Total
(a)	(b)	(c)	(d)	(e)	(f)	(g)
4-14 kgs	10	108,732	4	434,926	217,463	652,390
15-25 kgs	20	60,324	4	241,295	120,648	361,943
25-35 kgs	30	19,622	8	156,978	78,489	235,467
Above 35 kg	60	79,810	12	957,719	478,859	1,436,578
		268,488		1,790,919	895,459	2,686,378

Footnotes for Table 16:

- (a) Patient category per weight band.
- (b) Median weight per weight category
- (c) Projected number of severe malaria cases computed from quinine injection consumption figures (Table 14, column d).
- (d) Number of ampoules per patient per dose computed as per the recommended dosing schedule.
- (e) Total number of ampoules required to treat a patient as per the recommended dosing schedule assuming that the patients are able to take oral medication after 48 hours.
- (f) (CxE) giving the total number of ampoules required.
- (g) Total country requirement after adding six months of Buffer stock

7.5 Rectal Artesunate

In the absence of quinine injection, the guidelines also recommend that rectal Artesunate can be used to initiate treatment in cases of severe malaria.

7.5.1 Treatment regimen

It is administered at a dose of 10mg/kg. A second dose may be given after 24 hours if the patient is unable to access parenteral therapy.

7.5.2: Methodology

Refer to 7.3.2 above.

7.5.3 Specific Assumptions

- The number of patients requiring pre-referral treatment are estimated by the DOMC at 50% of all severe malaria cases
- Rectal Artesunate capsules will be used for pre referral treatment in children under 25 kgs.
- The 50mg capsule will be used for 5-15kg patients while the 200mg capsule will be used for 15-25 kg patients.
- Each child will receive two doses of the rectal Artesunate.

7.5.4 Results

Table 17: Requirements of rectal Artesunate for pre-referral care

Weight band (kg)	Median weight	Projected number of severe malaria cases	patients requiring pre-referral treatment	Capsules per dose	Total per patient	Total annual capsules required	Total
(a)	(b)	(C)	(d)	(e)	(f)	(g)	(h)
50mg/cap formulation							
5-15kg	10	108,732	54,366	2	4	217,463	326,195
200mg/cap formulation							
15-25kg	20	60,324	30,162	1	2	60,324	90,486

Footnotes for Table 17:

- (a) Refers to the various weight categories
- (b) Refers to the median weight for each weight category
- (c) Estimated number of severe malaria cases per weight category, computed from quinine injection consumption figures (Table 13, column d)
- (d) The number of patients requiring pre-referral treatment (estimated by the DOMC at 50% of all severe malaria cases).
- (e) Refers to the number of capsules required per dose for a patient within the weight category.
- (f) Refers to the total quantity of Artesunate capsules required per patient
- (g) The total country requirements per year.
- (h) The total country requirements after adding six months buffer stock.

8.0 MALARIA RAPID DIAGNOSTICS TESTS (RDTs)

8.1 Specific assumptions

- The initial estimated cases were obtained from the DHIS morbidity statistics data, under the assumption that these were the unconfirmed malaria cases in the year 2011 – 2012, i.e. patients treated for Malaria but without any diagnostic testing done on them.
- These initial estimated cases were then adjusted by 2.8% to represent population growth, received from the Kenya National Bureau of Statistics website.
- 30% reduction adjustment was done to cater for a decrease in exposure due to universal net coverage.
- 37% reduction adjustment was done to cater for a decrease in exposure due to actual net use; this was obtained from the latest post mass distribution survey.
- Diagnostic coverage by microscopy over the next 3 years will increase from the current 30% to 50% by 2015.

8.2 Methodology

For the quantification for RDTs for FY 2012/ 2013, the morbidity statistics from the DHIS system was used as there was an average of 75% reporting rate, which was not the case last year where quantification for RDTs was based on the Global Fund Round 10 proposal developed by the DOMC.

The above assumptions were put in place and a similar methodology to that of acquiring the amounts of AL required was adopted.

The quantities were then adopted for the financial years of 2012 – 2015, as shown on Table 18 below.

8.3: Results

Table 18: RDT FORECAST AND QUANTIFICATION

PERIOD	Nos of unconfirmed malaria cases by DHIS data	Adjustment for population growth	Adjustment of net coverage (30%) and adjustment for net use (37%)	Estimate patients after Net adjustment	RDT coverage	Total RDTs due to increase in RDT coverage
	(a)	(b)	(c)	(d)	(e)	(f)
2012 -2013	11,193,837	11,507,264	1,277,306	10,229,958	30%	10,229,958
2013 -2014	10,229,958	10,516,397	1,167,320	9,349,077	40%	10,283,985
2014 -2015	9,349,077	9,610,851	1,066,804	8,544,047	50%	9,398,451

Footnotes for table 18

- a) The number of unconfirmed malaria cases derived from DHIS data.
- b) 2.8 % adjustment for population growth
- c) Adjustment for net coverage and net use (30# and 37% respectively)
- d) a – c
- e) Target increases in RDT coverage
- f) Total RDTs required for each Financial year.

9.0 RECOMMENDATIONS

Recommendations for the DOMC

Immediate

- Based on the proposed call down schedules, initiate the call-down of 50% of GFATM immediately to avert a stock out.
- Initiate the procurement of RDT for year 2 considering the lead time of one year from the previous procurement cycle.
- Based on the fact that KEMSA is overstocked with Sulphadoxine/Pyrimethamine (SP) tablets, the DOMC should communicate with KEMSA, via the Department of Pharmacy, to ensure that no further SP is procured for the public sector for the present financial year.
- The current quinine stock should be utilized and no more should be purchased this year due to the change in policy to Artesunate injection for the treatment of severe malaria.
- Continue to monitor the stock situation on a monthly basis to enable prompt response to emerging issues.
- There is gap in the stocks of artesunate, there is need to mobilize resources for the procurement of artesunate injection, due to the change in protocol for the management of severe malaria.

Medium term

- There should be a fallback plan to allow for direct procurement of antimalarials, when delays in the regular procurement process are eminent.
- The government of Kenya should increase funding for first line antimalarials
- There should be regular monitoring of the procurement process as well as management of the contracts.
- The Drug supply Management sub-committee should have a six month review of this quantification exercise due to changing trends.
- The Drug Supply Management Sub-Committee should continue to play their role in the facilitation of all urgent and system issues that are within their scope of responsibilities to improve management of malaria medicines.

- The supportive supervision role of health facilities by District Pharmaceutical Facilitators and Malaria focal persons should be strengthened to allow for improved inventory management and continuous flow of timely and accurate consumption data for decision making.
- The Logistics Management Information system for malaria medicines should be strengthened to ensure increased reporting rates as well as improved data quality.
- Findings from the Bi-annual Pharmaceutical Management of Malaria Medicines assessments/ Quality of care surveys that seek to establish the status of pharmaceutical indicators should be utilised to provide input into the annual quantification exercise.
- Continuous monitoring of the stock situation in the country is a key to timely identification and stop gaps intervention as well improving access to treatment for malaria.

10.0 LIMITATIONS OF THE QUANTIFICATION PROCESS

- The DSMSC also acknowledge that the reporting rates from facilities need to increase in order that the quantification gives more precise reports. The committee is working with all the relevant stakeholders to ensure measures are put in place to realise improved data quality and reporting rates.

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APPENDICES

Appendix 1: Detailed AL Gap analysis and forecast for 2011-2016

	2011	2012	2013	2014	2015	2016
Consumption data (a)	18,248,515	18,759,474	19,284,739	19,824,712	20,379,804	20,950,438
Total number of malaria cases extrapolated from consumption data (b)	37,241,868	38,284,640	39,356,610	40,458,595	41,591,436	42,755,996
Target coverage						
National target coverage of malaria cases % (c)	65.0%	75.0%	77.5%	82.5%	82.5%	82.5%
Target coverage by sector (d-f)						
Health Facility	54	60	60	65	65	65
Community Case Management	1	5	7.5	7.5	7.5	7.5
Private Sector	10	10	10	10	10	10
Number of treatments required (g)						
Health Facility	20,110,609	22,970,784	23,613,966	26,298,087	27,034,433	27,791,397
Community Case Management	372,419	1,914,232	2,951,746	3,034,395	3,119,358	3,206,700
Private Sector	3,724,187	3,828,464	3,935,661	4,045,860	4,159,144	4,275,600
Total	24,207,214	28,713,480	30,501,373	33,378,341	34,312,935	35,273,697
Factor in decreasing consumption with vector control (h)						
No of malaria cases reduced with vector control	2,420,721	5,742,696	9,150,412	10,013,502	10,293,880	10,582,109
Total Number of treatment after subtracting number reduced vector control	21,786,493	22,970,784	21,350,961	23,364,839	24,019,054	24,691,588
Factor in decreasing consumption with increasing diagnosis (i)						
Percentage diagnosis	25%	30%	45%	60%	70%	80%
Percentage positive tests (.5)	50%	50%	50%	50%	50%	50%
Correcting for compliance	50%	60%	70%	90%	90%	95%
No of malaria cases reduced with increasing diagnosis	1,361,656	2,067,371	3,362,776	6,308,506	7,566,002	9,382,803
Total Number of treatment after subtracting number reduced due to increasing diagnosis	20,424,837	20,903,414	17,988,185	17,056,332	16,453,052	15,308,784
Proportion of malaria cases by sector (j)						
Health Facility	83%	80%	77%	79%	79%	79%
Community Case Management	2%	7%	10%	9%	9%	9%
Private Sector	15%	13%	13%	12%	12%	12%
Number of malaria cases by sector						
Health Facility	16,968,326	16,722,731	13,926,336	13,438,322	12,963,011	12,061,466
Community Case Management	314,228	1,393,561	1,740,792	1,550,576	1,495,732	1,391,708
Private Sector	3,142,283	2,787,122	2,321,056	2,067,434	1,994,309	1,855,610