USAID | DELIVER PROJECT

Technical Report

CAMBODIA: Malaria Commodities Quantification 2016-2017

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Technical Report

CAMBODIA: Malaria Commodities Quantification 2016-2017

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USAID | DELIVER PROJECT, Task Order 7
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Abstract
In September 2015, the Cambodia Ministry of Health (MOH), with technical assistance from the USAID | DELIVER PROJECT, Task Order 7, conducted a national Malaria Commodities Quantification Workshop to prepare a two year forecast and supply plan of the total commodity and funding needs for 2016 and 2017. The technical assistance included the use of different forecasting methodologies for estimating commodity requirements, and training of staff from the National Center for Parasitology, Entomology and Malaria Control (CNM) in *PipeLine*, a supply planning software tool.

Cover photo: CNM, Phnom Penh, Cambodia, 2015, metal sculpture of Anopheles Mosquito. Photo by Laila Akhlaghi.

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Acronyms

ACT	artemisinin-based combination therapy
AMC	average monthly consumption
API	Annual Parasite Incidence
AS	artesunate
ASMQ	artesunate plus mefloquine
CAP Malaria	Control and Prevention of Malaria
CDC	U.S. Centers for Disease Control and Prevention
CHAI	Clinton Health Access Initiative
CMS	Central Medical Stores
CNM	National Center for Parasitology, Entomology and Malaria Control
DDF	Department of Drugs and Food
DMDM	Drug and Medical Devices Management for Health Center Level
DHA-PPQ	dihydroartemisinin plus piperaquine
G6PD	glucose-6-phosphate dehydrogenase
GF	Global Fund
LMIS	logistics management information system
LMU	logistics management unit
MEAF	Malaria Elimination Action Framework
MIS	Malaria Information System
MOH	Ministry of Health
MOS	months of stock
MSF	Mèdicins Sans Frontières
NFM	New Funding Model
NGO	non-governmental organization
NTGs	national treatment guidelines
OD	Operational District
Pf	Plasmodium falciparum
Pf/Pv	Plasmodium falciparum and Plasmodium vivax
PHFs	public health facilities
PMI	President's Malaria Initiative

PPM	public private mix
PQ	primaquine
PR	Principal Recipient (Global Fund)
PSI	Population Services International
PSK	Population Services International affiliate in Cambodia
Pv	Plasmodium vivax
RDT	rapid diagnostic test
SD	Standard Diagnostics, Inc.
SDP	service delivery point
SOH	stock on hand
UNOPS	United Nations Office for Project Services
USAID	United States Agency for International Development
VMW	village malaria worker
WHO	World Health Organization

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We would like to recognize and thank all the partners who participated in the workshop including the Population Services International affiliate in Cambodia (PSK), the World Health Organization (WHO), University Research Corporation (URC)/Control and Prevention of Malaria (CAP Malaria) Project, the Clinton Health Access Initiative(CHAI), the Malaria Consortium, the United Nations Office for Project Services (UNOPS), and other Ministry of Health representatives for their technical input, and to the visiting team from the Myanmar national malaria program for sharing their experiences.

We would also like to thank USAID | DELIVER PROEJCT staff Kinsy Hood and Claudia Allers for their guidance and facilitation for a successful workshop, and Chris Warren, senior technical advisor, for his technical contributions during the workshop.

Finally, we would like to express our thanks to the USAID Cambodia Mission, specifically Rida Slot, Project Management Specialist, and Christina Lau, Infectious Disease Team Leader, and the U.S. President's Malaria Initiative (PMI) who provided guidance and funding for this activity.

Overview

Although considerable progress has been made in malaria control in the Greater Mekong Sub-Region (GMS) during the past 10 years, malaria remains a major concern for the international community and ministries of health in the region. This is due primarily to the development and possible spread of resistance to artemisinin drugs, the principal component of the combination therapies for malaria that now are the first-line treatment for malaria throughout the GMS and the world.

PMI supports anti-malaria efforts in the GMS (Burma, Cambodia, Laos, and Thailand) with the goal of limiting the spread of multidrug resistant malaria and addressing other common challenges to further reduce malaria morbidity and mortality. By promoting antimalarial drug resistance surveillance networks, regional cooperation, and capacity-building in NMCPs, PMI aims to limit the spread of multidrug resistant malaria in the region and beyond.

The USAID | DELIVER PROJECT contributes to this support through the procurement of malaria prevention, diagnostic and treatment supplies, and strengthening the in-country systems that manage them. Project activities are organized around improving system performance and visibility to ensure that malaria products are available when and where they are needed, to strengthen in-country supply chains, to bridge the gap between NMCPs and supply chain operators and build local capacity to sustain system performance.

The project has been supporting the National Center for Parasitology, Entomology and Malaria Control (CNM) in forecasting and supply planning for malaria products, including artemisinin-based combination therapies (ACTs), on an ad hoc basis since 2013 when a Regional Logistics Advisor was placed in Phnom Penh. However, engagement for this activity has been limited to a few key people within CNM. The project in Cambodia has been raising the visibility of this work to further build capacity in quantification and promote country ownership of the process.

In response to requests from the Global Fund (GF) during the development of the New Funding Model (NFM), partners within the country developed quantifications of malaria commodity needs separately from, and in addition to, those supported by the CNM. These quantifications, leveraging different datasets and with different objectives, used different approaches, assumptions, and tools, and ultimately, produced different results.

This has resulted in different types of quantifications – one based on program targets that highlights where the program would like to be in the coming years, that does not take into account the actual number of patients tested and treated, the actual quantities of products dispensed to patients (consumption), or the current stock on hand in the country – versus other quantifications that try to estimate the commodity requirements based on current and expected program performance for shorter term procurement purposes. A standardized approach and quantification methodology, with ongoing data sharing and coordination among partners, is needed to ensure a continuous and coordinated supply of commodities for the country.

Moving forward, it is critical for all stakeholders to work together to review, revise, and harmonize one national quantification for the country. The quantification should be informed by inputs from all partners on malaria program plans, commodity needs, funding commitments, and procurement

plans to avoid fragmentation. Ultimately, there should be one comprehensive, coordinated quantification that all partners and the CNM agree to.

In February 2015, the USAID | DELIVER PROEJCT held a Quantification Overview Workshop to introduce CNM and malaria partners to basic concepts and best practices in quantification of malaria commodities. Approximately 20 participants attended the workshop representing CNM, NGO partners, USAID, and the United Nations Office for Project Services (UNOPS), the Global Fund Principal Recipient.

Based on the positive response to the overview workshop, the project was asked to support a national quantification exercise. Given the programmatic changes that are being undertaken in the near future, such as the scale up of microscopy, transition of community based programs to NGOs, transition of some private provider commodity supply to CNM, an increase in the number of village malaria workers (VMWs), and expansion of active case detection and surveillance, a coordinated national quantification is recommended going forward.

The quantification workshop was conducted from September 7-11, 2015 with USAID | DELIVER PROJECT technical advisors providing facilitation. The participants included: PR-UNOPS staff (3), WHO representative (1), CNM Staff (7), PSI (2), Department of Drugs and Food (1), Central Medical Stores (CMS) (1), CAP-Malaria (1), USAID | Cambodia (1), and participants from the Burma NMCP (3). A complete list of participants can be found in Appendix 1.

Purpose and scope of the quantification

The purpose of the quantification was to estimate the commodity needs and costs to support diagnostic testing and treatment for the national malaria program for 2016-2017. The complete list of malaria products required per the current national treatment guidelines (NTGs) are listed in Table 1. The products listed in bold, while included in the NTGs, are not currently being procured or used. These products are being considered for future use under new treatment initiatives. The items crossed out are also part of the NTGs, but during the workshop the participants decided to eliminate these for future use. Other laboratory products (e.g. items for microscopy) and bednets were not included in the quantification.

Table 1. List of Malaria Products Quantified

First-line treatment	Second-line treatment	Severe treatment	Testing	Gametocytocide
~~DHA+PPQ 3 tab (20mg/160mg)~~ DHA+PPQ 3 Tab (40mg/320mg) DHA+PPQ 6 Tab (40mg/320mg) DHA+PPQ 9 Tab (40mg/320mg) ~~FDC ASMQ 3 Tab (25mg/50mg)~~ ~~FDC ASMQ 6 Tab (25mg/50mg)~~ FDC ASMQ 3 Tab	**Tetracycline 250mg** **Doxycycline 100mg**	Quinine 300mg Quinine, d-HCl, 600 ~~Artemether, 20mg/ml 1ml~~ ~~Artemether, 80mg/ml 1ml~~ Artesunate, 60mg, powder for injection **Artesunate suppositories 50mg** **Artesunate suppositories 200mg**	RDTs (SD Bioline®) **G6PD RDTs**	**Primaquine 3.75mg** **Primaquine 7.5mg** **Primaquine 15mg**

First-line treatment	Second-line treatment	Severe treatment	Testing	Gametocytocide
(100mg/200mg) FDC ASMQ 6 Tab (100mg/200mg)				

Two separate quantifications were completed for the 2016-2017 time period. The first covered public sector commodity needs for all provinces in the country and the subsidized private sector in Tier-1 focus areas where resistance to current treatments have been identified. The second quantification covered commodity needs in the subsidized private sector in the Tier-2 areas only where resistance has not yet been identified.

Prior to the workshop, in order to gain a clear understanding of the malaria situation in Cambodia, malaria commodity consumption patterns, and the supply chain management system, data for the quantification exercise was collected from a variety of sources including CNM reports and information systems. These included the Malaria Information System (MIS), the Private Public Mix (PPM) information system with data entered by PSK and CNM, sales data from the Cambodian PSI affiliate (PSK), data from the logistics management information system (LMIS) provided by the Central Medical Stores (CMS), Cambodia census data, the Cambodia Malaria Survey, and extensive interviews with key stakeholders. A list of source documents is included in the References section at the end of this document.

This technical report documents the different types of data, forecasting methods, and the assumptions that were agreed upon during the workshop to produce a demographic-, a services-, and a consumption-based forecast, as well as the supply planning data and assumptions that were used to calculate the total procurement quantities and to plan the shipment delivery schedules for the 2016-2017 period.

Objectives

The objectives of the USAID | DELIVER PROJECT technical assistance provided in support of the quantification workshop were to –

- Lead a quantification workshop for malaria commodities facilitating a collaborative, consensus-building approach to data analysis and agreement on assumptions among stakeholders to produce one national quantification of commodity needs for the country,
- Build knowledge and capacity within the CNM and malaria stakeholders on the principles, methodology, and tools for quantification of malaria commodities,
- Promote best practices and country ownership of the quantification process for malaria commodities.

The list of products to be quantified included the following pharmaceutical and diagnostic supplies:

- Artemisinin-based combination therapy ACTs (all pediatric, adolescent, and adult doses and formulations)
- Dihydroartemisinin plus piperaquine (DHA-PPQ)
- Artesunate plus mefloquine (ASMQ), fixed dose combination

- Primaquine (PQ)
- Quinine sulfate
- Artesunate (AS) injectable
- Rapid diagnostic test kits (mRDTs)
  - RDTs
  - G6PD RDTs

Background

Cambodia is a malaria pre-elimination country where resistance to current first-line treatment (DHA-PPQ) has been documented in nine of 23 provinces (Kampong Cham was recently split into two provinces however, historical data reflects it as one). The provinces where resistance has been identified are classified as "Tier-1". Resistance may be present in other provinces, but there have not been enough cases tested yet to make this determination. As resistance testing continues, the categorization of provinces as Tier-1 or Tier-2 may change. The current Tier-1 and Tier-2 provinces with their respective populations as of 2008 are listed in Table 2.

Table 2. List of Provinces, Respective Tier Designation, and Populations

Tier-1	Population	Tier-2	Population
Battambang	1,024,663	Banteay Meanchey	678,033
Kampong Speu	716,517	Kampong Cham	1,680,694
Kampong Thom	630,803	Kampong Chhnang	471,616
Kampot	585,110	Kandal	1,265,085
Kratie	318,523	Koh Kong	139,722
Preah Vihear	170,852	Mondul Kiri	60,811
Pursat	397,107	Phnom Penh	1,325,681
Oddar Meanchey	185,443	Prey Veng	947,357
Pailin	70,482	Ratanak Kiri	149,997
		Siemreap	896,309
		Sihanoukville	199,902
		Stung Treng	111,734
		Svay Rieng	482,785
		Kep	35,753

Another change in the management of malaria commodities that was incorporated into the quantification assumptions is that the CNM will take over the distribution of malaria products

(ACTs and RDTs) to private providers that are registered and participating in the Public Private Mix (PPM) program in Tier-1 provinces starting in January 2016.

Objectives of the Cambodia Malaria Elimination Action Framework (MEAF) for 2016-2020 that will affect the demand for malaria commodities and should therefore be taken into consideration in this and future quantifications include –

1. Provide effective program management and coordination at all levels to efficiently deliver a combination of targeted interventions for malaria elimination by 2017,
2. Achieve universal coverage of case management services by 2016 to ensure 100% parasitological diagnosis of all suspected cases and effective, efficacious treatment of all confirmed cases,
3. Protect at least 90% of all populations at risk of malaria with an appropriate vector control intervention by 2017,
4. Enhance the surveillance system to detect, immediately notify, investigate, classify and respond to all cases and foci by 2017 to move toward malaria elimination,
5. Implement a comprehensive IEC/BCC approach that facilitates at least 90% of people seeking treatment for fever within 24 hours in an appropriate health facility/with care provider, and at least 85% of at-risk population utilizing an appropriate protection tool by 2017.

This quantification activity directly supports Objectives 1 and 2.

Product selection

The Cambodia National Treatment Guidelines for Malaria, December 2014, identify two first line treatments for uncomplicated malaria, DHA-PPQ and ASMQ. Due to findings of resistance to DHA-PPQ in several provinces, ASMQ will be procured for treatment in select provinces identified as Tier 1 in Table 2. Unfortunately, the manufacturer for the ASMQ fixed-dose combination (FDC) product required a minimum order quantity for production. The manufacturer has stated that they are willing to produce ASMQ 100mg/200mg, but will not be able to manufacture ASMQ 25mg/50mg due to the low number of pediatric cases and resulting treatments in Cambodia.

Initially, based on participant recommendations, it was assumed that DHA-PPQ would be used to treat all infant and child cases. During the quantification debriefing, the CNM expressed a strong desire to split the ASMQ tablets into halves and quarters for treatment of infants and children in Tier-1 provinces. Therefore, adjustments in the quantification assumptions and calculations were made after the workshop for procurement of ASMQ 100/200mg tablets (X3 and X6) only.

Several products and treatment protocols included in the NTGs that are not currently in use, (listed in bold in Table 1) were included in the quantification for consideration in future procurements. These products included:

- artesunate suppositories: assuming a new suppository formulation being reviewed would allow better handling and distribution conditions for Village Malaria Workers (VMW),
- G6PD tests: to be used for all Plasmodium vivax and Plasmodium falciparum/Plasmodium vivax (Pf/Pv) mix cases,

- Primaquine (all three dosage forms): to be used as recommended by WHO. (Calculations were also made for the total quantities needed if only the largest 15 mg dosage form were to be procured).
- Doxycycline: for treatment failure of uncomplicated malaria. (Calculations were also made if tetracycline were to be procured instead).

Other assumptions agreed upon during the quantification were that all health providers in the country (public and private) will treat malaria according to the national treatment guidelines and the above outlined policies. This includes the availability of confirmatory diagnosis (through RDT and/or microscopy) at all health facilities (public and private), and that testing is performed on all suspected cases as per national treatment guidelines.

Sources of supply and procurement

Multiple partners are involved in the procurement and distribution of malaria medicines and RDTs in Cambodia.

- UNOPS, the Global Fund Principal Recipient (PR), is the primary source for procurement of malaria products,
- The U.S. President's Malaria Initiative (PMI) has regional and country funds that are used to fill commodity gaps when required/requested,
- Mèdicins Sans Frontières (MSF) provided a one-time donation of short shelf life products – 17,700 units of DHA-PPQ X3; 8,700 units of DHA-PPQ X6; and 37,500 units of DHA-PPQ X9 in 2015,
- The Ministry of Health currently procures second line treatments, as well as treatment for severe malaria. The Global Fund may supply Artesunate for Injection in the future.
- The WHO has provided emergency procurements in the past.

Management Information Systems

The project advisors were able to easily gather numerous data points for analysis to be used in the quantification. An exceptional amount of data was available from the Malaria Information System (MIS) The MIS is a separate information system from the HMIS. Both collect data on malaria patients and services, but the MIS is considered more timely and reliable. The MIS includes data on the number of malaria cases treated, by severity and by age group, and number of RDTs (tests) used. All data was able to be segmented by province and by month.

Stock on hand and consumption data from the logistics management information system (LMIS) was limited. Only data on the quantities of ACTs and RDTs issued from the central level were available as a proxy for the consumption-based forecast.

Forecasting Methodology

Three different forecasts were prepared using three different types of data. The first using demographic data, the second using services data, and the third using consumption data. Based on the data analysis and the consensus on the forecasting assumptions discussed during the workshop, the participants selected the services-based forecast as the final forecast, which was then used as the basis for the supply plan. The malaria services data were considered to be more complete and of better quality, with fewer assumptions needed, compared to the demographic and the consumption-based forecasts.

Demographic-based forecast

Algorithms were used during the course of the workshop to assist in data collection and assumptions-building for both the demographic and the services-based forecasts. Algorithms provide a systematic way of thinking through the variables in these two forecasting methods and facilitate the calculations. The algorithms used for these two forecasts are presented in Appendix 2.

The percentage distribution of malaria cases was determined and forecasted by age group. Since only the first six months of data for 2015 were available, (January to June), the quantification team opted to use the averages from the first six months of 2014 and 2015 in both the demographic- and the services-based forecasts. The averages for the full year for 2013 were used. These averages by year, and over the three years, are presented in Table 3 below.

Table 3. Uncomplicated Malaria Cases by Age Group

Age	% of caseload Jan-Dec 2013	% of caseload Jan-June 2014	% of caseload Jan-June 2015	Average over three years
0-4	3%	3.27%	1.95%	2.74%
5-14	10%	10.60%	7.79%	9.46%
15-49	80%	80.14%	84.43%	81.52%
>49	7%	5.99%	5.83%	6.27%

Since malaria medications are typically dosed based on weight, the WHO weight per age averages were used for under five years of age, and the U.S. Centers for Disease Control and Prevention (CDC) weight per age at the 50th percentile was used for the 5 to 14 year age group. (The WHO standards only go up to age five, hence, the CDC standards were applied for the older age groups). The boy and girl averages were averaged for use in the age group calculations. It was also assumed when calculating medication needs for treatment, that the maximum days of treatment would be required, as well as whole vials would be used per day of treatment. Another assumption for the demographic and the services-based forecasts was that the severe malaria cases would only be

treated in public health facilities and not by PPM providers. All other assumptions and source references are documented in Appendix 3. Variables Used in the Demographic-based Forecast.

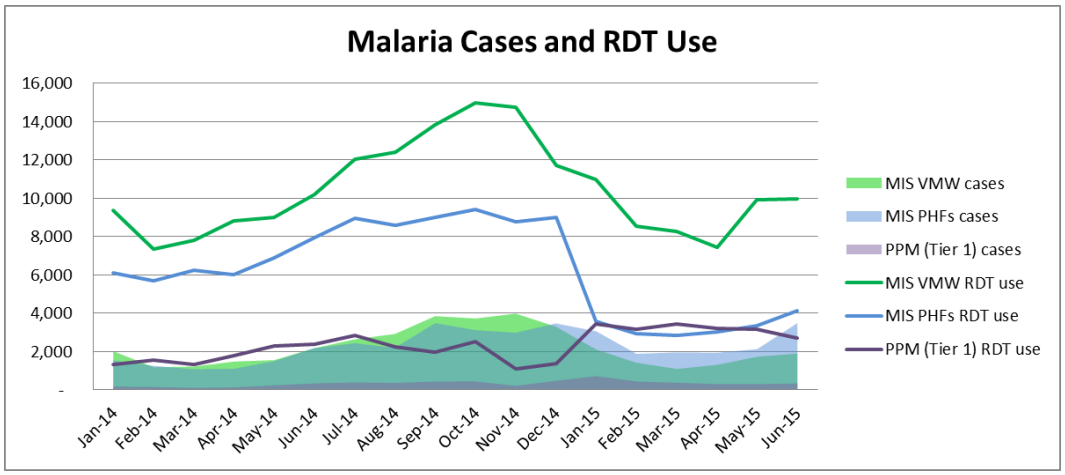
Services-based forecast

The services-based forecast relied on reported cases of uncomplicated and severe malaria from MIS data instead of using population and incidence figures to determine the number of future cases (as in the demographic-based forecast). The MIS data in Cambodia are very reliable and participants felt confident in using these figures. The age and weight proportions and treatment assumptions were the same as in the demographic-based forecast documented above. All other assumptions used in the services-based forecast of commodity needs for treatment of uncomplicated malaria and severe malaria cases are included in Appendix 4. Variables Used in the Services-based Forecast.

For determining the RDT needs, the advisors and participants reviewed the number of cases reported and the number of RDTs used per month by sector, (public health facilities [PHFs], village malaria worker [VMW], and public private mix [PPM]), and by provider. The results of this data are presented in

Figure 1. Malaria Cases and RDT Use by Service Provider.

Figure 1. Malaria Cases and RDT Use by Service Provider

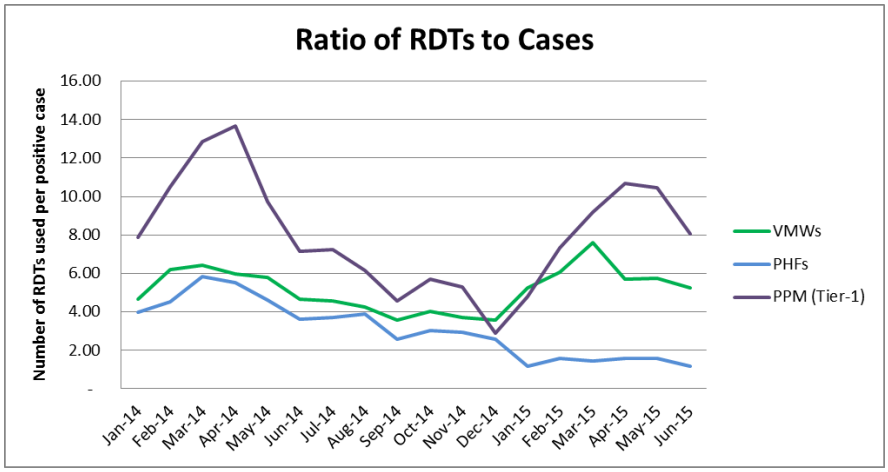


The resulting ratio of RDTs used per malaria case reported is documented in

Figure 2: Ratio of RDTs to Uncomplicated Malaria Cases by Service Provider. PSK representatives stated that their providers are using more RDTs, and the CNM confirmed during the quantification

debriefing that PHFs had experienced a shortage of RDTs early in 2015 which may have led to rationing behavior by public sector providers.

Figure 2. Ratio of RDTs to Uncomplicated Malaria Cases by Service Provider

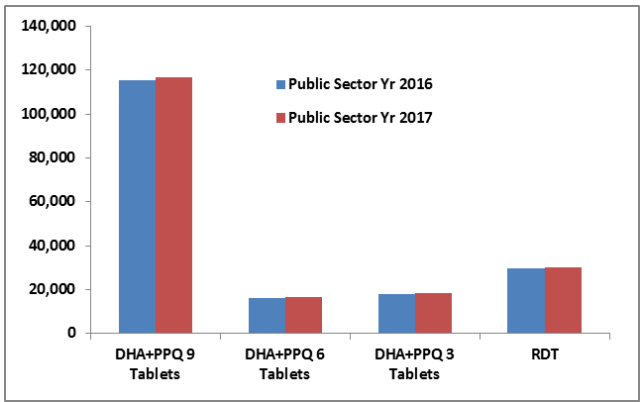


Based on this data, it was assumed that an average of 4.4 RDTs per case would be used in the public sector and private sector Tier-1 provinces, and an average of 10 RDTs per case would be used in the private sector Tier 2 provinces.

Consumption-based forecast

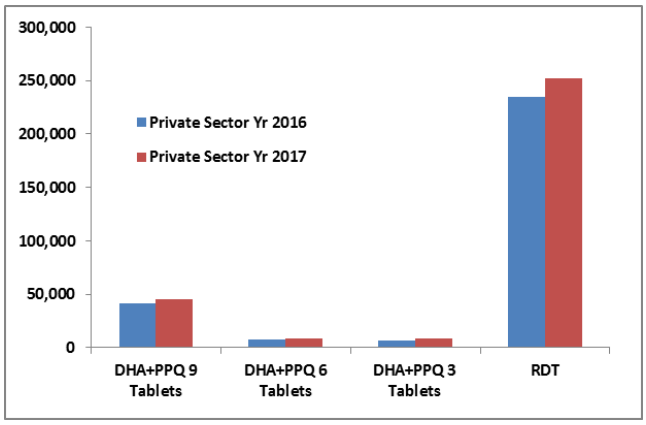
In the absence of facility based consumption data (the actual quantities of products dispensed to patients), 12 months of central level issues data, (the total quantity of each product issued from the CMS between July 2014 and June 2015), was used as a proxy for consumption to be able to produce a consumption-based forecast for the public sector. The population growth rate and linear trend extrapolation were applied to generate the estimated consumption for 2016 and 2017 as shown in Figure 3.

Figure 3. Public Sector Consumption-based Forecast (using population growth rate and central level issues data)



Similarly, for the Tier-2 private sector consumption-based forecast, since consumption data (actual quantities of products dispensed to patients) were not available, historical sales data were used to estimate future consumption. High sales points from 2012, 2013, 2014, and Jan-June 2015 were used to project future sales for 2016 and 2017 as shown in Figure 4.

Figure 4. Tier 2 Private Sector Consumption-based Forecast (using historical sales data)



The public and private sector consumption-based forecasts for 2016 and 2017 were subsequently adjusted to reflect the expected program growth rates, the increase in number of PSK PPM providers, and seasonality patterns described in the section on *Adjustments for Program Growth and Seasonality* in this report.

Limitations of the consumption-based forecast

It is important to mention that using central level issues data or national sales data as a proxy for consumption may result in an overestimate of actual demand for commodities if the assumption is that all quantities distributed have been used (consumed) and the stock on hand below the central level is unknown. By the same token, reporting all distribution as consumption can mask stockouts if the actual stock on hand at the facility level is not being reported. The best proxy for a consumption-based forecast in the absence of actual consumption data, (quantities dispensed to patients), would be issues data from the lowest level of the supply chain, for example from a health center store to a dispensary or village malaria worker.

Comparison of forecasting data and methods

After preparing three different forecasts using different sources and types of data, analyzing the data quality, and developing the forecasting assumptions, the workshop **participants unanimously decided to accept the services-based forecasts for 2016-2017.** A summary of the strengths and

limitations of the various forecasting data and methods identified by the workshop participants is presented in Table 4.

Table 4. Strengths and Limitations of Forecasting Methods

Method	Strength	Limitation
Demographic-based forecast	• Can be used when no other data exists	• Data can be old and not reflect current trends • Data come from various surveys, all of which may not be accurate or reliable • Too many calculation steps
Services-based forecast	• Data is reliable and strong • Based on routine data collection • Frequency of reporting is good • All service levels report • Can be scaled-up	• Needs quality analysis • Adjustments are still needed • Different partners may have variable quality data
Consumption-based forecast	• Effective method if actual consumption data were available.	• Only central level issues data available (quantities of products distributed) • Proxy for consumption, not true consumption • Risk of overestimating future consumption • Needs to be adjusted for stockouts, product losses and expiries

Adjustments for program growth and seasonality

Additional factors needed to be considered to reflect expected program changes and growth once the services-based forecast was selected for determining future consumption.

- One of the most important factors was that 2015 data appeared to be showing a pattern of a 31% increase in the number of malaria cases treated over the same months in 2014.
- Another factor that could be quantified and planned for was the anticipated incorporation of 2,000 new VMWs by the end of 2016 with an estimated RDT use of about 4.4 RDTs per VMW/month. During the quantification debriefing, CNM adjusted this estimate to 1,100 new VMWs by the end of 2016 and 1,965 new VMWs by the end of 2017.
- Another adjustment was also made to the private sector Tier-2 forecast. The data collected from PPM partners in Tier 2 included 158 PPM registered providers currently reported by PSK, and 154 providers reported by CNM for a total of 312 PPM registered providers. To estimate the commodities needed for 2016, it was anticipated that the number of registered PPM providers reached by PSK would increase to 550 resulting in a total of 704 PPM providers. Therefore, the forecast was adjusted to reflect an increase of an additional 392 registered PPM providers for PSK in 2016.
- (NOTE: PSK currently reaches a large number of providers that are registered, non-PPM providers which means that they are not required to provide case data that is reported through

the MIS system. Going forward, all private providers that receive products must be a part of PPM which explains the rapid scale up of providers in Tier 2.)

- The advisors and participants also agreed on assumptions that current case rates would continue to be 31% higher than 2014 for the remainder of 2015, would reduce to 15% in 2016, and would stabilize in 2017. These rates are documented in

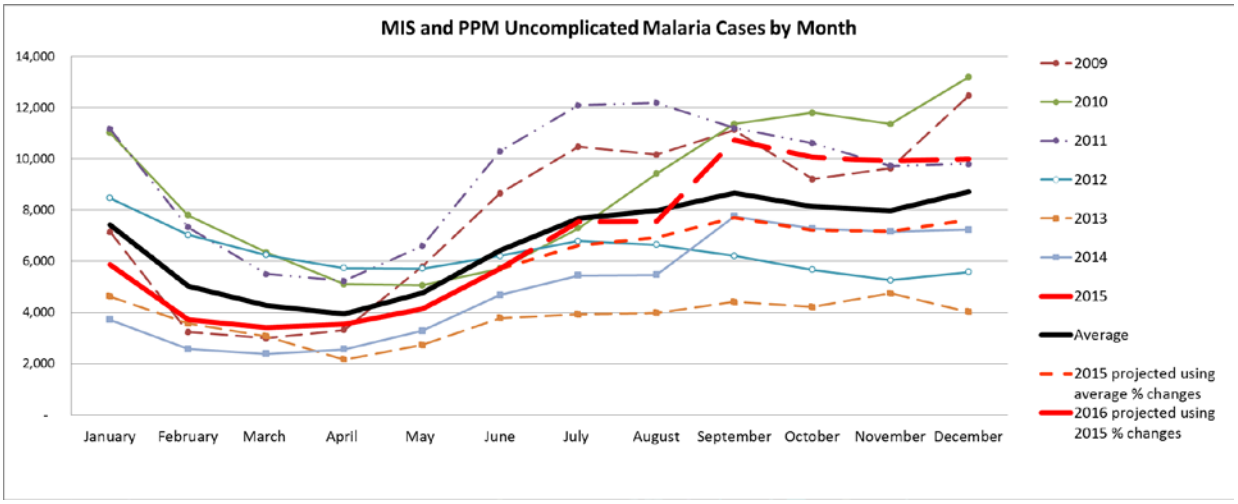
Table 5.

Table 5. Program Growth Rates Used in Forecast

Program Growth 2014 to 2015	Program Growth 2015 to 2016	Program Growth 2016 to 2017
31%	15%	0%

These assumptions coincided with other calculations conducted using seasonality patterns to both the public and private sector quantifications. If 2015 continues with a 31% case rate over 2014 patterns, and the ending point is used to start the 2016 forecast, then the 2016 figures using average seasonality patterns would be in total 15% higher than 2015. The seasonality patterns and forecasts for 2015 and 2016 are shown in Figure 5.

Figure 5. Seasonality Patterns



The participants also recognized that there are numerous other factors that are difficult to quantify that may change the pattern of malaria cases, and therefore the demand for malaria testing and treatment commodities, in 2016 and 2017. These included –

- Land projects that involve construction in heavily forested and malarious zones,
- Increasing use of ASMQ and primaquine (PQ) that will likely decrease failure and retreatment cases,
- Maintenance of current levels of bednet use,
- Expansion of active case detection.

Results of the demographic, services and consumption-based forecasts

The final results of the three different forecasts for 2016 and 2017 are presented in Tables 6 and 7 below. The participants selected the services-based forecasts for the Public Sector and Tier-1 PPM,

and for the Private Sector Tier-2 PPM. The Public Sector and Tier-1 PPM forecast was further adjusted to calculate the monthly commodity needs using average seasonality patterns from 2009-2014. These final monthly figures to reflect seasonality are documented in Table 8.

Table 6. Comparison of Demographic, Services and Consumption-based Forecasts for Public Sector and Tier-1 PPM

Product	Basic Unit	Demographic			Services			Consumption		
		2015	2016	2017	2015	2016	2017	2015	2016	2017
DHA+PPQ 3 Tablets (20mg/160mg)	FDC Tablet									
DHA+PPQ 3 Tablets (40mg/320mg)	FDC Tablet	791	1,119	520	3,636	3,521	2,919	23,329	27,243	27,664
DHA+PPQ 6 Tablets (40mg/320mg)	FDC Tablet	1,873	2,619	1,169	4,308	4,250	3,524	21,120	24,663	25,044
DHA+PPQ 9 Tablets (40mg/320mg)	FDC Tablet	26,475	37,016	16,534	59,017	58,233	48,283	148,637	173,575	176,258
FDC ASMQ 3 Tablets (100mg/200mg)	FDC Tablet	10	1,091	2,192		780	1,583			
FDC ASMQ 6 Tablets (100mg/200mg)	FDC Tablet	206	21,601	43,411		10,904	22,145			
Tetracycline 250mg	Tablet/Cap									
Doxycycline 100mg	Tablet/Cap	61,159	133,402	135,456	134,630	157,209	159,630			
Quinine 300mg tabs	Tablet	243,650	531,457	539,642	547,602	637,478	647,295			
Quinine, d-HCl, 600 mg/2ml inj.- amp.	Ampoule	1,635	3,567	3,622	4,929	5,229	5,310			
Artesunate, 60mg, powder for injection, vial	vial	15,645	34,125	34,650	25,133	48,376	49,121			
Primaquine 3.75mg	Tablet	4,680	47,164	43,798	71,464	83,449	84,734			
Primaquine 7.5mg	Tablet	5,735	52,825	53,638	117,579	137,294	139,403			
Primaquine 15mg	Tablet	90,554	835,070	847,930	777,733	908,910	922,907			
Artesunate suppositories 50mg	suppository	17	153	155	222	259	263			
Artesunate suppositories 200mg	suppository	583	1,272	1,291	1,844	2,153	2,186			
RDT (SD Bioline®)	RDT	504,383	1,389,956	1,576,966	337,096	646,645	822,208	38,405	66,297	67,322
G6PD RDTs	RDT	3,358	30,954	31,431	32,240	37,647	38,227			

Table 7. Comparison of Demographic, Services and Consumption-based Forecasts for Tier-2 PPM*

Product	Basic Unit	Demographic			Services			Consumption/PSK Sales		
		2015	2016	2017	2015	2016	2017	2015	2016	2017
DHA+PPQ 3 Tablets (40mg/320mg)	FDC Tablet	2,582	1,278	1,297	974	1,138	1,155		61,989	72,565
DHA+PPQ 6 Tablets (40mg/320mg)	FDC Tablet	6,242	3,089	3,137	1,176	1,373	1,394		90,910	107,831
DHA+PPQ 9 Tablets (40mg/320mg)	FDC Tablet	86,684	43,647	44,319	15,903	18,571	18,857		309,012	313,811
FDC ASMQ 3 Tablets (100mg/200mg)	FDC Tablet									
FDC ASMQ 6 Tablets (100mg/200mg)	FDC Tablet	1,521								
Tetracycline 250mg	Tablet/cap									
Doxycycline 100mg	Tablet/cap	205,080	101,482	103,044	37,452	43,733	44,407			
Quinine 300mg tabs	Tablet	804,610	398,152	404,284	153,802	179,597	182,362			
Quinine, d-HCl, 600 mg/2ml inj.- amp.	Tablet									
Artesunate, 60mg, powder for injection, vial	Ampoule									
Primaquine 3.75mg	vial	15,808	33,055	33,564	19,512	22,784	23,135			
Primaquine 7.5mg	Tablet	19,375	40,514	41,138	32,102	37,486	38,064			
Primaquine 15mg	Tablet	306,040	639,957	649,812	212,517	248,158	251,979			
Artesunate suppositories 50mg	Tablet									
Artesunate suppositories 200mg	suppository									
RDT (SD Bioline®)	suppository	279,116	1,872,196	1,901,028	182,806	347,111	384,498		2,449,655	2,518,854
G6PD RDTs	RDT	11,361	23,757	24,123	8,802	10,279	10,437			

***The Tier-2 PPM demographic and services-based forecasts are based on 1) the number of malaria cases reported from registered PPM providers in 2015 which underreports services provided by non-PPM providers who have not been required to report case data until 2016, and 2) assumptions about the number of registered PSK PPM providers expected to increase from 158 to 550 in 2016. In contrast, the consumption-based forecast may be overestimated since it is based on historical sales data which reports all distribution as consumption (see "Limitations of the consumption-based forecast" on page 10.)

Table 8. Services-based Forecast Adjusted for Seasonality for Public Sector and Tier-1 PPM

	DHA+ PPQ 3 Tabs (40mg/ 320mg)	DHA+P PQ 6 Tabs (40mg/ 320mg)	DHA+ PPQ 9 Tabs (40mg/ 320mg)	FDC ASMQ 3 Tabs (100mg/ 200mg)	FDC ASMQ 6 Tabs (100mg/ 200mg)	Doxy 100mg	Quinine 300mg tabs	Quinine d-HCl, 600 mg/2ml inj.- amp.	AS, 60mg, pwd for inj, vial	PQ 3.75mg	PQ 7.5mg	PQ 15mg	AS supp 50mg	AS supp 200mg	RDT (SD Bioline®)	G6PD RDTs
Jan-16	325	392	5,368	72	1,005	14,492	58,766	482	4,460	7,693	12,656	83,788	24	198	59,611	3,470
Feb-16	253	305	4,178	56	782	11,280	45,739	375	3,471	5,987	9,851	65,214	19	154	46,397	2,701
Mar-16	224	270	3,698	50	693	9,984	40,486	332	3,072	5,300	8,719	57,724	16	137	41,068	2,391
Apr-16	196	236	3,237	43	606	8,739	35,435	291	2,689	4,639	7,632	50,523	14	120	35,944	2,093
May-16	224	271	3,711	50	695	10,019	40,627	333	3,083	5,318	8,750	57,925	16	137	41,211	2,399
Jun-16	287	347	4,748	64	889	12,818	51,978	426	3,944	6,804	11,194	74,109	21	176	52,725	3,070
Jul-16	315	380	5,206	70	975	14,055	56,991	468	4,325	7,460	12,274	81,257	23	192	57,810	3,366
Aug-16	314	379	5,198	70	973	14,034	56,907	467	4,318	7,449	12,256	81,137	23	192	57,725	3,361
Sep-16	364	439	6,019	81	1,127	16,249	65,891	541	5,000	8,625	14,191	93,946	27	223	66,838	3,891
Oct-16	341	411	5,636	75	1,055	15,215	61,697	506	4,682	8,076	13,288	87,967	25	208	62,584	3,644
Nov-16	346	417	5,719	77	1,071	15,439	62,605	514	4,751	8,195	13,483	89,261	25	211	63,505	3,697
Dec-16	333	402	5,514	74	1,032	14,885	60,358	495	4,580	7,901	12,999	86,058	25	204	61,226	3,565
Jan-17	325	325	4,451	146	2,041	14,716	59,671	489	4,528	7,811	12,851	85,078	24	202	75,795	3,524
Feb-17	253	253	3,464	114	1,589	11,453	46,443	381	3,524	6,080	10,002	66,218	19	157	58,993	2,743
Mar-17	224	224	3,066	101	1,406	10,138	41,109,	337	3,120	5,381	8,853	58,613	17	139	52,218	2,428
Apr-17	162	196	2,684	88	1,231	8,873	35,981	295	2,730	4,710	7,749	51,301	15	122	45,703	2,125
May-17	186	225	3,077	101	1,411	10,173	41,252	338	3,130	5,400	8,884	58,817	17	139	52,399	2,436
Jun-17	238	287	3,937	129	1,806	13,016	52,778	433	4,005	6,909	11,366	75,251	21	178	67,040	3,117
Jul-17	261	315	4,317	142	1,980	14,271	57,868	475	4,391	7,575	12,463	82,508	23	195	73,506	3,417
Aug-17	261	315	4,310	141	1,977	14,250	57,783	474	4,385	7,564	12,444	82,386	23	195	73,397	3,412
Sep-17	302	364	4,991	164	2,289	16,500	66,905	549	5,077	8,758	14,409	95,393	27	226	84,985	3,951
Oct-17	283	341	4,673	153	2,143	15,449	62,647	514	4,754	8,201	13,492	89,322	25	212	79,576	3,700
Nov-17	287	346	4,742	155	2,175	15,677	63,569	521	4,824	8,321	13,690	90,636	26	215	80,747	3,754
Dec-17	276	334	4,572	150	2,097	15,114	61,288	503	4,651	8,023	13,199	87,384	25	207	77,849	3,619

Additional forecasting scenarios and assumptions

- As stated earlier in this report, forecasts were also prepared for some products currently not in use, such as primaquine (PQ) for 2nd-line treatment and artesunate (AS) suppositories. Special considerations for use of these products, including storage conditions for artesunate suppositories, and an update of the forecasting assumptions will be needed prior to procurement. This issue is addressed in more detail in the recommendations.
- If only the 15mg dosage form of PQ is procured, then adjustments will need to be made to be able to use the 15 mg tablets to meet the infant and child 3.75mg and 7.5mg dosage requirements. Assuming that the 15mg tablets can be cut to provide the lower dosages, additional quantities of the 15mg dosage form will need to be procured, and the quantities forecasted for 7.5mg would then need to be divided by two and the quantities forecasted for 3.75mg divided by four.
- The annual village malaria worker (VMW) caseload in Cambodia has ranged from about 21,000 to 50,000 uncomplicated cases over the last few years, with severe malaria cases representing up to three percent of all uncomplicated cases. Therefore, the estimates for treatment of severe malaria by VMWs may be too low to provide at least one artesunate suppository for each VMW. (Three percent of 21,000 to 50,000 cases would be 630 to 1,500 severe cases per year, meaning that not all 2,000 VMWs would be provided with artesunate suppositories). Therefore, it may be necessary to review and adjust the forecast to provide a minimum quantity for each VMW.
- If the CNM decides to recommend tetracycline instead of doxycycline for second line treatment, the quantities of doxycycline in Table 8 above will need to be multiplied by three to provide the equivalent treatment with tetracycline. Fourteen tablets are required for treatment with doxycycline versus 42 tablets with tetracycline. Side effects and adverse reactions of tetracycline, along with cost, will also need to be considered to make the final determination.

Supply Planning

The supply plan lists the quantities, funding sources, cost, and timing of the shipments required to maintain malaria program stock levels between the established minimum and maximum levels for all products during the period of the quantification. The supply plan generates the commodity as well as the funding requirements after applying the unit cost and freight costs for shipment of the products. The PipeLine software used to develop the supply plan requires current stock on hand data, the quantities of any shipments already on order, historical consumption if available, and the forecasted monthly consumption for the period of the quantification. Using the months of stock (MOS) at the time of the quantification as a guide, (MOS is calculated using the stock on hand [SOH] divided by the estimated average monthly consumption [AMC]), the planned shipments were scheduled to arrive when the program stock levels are expected to reach the minimum level.

Supply Planning Assumptions

- Multiple partners are involved in funding and procurement of malaria commodities for the national malaria control program. These include the MOH, Global Fund, USAID/PMI, Mèdicins Sans Frontières (MSF), and WHO.
- The length of the health commodity supply pipeline according to the Cambodia Drug and Medical Devices Management at Health Center Level published in 2008 is 16 months of stock. Table 9 below shows the established maximum and minimum stock levels for health facilities, the operational districts and the central level. For the purpose of this quantification, the desired stock level was set at 12 months of stock in the PipeLine database for Cambodia.

Table 9. Maximum and minimum stock levels at each level of the supply pipeline

Level	Max	Min	Source
Central	7	3	Calculated
Operational District	6	3	Drug and Medical Devices Management at Health Center Level (2008)
Health Facility	3	0.5	Drug and Medical Devices Management at Health Center Level (2008)
Length of supply pipeline	16	7*	Drug and Medical Devices Management at Health Center Level (2008)

* rounded up

- The stock on hand of malaria commodities at the operational district and health facility levels was not available. Therefore, only stock on hand at the central level was taken into consideration for the supply plan.
- The unit costs of the malaria commodities were adapted from previous UNOPS (GF) and USAID/PMI procurements, and from the International Drug Price Indicator Guide (see References section at the end of this report)

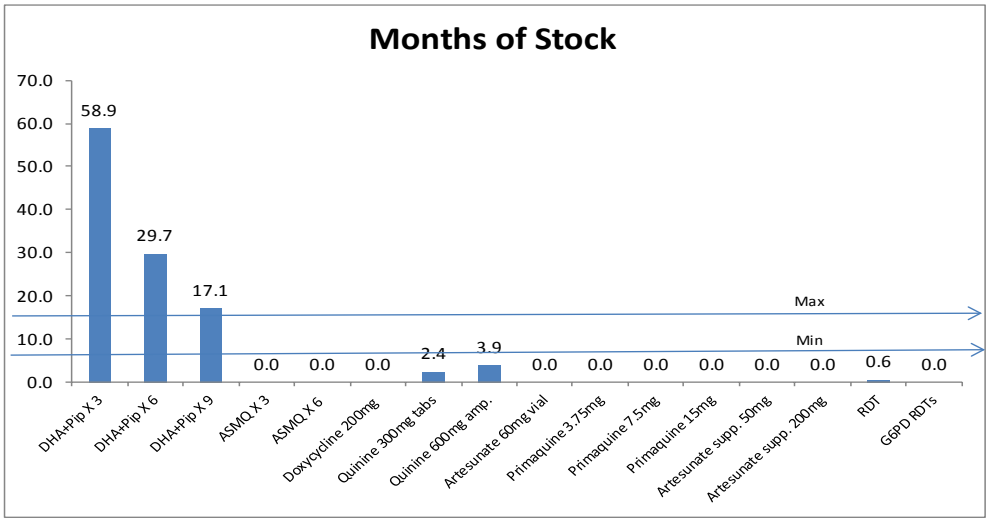
- Freight costs were not included in the supply plan and final outputs of the quantification

Public Sector

Months of stock (MOS) as of September 5th, 2015

Using the central level stock on hand and the forecasted consumption for 2015, the months of stock (MOS) of the malaria products was calculated and graphed. Presently, the stocks of DHA-PPQ are above the maximum level. The months of stock for DHA-PPQ X 3 and DHA-PPQ X 6 are 58.9 and 29.7 MOS respectively. Unless consumption were to increase dramatically, these products are overstocked and may expire. Quinine tablets and injectable artesunate are below the minimum stock level. Other products are stocked out or have not yet been procured for the program as depicted in Figure 6.

Figure 6. Public Sector Months of Stock as of September 5, 2015



The fact that stock on hand data at the operational districts and health facilities were not available to the quantification team implies that the national stock status of these products may be even higher than the calculated months of stock, and that other products may also be overstocked and at risk of expiry at the lower levels. For the same reason, lack of data visibility at the OD and health facility levels does not allow CNM to identify stocks that may be at or below the established minimum level and therefore at risk of stockout.

The incoming Global Fund shipment of 407,000 RDTs scheduled to arrive in November 2015 will increase the months of stock of RDTs at the central level to 14 MOS. See Table 10 below.

Table 10. Public Sector Current Stock on Hand and Incoming Orders

Malaria Commodities	Basic Unit	2015 Forecast	2015 AMC	Central level Stock on Hand		Months of Stock	Remark	GF In-coming Shipment Nov 2015	Months of Stock in Nov 2015
				Aug 31st	Sept 5th				
DHA+PPQ 3 Tabs (40mg/320mg)	FDC Tablet	3,636	303	142	17,700	58.9	Donation from MSF in Sept, 2015 increased stock level		
DHA+PPQ 6 Tabs (40mg/320mg)	FDC Tablet	4,308	359	1,978	8,700	29.7			
DHA+PPQ 9 Tabs (40mg/320mg)	FDC Tablet	59,017	4,918	46,800	37,500	17.1			

Malaria Commodities	Basic Unit	2015 Forecast	2015 AMC	Central level Stock on Hand		Months of Stock	Remark	GF In-coming Shipment Nov 2015	Months of Stock in Nov 2015
				Aug 31st	Sept 5th				
FDC ASMQ 3 Tabs (100mg/200mg)	FDC Tablet	0	0	0	0	0.0			
FDC ASMQ 6 Tabs (100mg/200mg)	FDC Tablet	0	0	0	0	0.0			
Doxycycline 100mg	Tab/Cap	134,630	11,219	0	0	0.0			
Quinine 300mg tabs	Tablet	547,602	45,634	110,000	0	2.4			
Quinine, d-HCl, 600 mg/2ml- amp	Ampoule	4,929	411	1,610	0	3.9			
Artesunate, 60mg, vial	vial	25,133	2,094	0	0	0.0			
Primaquine 3.75mg	Tablet	71,464	5,955	0	0	0.0			
Primaquine 7.5mg	Tablet	117,579	9,798	0	0	0.0			
Primaquine 15mg	Tablet	777,733	64,811	0	0	0.0			
Artesunate suppositories 50mg	suppository	222	19	0	0	0.0			
Artesunate suppositories 200mg	suppository	1,844	154	0	0	0.0			
RDTs (SD Bioline®)	RDT	337,096	28,091	15,573	0	0.6		407,000	14
G6PD RDTs	RDT	32,240	2,687	0	0	0.0			

2016 Malaria commodity and funding requirements

Commodity requirements

Shipment planning commenced in January 2016 for commodities that are presently stocked out at the central level after confirming that no further shipments are expected in 2015. Assuming the shipments of 407,000 and 110,077 RDTs arrive in November 2015 and March 2016 respectively as planned, future RDT shipments were programmed to arrive after March 2016 to maintain inventory levels in the country between the established maximum and minimum levels.

Table 11. Public Sector 2016 Commodity Gaps

Malaria Commodities	2016 Commodity Requirements	Commitment by Commodity		2016 Commodity Gap
		GF	USAID/PMI	
Artesunate 60mg vial	92,096	5,000		87,096
Artesunate suppository 200mg	4,420			4,420
Artesunate suppository 50mg	508			508
ASMQ 100/200mg X 3 tablets	1,896		1,042	854
ASMQ 100/200mg X 6 tablets	35,210	12,182	19,799	3,229
DHA-PPQ X 9 tablets	30,206	30,758		0
Doxycycline 100mg tab/cap	302,115			302,115
G6PD RDT	77,029			77,029
Primaquine 15mg X 100 tabs	17,171	5,932		11,239
Primaquine 3.75mg X 100 tabs	1,716			1,716
Primaquine 7.5mg X 100 tabs	2,705			2,705
Quinine 300mg tablet	1,288,588			1,288,588
Quinine 600mg/2ml ampoule	10,683			10,683
RDT (SD Bioline®)	790,865	110,077		680,788

While the 2016 needs for DHA-PPQ X3 tabs and DHA-PQP X6 tabs are covered by the current high months of stock at the central level, the central level stock on hand and commitment for DHA-PPQ X 9 tabs by Global Fund cover the 2016 need of DHA-PPQ X 9. For the other 2016 commodity requirements, the Global Fund and USAID/PMI have committed to the provision of

5,000 vials of artesunate 60mg injectable, and 12,182 doses and 30,758 doses of artesunate/ mefloquine (ASMQ) X 3 and X 6 tablets respectively. Other commitments from the Global Fund include 5,932 Primaquine 15mg X 100 tablets and 110,077 RDTs. USAID/PMI has a commitment of 1,042 doses and 19,799 doses of ASMQ X 3 and X 6 tablets respectively.

The 2016 Commodity Gap is the resultant need after funders' commitments have been subtracted from the 2016 commodity requirements. In some cases, the GF commitments are more than the quantities needed for the year. See Table 11 above. Also see **Appendix 5** for the quantities and timing of the shipments needed in 2016 to be able to maintain program stock levels within the established maximum and minimum levels. It also shows when the current commitments from GF and USAID/PMI will be expected in country.

Funding requirements

The corresponding funding requirements for procurement of malaria commodities in 2016 are shown in Table 12 below. The total funding commitment from Global Fund in 2016 is $147,942.81 and from USAID/PMI is $69,577.74

Table 12. Public Sector 2016 Funding Gap

Malaria Commodities	Unit Cost	2016 Funding Requirements	Cost of committed commodities		2016 Funding Gap
			GF	USAID/PMI	
Artesunate 60mg vial	$3.80	$349,964.80	$19,000.00		$330,964.80
Artesunate suppository 200mg	$0.63	$2,762.50			$2,762.50
Artesunate suppository 50mg	$0.35	$177.80			$177.80
ASMQ 100/200mg X 3 tablets	$2.17	$4,114.32		$2,261.14	$1,853.18
ASMQ 100/200mg X 6 tablets	$3.40	$119,714.00	$41,418.80	$67,316.60	$10,978.60
DHA-PPQ X 9 tablets	$0.93	$28,091.58	$28,604.94		$0.00
Doxycycline 100mg tab/cap	$0.01	$3,262.84			$3,262.84
G6PD RDT	$0.45	$34,262.84			$34,663.05
Primaquine 15mg X 100 tabs	$1.58	$27,164.52	$9,384.42		$17,780.10
Primaquine 3.75mg X 100 tabs	$1.58	$2,714.71			$2,714.71
Primaquine 7.5mg X 100 tabs	$2.00	$5,396.48			$5,396.48
Quinine 300mg tablet	$0.04	$54,120.70			$54,120.70
Quinine 600mg/2ml ampoule	$0.20	$2,179.33			$2,179.33
RDT (SD Bioline®)	$0.45	$355,889.25	$49,534.65		$306,354.60
		$990,215.88	**$147,942.81**	**$69,577.74**	**$773,208.69**

As indicated, the total 2016 Funding Gap is $773,208.69. Please note that this and other funding estimates are not inclusive of freight cost or other supply chain costs.

2017 Malaria commodity and funding requirements

Commodity requirements

In 2017, the Global Fund has committed to procuring 600 vials of artesunate 60mg injectable, 12,440 doses of ASMQ X 6 tablets, 29,026 doses of DHA-PPQ X 9 tablets, 5,598 bottles of primaquine 15mg X 100 tablets, and 290,262 RDTs. The 2017 Commodity Gap is shown in Table 13.

Table 13. Public Sector 2017 Commodity Gap

Malaria Commodities	2017 Commodity Requirements	Commitment by Commodity		2017 Commodity Gap
		GF	USAID/PMI	
Artesunate 60mg Vial	52,839	6,000		46,839
Artesunate suppository 200mg	2,029			2,029
Artesunate suppository 50mg	261			261
ASMQ 100/200mg X 3 tablets	2,001			2,001
ASMQ 100/200mg X 6 tablets	12,141	12,440		0
DHA-PPQ X 6 tablets	1,627			1,627
DHA-PPQ X 9 tablets	54,767	29,026		25,741
Doxycycline 100mg capsule	134,457			134,457
G6PD RDT	35,728			35,728
Primaquine 15mg X 100tabs	10,953	5,598		5,355
Primaquine 3.75mg X 100 tabs	808			808
Primaquine 7.5mg X 100 tabs	1,413			1,413
Quinine 300mg tablet	650,380			650,380
Quinine 600mg/2ml ampoule	4,981			4,981
RDT (SD Bioline*)	1,121,873	290,262		831,611

See

Appendix 6 for the quantities and timing of the shipments needed in 2017 to be able to maintain program stock levels within the established maximum and minimum levels. It also shows when the current commitments from the GF will be expected in country.

Funding requirements

The funding requirements for procurement of malaria commodities in 2017 are shown in Table 14 below. The total funding commitment from the Global Fund for 2017 is $231,564.12 leaving a Funding Gap of $642,659.97

Table 14. Public Sector 2017 Funding Gap

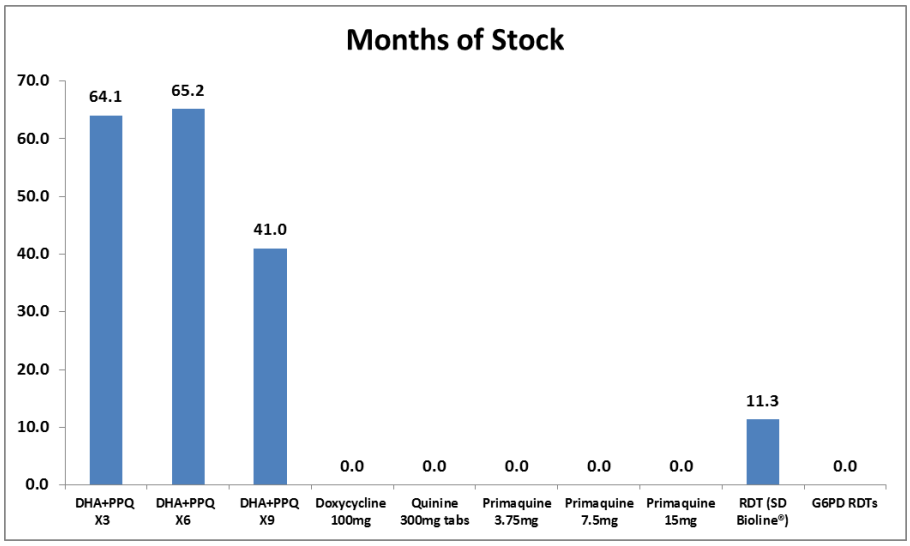
Malaria Commodities	Unit Cost	2017 Funding Requirements	Cost of committed commodities		2017 Funding Gap
			GF	USAID/PMI	
Artesunate 60mg Vial	$3.80	$200,788.20	$22,800.00		$177,988.20
Artesunate suppository 200mg	$0.63	$1,268.13			$1,268.13
Artesunate suppository 50mg	$0.35	$91.35			$91.35
ASMQ 100/200mg X 3 tablets	$2.17	$4,342.17			$4,342.17
ASMQ 100/200mg X 6 tablets	$3.40	$41,279.40	$42,296.00		$0.00
DHA-PPQ X 6 tablets	$1.46	$2,375.42			$2,375.42
DHA-PPQ X 9 tablets	$0.93	$50,933.31	$26,994.18		$23,939.13
Doxycycline 100mg capsule	$0.01	$1,452.14			$1,452.14
G6PD RDT	$0.45	$16,077.60			$16,077.60
Primaquine 15mg X 100tabs	$1.58	$17,327.65	$8,856.04		$8,471.61
Primaquine 3.75mg X 100 tabs	$1.58	$1,278.26			$1,278.26
Primaquine 7.5mg X 100 tabs	$2.00	$2,818.94			$2,818.94
Quinine 300mg tablet	$0.04	$27,315.96			$27,315.96
Quinine 600mg/2ml ampoule	$0.20	$1,016.12			$1,016.12
RDT (SD Bioline*)	$0.45	$504,842.85	$130,617.90		$374,224.95
		$873,207.48	**$231,564.12**		**$642,659.97**

Private Sector

Months of Stock as of August 31st, 2015

Using PSK's central level stock on hand, and the forecasted consumption in all registered private health facilities in Tier 2 provinces, (estimated from the number of malaria cases to be reported by the expected increase in PPM providers to 550 in 2016), all presentations of DHA-PPQ have more than 24 months of stock in the month of August 2015 as shown in Figure 7.

Figure 7. Private Sector Months of Stock as of August 31, 2015



The relationship between the forecasted consumption and central level stock; and the forecasted sales and central level stock are very different since a fraction of what was sold has actually been consumed (dispensed to patients) over time, while the other fraction not yet consumed is still in stock at the private health facility stores.

Table 15. Private Sector Current Stock on Hand and Incoming Orders

Malaria Commodities	Basic Unit	2015 Forecast	AMC	Stock on Hand @ Aug 2015	Months of Stock	In-coming Shipment @ Nov 2015	Months of Stock @ Nov 2015
DHA+PPQ 3 Tabs (40mg/320mg)	FDC Tablet	974	81	5,201	64.1		62.1
DHA+PPQ 6 Tabs (40mg/320mg)	FDC Tablet	1,176	98	6,388	65.2		63.2
DHA+PPQ 9 Tabs (40mg/320mg)	FDC Tablet	15,903	1,325	54,346	41.0		39.0
Doxycycline 100mg	Tab/Cap	37,452	3,121	0	0.0		0.0
Quinine 300mg tabs	Tablet	153,802	12,817	0	0.0		0.0
Primaquine 3.75mg	Tablet	19,512	1,626	0	0.0		0.0
Primaquine 7.5mg	Tablet	32,102	2,675	0	0.0		0.0
Primaquine 15mg	Tablet	212,517	17,710	0	0.0		0.0
RDT (SD Bioline®)	RDT	182,806	15,234	172,574	11.3	500,000	42.2
G6PD RDTs	RDT	8,802	734	0	0.0		0.0

Based on the estimated consumption from the services-based forecast, the months of stock for RDTs will increase to 42.2 MOS when the expected in-coming shipment of 500,000 is received in PSK's warehouse in November 2015.

2016 Malaria commodity and funding requirements

Commodity requirements

PSK's commodity requirements for Tier 2 in 2016 will be covered by the existing stocks of DHA-PPQ X 3, DHA-PPQ X 6 and DHA-PPQ X 9 tablets. The November 2015 shipment of 500,000 RDTs will meet the RDT needs for 2016. All commodity requirements for doxycycline, primaquine

and quinine tablets, and G6PD RDTs will need to be met. See the Commodity Gaps for 2016 in Table 16 below.

Table 16. Private sector 2016 Commodity Gap

Malaria Commodities	2016 Commodity Requirements*	Commitment by Commodity		2016 Commodity Gap
		GF	USAID/PMI	
DHA-PPQ X 3 tablets	0	4,800		0
DHA-PPQ X 6 tablets	0	6,600		0
DHA-PPQ X 9 tablets	0	48,600		0
RDT (SD Bioline®)	0			0
Doxycycline 100mg capsule	24,861			24,861
G6PD RDT	5,841			5,841
Primaquine 15mg X 100 tabs	141,118			141,118
Primaquine 3.75mg X 100 tabs	13,841			13,841
Primaquine 7.5mg X 100 tabs	21,331			21,331
Quinine 300mg tablet	102,130			102,130

*Commodity requirements of "0" means that demand is expected to be met by existing stocks

See Appendix 7 for the quantities and timing of the shipments needed in 2016 to be able to maintain program stock levels within the established maximum and minimum levels for the private sector. It also shows when the current commitments from the GF will be expected in country.

Funding requirements

The funding requirements for procurement of malaria commodities for the private sector in 2016 are shown in Table 17 below. The total funding commitment from the Global Fund for 2016 is $64,338.00, leaving a Funding Gap of $294,886.89.

Table 17. Private Sector 2016 Funding Gap

Malaria Commodities	Unit Cost	2016 Funding Requirements*	Cost of committed commodities		2016 Funding Gap
			GF	USAID/PMI	
DHA-PPQ X 3 tablets	$1.98	0	$9,504.00		$0.00
DHA-PPQ X 6 tablets	$1.46	0	$9,636.00		$0.00
DHA-PPQ X 9 tablets	$0.93	0	$45,198.00		$0.00
RDT (SD Bioline*)	$0.45	$0			$0.00
Doxycycline 100mg capsule	$0.01	$268.50			$268.50
G6PD RDT	$0.45	$2,628.45			$2,628.45
Primaquine 15mg X 100tabs	$1.58	$223,248.68			$223,248.68
Primaquine 3.75mg X 100 tabs	$1.58	$21,896.46			$21,896.46
Primaquine 7.5mg X 100 tabs	$2.00	$42,555.35			$42,555.35
Quinine 300mg tablet	$0.04	$4,289.46			$4,289.46
		$359,224.89	**$64,338.00**	**$0.00**	**$294,886.89**

* Funding requirements of "$0" means that commodity requirements are expected to be met by existing stocks

Commodity requirements

The quantities of DHA-PPQ X 3 and DHA-PPQ X 6 required for treatment of Tier 2 malaria cases in 2017 will be covered by existing stocks, and the 7,297 tablets of DHA-PPQ X 9 required will be met by the GF 2017 commitment of 40,500. The shipment of 500,000 RDTs expected in November 2015 will also meet the 2017 RDT requirements. All commodity requirements for doxycycline, primaquine and quinine tablets, and G6PD RDTs will need to be met. See the Commodity Gaps for 2017 in Table 18 below.

Table 18. Private Sector 2017 Commodity Gap

Malaria Commodities	2017 Commodity Requirements*	Commitment by Commodity		2017 Commodity Gap
		GF	USAID	
DHA-PPQ X 3 tablets	0	4,000		0
DHA-PPQ X 6 tablets	0	5,500		0
DHA-PPQ X 9 tablets	7,297	40,500		0
RDT (SD Bioline*)	344,270			344,270
Doxycycline 100mg capsule	16,638			16,638
G6PD RDT	3,533			3,533
Primaquine 15mg X 100tabs	94,328			94,328
Primaquine 3.75mg X 100 tabs	8,618			8,618
Primaquine 7.5mg X 100 tabs	15,637			15,637
Quinine 300mg tablet	68,263			68,263

*Commodity requirements of "0" means that demand is expected to be met by existing stocks at the end of 2016

See Appendix 8 for the quantities and timing of the shipments needed in 2017 to be able to maintain program stock levels within the established maximum and minimum levels for the private sector. It also shows when the current commitments from the GF will be expected in country.

Funding requirements

The funding requirements for procurement of malaria commodities for the private sector in 2017 are shown in Table 19 below. The total funding commitment from the Global Fund for 2017 is $37,665.00, leaving a Funding Gap of $353,614.47.

Table 19. Private Sector 2017 Funding Gap

Malaria Commodities	Unit Cost	2017 Funding Requirements*	Cost of committed commodities		2017 Funding Gap
			GF	USAID/PMI	
DHA-PPQ X 3 tablets	$1.98	0	$7,920.00		$0.00
DHA-PPQ X 6 tablets	$1.46	0	$8,030.00		$0.00
DHA-PPQ X 9 tablets	$0.93	$6,786.21.	$37,665.00		$0.00
RDT-Bioline*	$0.45	$154,921.50			$154,921.50
Doxycycline 100mg capsule	$0.01	$179.69			$179.69
G6PD RDT	$0.45	$1,589.85			$1,589.85
Primaquine 15mg X 100tabs	$1.58	$149,226.90			$149,226.90
Primaquine 3.75mg X 100 tabs	$1.58	$13,633.68			$13,633.68
Primaquine 7.5mg X 100 tabs	$2.00	$31,195.82			$31,195.82
Quinine 300mg tablet	$0.04	$2,867.05			$2,867.05
		$391,279.47	**$37,665.00**	**$0.00**	**$353,614.47**

* Funding requirements of "$0" means that commodity requirements are expected to be met by existing stocks at the end of 2016

Total Funding Gap for procurement of malaria commodities for 2016 and 2017

The total funding gap for procurement of malaria commodities to cover public and private sector needs in 2016 and 2017 is $1,415,868.85 and $648,501.37 respectively. The details of the funding gaps by year and by sector are shown in Table 20 below. Note that the 2016 and 2017 commodity funding commitments have already been subtracted from the total funding gap.

Table 20. Total Funding Gap (public and private sectors)

	Funding Source	Public		Private	
		2016	2017	2016	2017
Total Cost of Malaria Commodities		$990,215.88	$873,207.48	$294,886.89	$360,400.68
Cost of Committed Commodities	Global Fund	$147,942.81	$231,564.12	$64,338.00	$53,615.00
	USAID/PMI	$69,577.74	?	?	?
	MOH	?	?	?	?
	WHO	?	?	?	?
	MSF	?	?	?	?
	Other	?	?	?	?
Commitments from future Budget Allocations	Global Fund	?	?	?	?
	USAID/PMI	?	?	?	?
	MOH	?	?	?	?
	WHO	?	?	?	?
	MSF	?	?	?	?
	Other	?	?	?	?
Total Funding Gap by Year/Sector		**$773,208.69**	**$642,659.97**	**$294,886.89**	**$353,614.47**

	Funding Source	Public		Private	
		2016	2017	2016	2017
Total Funding Gap by Sector		**$1,415,868.65**		**$648,501.37**	
Total Funding Gap			**$2,064,370.02**		

Recommendations

MOH Adoption and Dissemination of the Quantification Outputs

The national malaria program (CNM) should adopt and formally present the results of the malaria commodities quantification to government, donor agencies, and partners. This will enable the program to—

- create awareness of the magnitude of the resources needed to support implementation of the malaria pre-elimination strategy,
- encourage government to increase funding commitments to the national program,
- receive feedback on the forecasting and supply planning assumptions agreed on during the workshop,
- create a platform for government to gain insight into and coordinate donor plans and inputs for commodity support for the national malaria control program,
- present the national stock status of malaria commodities to all stakeholders, and outline the actions required to maintain adequate stock levels to avert overstocks and stockouts of key malaria products.

Resource Mobilization to Meet 2016-2017 Malaria Commodity Needs

The results of the quantification should be used to advocate for mobilization of resources to meet future commodity needs and address the funding gaps identified. One of the outputs of the national quantification was to identify the malaria commodity funding commitments and gaps for 2016 and 2017. This provides policymakers with data to make more informed decisions about commodity procurements, and also serve as an advocacy tool for mobilizing resources to secure the commodities needed to support malaria testing and treatment as the country moves towards elimination.

Routine Monitoring and Six Month Review and Update of the Quantification

- Routine monitoring of product consumption and malaria services data, and assessment of the stock status (months of stock) for each product should be conducted on a monthly or at least a quarterly basis.
- CNM should institute a six month review and update of the national quantification to compare the forecasted consumption against the actual consumption and malaria services data, review the forecasting data and assumptions, assess the current stock status, and adjust the supply plan to

reflect the actual consumption and shipments received since the national quantification exercise. This will involve confirming the current stock on hand, the status of ongoing procurements, received shipments, funding commitments, planned procurements, and shipment delivery schedules. Adjustments to the two year forecast and supply plan should be made based on the six month review, and the period of the quantification should be extended six months to cover the next two year period.

- A forecast accuracy exercise should be conducted at the beginning of each quantification exercise and six month review to measure how closely actual program performance compared to the forecast, discuss the reasons for the differences amongst the stakeholders, and to adjust the forecasting data and assumptions as needed to improve forecast accuracy.

Increase Visibility of Logistics Data

- Use of central level stock on hand alone for supply planning is imperfect as it assumes zero level stock at the operational district (OD) and health facility levels. The impact of these assumptions implies that the current and future stock status (months of stock) is likely higher than estimated. To improve malaria commodities logistics management from the current level of operation, an effort should be made to routinely collect and analyze logistics data from ODs and health facilities for better informed decision making.
- The logistics management information system (LMIS) should be redesigned. The redesign should be broadened to involve a full logistics system design that will include LMIS data collection and reporting system; defined inventory control parameters for all levels; implementable distribution schedules; and defined roles and responsibilities that will link all stakeholders together from the central and OD levels to health facilities with a good network of information sharing, commodity flow, and timelines for action. This will also help to ensure that OD and health facility information will be available for future quantification exercises.
- A logistics committee or Logistics Management Unit (LMU) should be established at CNM with responsibility for monitoring consumption and stock status of malaria commodities, and adjusting the supply plans on a quarterly basis. This does not mean that the forecasts will need to be adjusted quarterly, rather they are to be updated twice per year. (see earlier recommendation on six month review of the forecast and supply plan).

Adherence to National Treatment Guidelines

- Cambodia has two treatment protocols for malaria depending on the geographical region where the infection was acquired. If infection occurs in a Tier-1 province where resistance to the current first line treatment (DHA-PPQ) has been confirmed, then the first line treatment is now Artesunate Mefloquine (ASMQ). The remaining provinces where resistance has not been confirmed are classified as Tier-2 provinces, and the first line treatment continues to be DHA-PPQ. In practice, it has been reported that failure of the first line treatment in a Tier 1 province (ASMQ) has resulted in the use of the Tier-2 first line treatment (DHA-PPQ), rather than the recommended Tier-1 second line treatment (Quinine plus doxycycline or tetracycline) as indicated in the recently updated national treatment guidelines. Therefore, CNM should focus on dissemination and monitoring of prescribing practices to ensure adherence to the new treatment guidelines.

- Policy decisions and changes to the national treatment guidelines should consider provider training needs and supportive supervision to ensure compliance with new protocols and correct use of new products, (such as failure on first-line and retreatment with doxycycline/tetracycline, G6PD testing, PQ treatment, and AS suppositories). Adequate resources and materials should be allocated, and the timing of provider training should be coordinated to ensure that new treatment policies do not result in new products being procured that providers have not been trained to use, which can result in product losses due to wastage and expiry.
- Procurement of the appropriate dosage forms of ASMQ 25/50mg for treatment of infants and children is recommended, rather than relying on providers to split ASMQ 100mg/200mg tablets into halves or quarters. This will facilitate correct prescribing and dispensing practices, and ensure that patients receive the most effective treatment according to the national treatment guidelines.

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Appendix 1. Participant List

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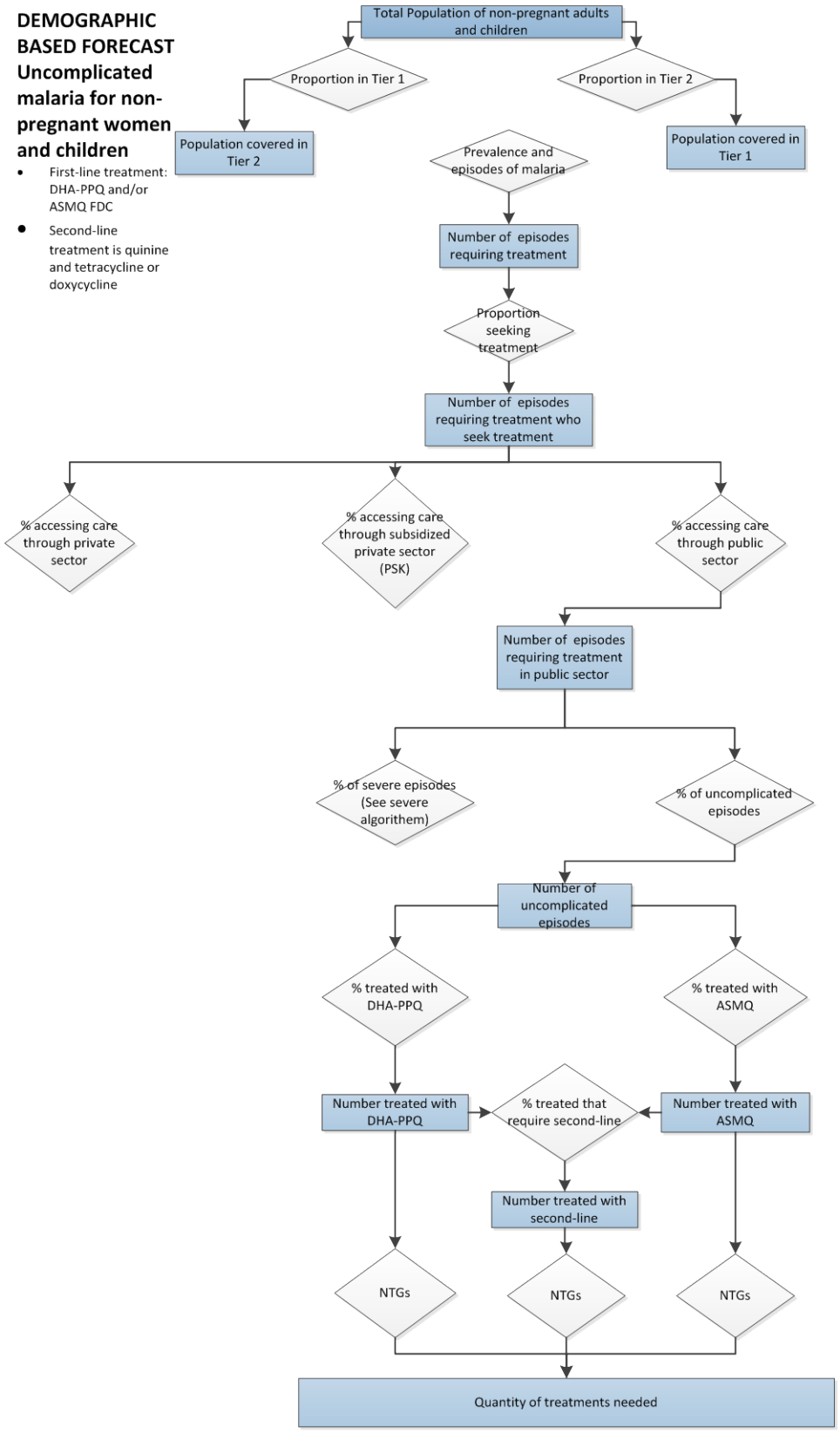
Appendix 2. Forecasting Algorithms

DEMOGRAPHIC BASED FORECAST
Uncomplicated malaria for non-pregnant women and children

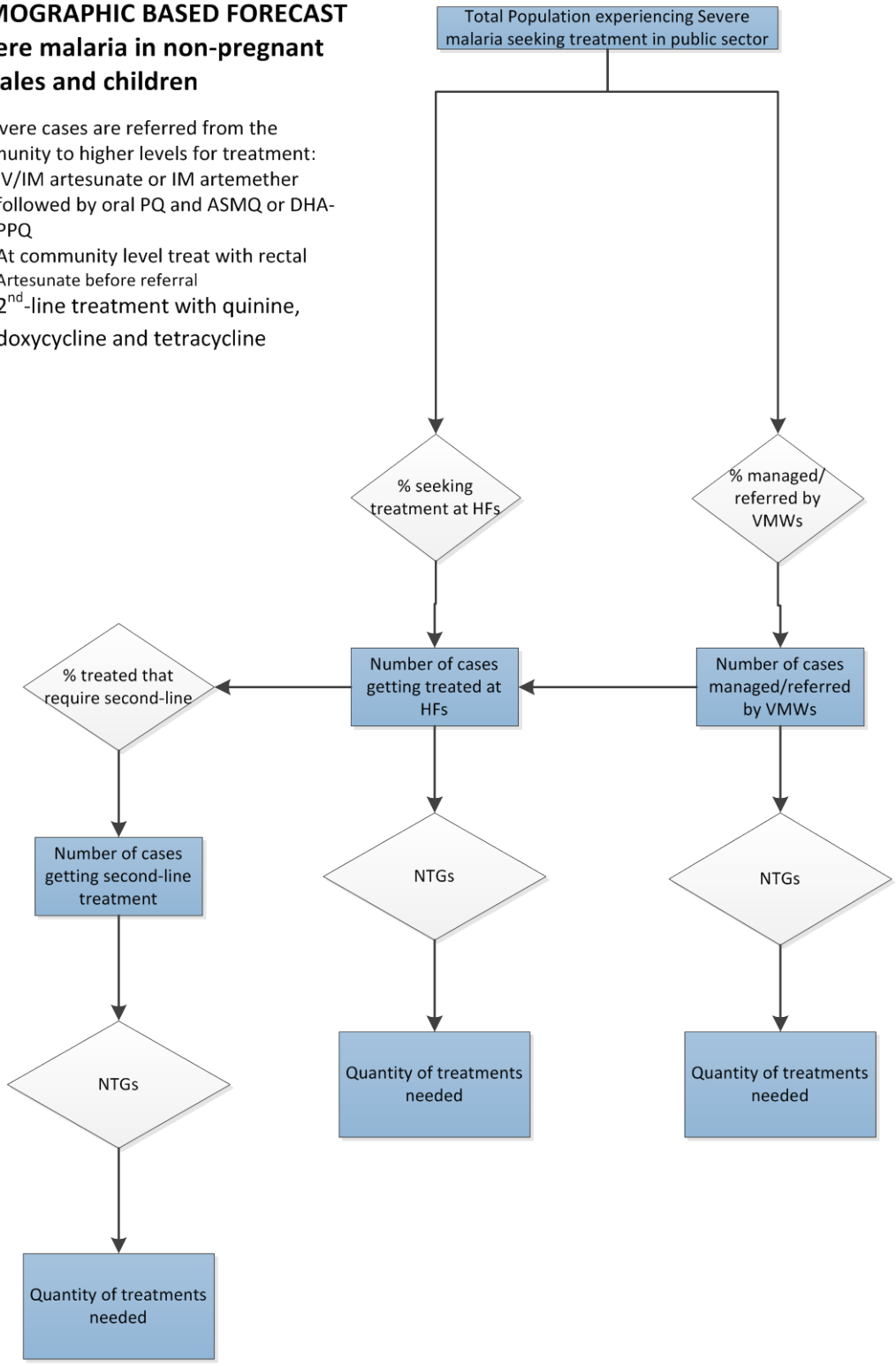
- First-line treatment: DHA-PPQ and/or ASMQ FDC
- Second-line treatment is quinine and tetracycline or doxycycline



DEMOGRAPHIC BASED FORECAST
Severe malaria in non-pregnant females and children

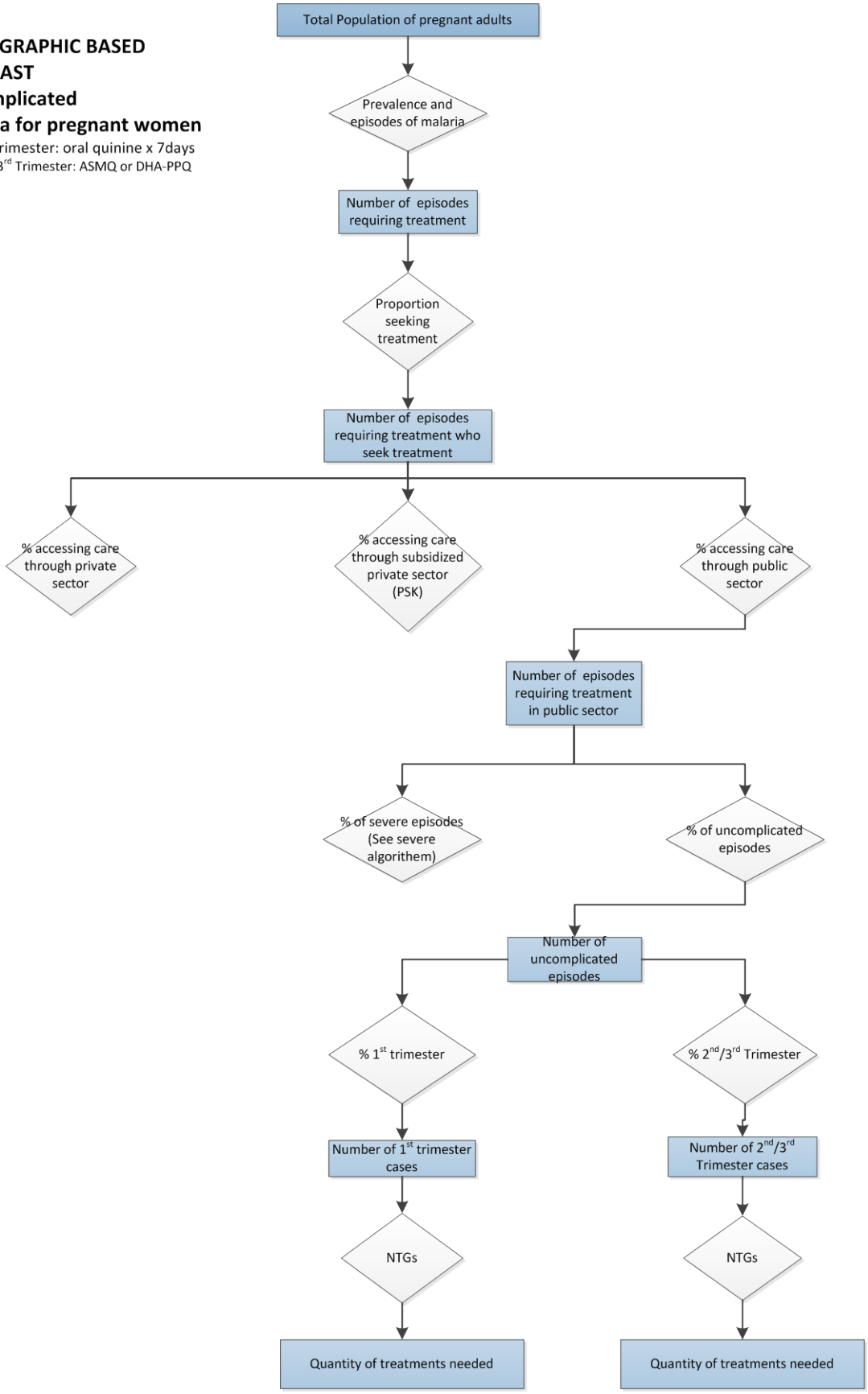
All severe cases are referred from the community to higher levels for treatment:

- IV/IM artesunate or IM artemether followed by oral PQ and ASMQ or DHA-PPQ
- At community level treat with rectal Artesunate before referral
- 2nd-line treatment with quinine, doxycycline and tetracycline



DEMOGRAPHIC BASED FORECAST
Uncomplicated Malaria for pregnant women

- 1st trimester: oral quinine x 7days
- 2nd/3rd Trimester: ASMQ or DHA-PPQ

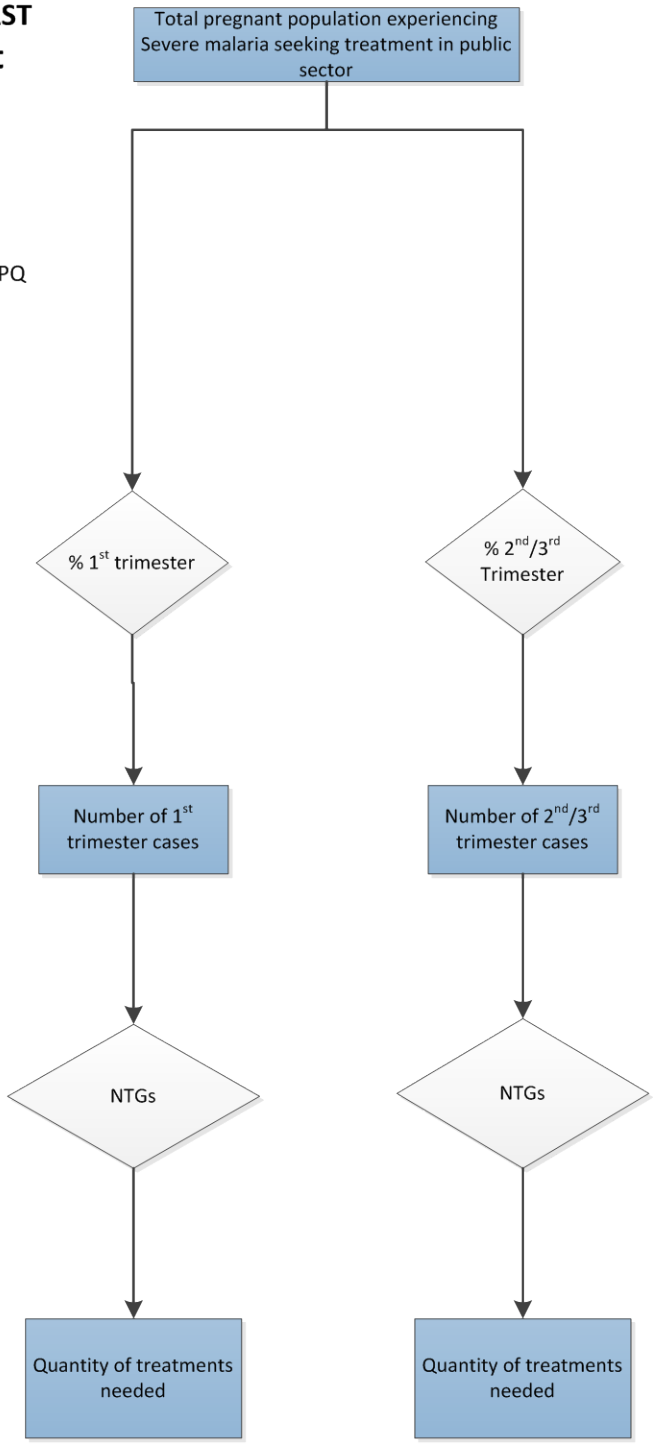


DEMOGRAPHIC BASED FORECAST

Severe malaria in pregnant women

All severe cases are referred from the community to higher levels for treatment:

- 1st trimester: IV quinine and tabs
- 2nd/3rd trimester: IV artesunate then ASMQ, or IM artemether then DHA-PPQ
- At community level treat with rectal artesunate before referral



Appendix 3. Variables used in the Demographic-based Forecast

Public Sector (Tier-1 and Tier-2) and Private Sector (Tier-1)

Variables	2015	2016	2017	Data Source
Population				2008 National Census
Growth Rate	1.54%			2008 National Census
Population of Pregnant Women	2.88%			CIA 2015 Estimation
Population in Tier-1 area	31%	31%	31%	Population proportion in Tier-1 and Tier-2 provinces
Population in Tier-2	69%	69%	69%	
Cases (APIs) of Malaria in Tier-1	0.74%	0.74%	0.74%	Using API data, weighted average by area.
Cases (APIs) of Malaria in Tier-2	0.28%	0.28%	0.28%	
Proportion that may seek treatment in Tier-1	89.70%			CMS 2013. Pg 67
Proportion that may seek treatment in Tier-2				
Proportion that will seek care from Public and Private Sector in Tier-1	39.90%	100%	100%	Are assuming in this area that source of malaria products will only be from CNM, based on policy change in 2016.
Proportion that will seek care from Public Sector in Tier-2	39.90%	44%	44%	Table 5.5 (included VMWs, Health facilities, and half of the pharmacy/shops and other)
Proportion of Uncomplicated Malaria	97.32%			Calculated average of Uncomplicated fever to Severe fever for 2015 using MIS data

Private Sector (Tier-2)

NOTE: Only variables that are different from above are included:

Proportion that will seek care from Public and Private Sector in Tier-1	60.10%	0%	0%	Are assuming in this area that source of malaria products will only be from CNM, based on policy change in 2016.
Proportion that will seek care from Public Sector in Tier-2	60.10%	56%	56%	Table 5.5 (included VMWs, Health facilities, and half of the pharmacy/shops and other)

Appendix 4. Variables used in the Services-based Forecast

Sector	Variable	2015	2016	2017	Data Source
Public sector and Tier-1 Private Providers	Number of uncomplicated malaria cases	49,400	50,161	50,934	2014 MIS cases plus PPM in Tier-1
	Number of severe malaria cases	1,661	1,687	1,712	
	Number of RDTs reported used by Services data	257,325	261,288	265,312	
Private sector in Tier-2	Number of RDTs reported used by Services data	32,446	32,946	33,453	PPM in Tier-2 2014
	Number of uncomplicated malaria cases reported in Tier-2 provinces	6,202	6,298	6,395	

Appendix 5. 2016 Public Sector Commodity and Funding Requirements

Product	Receive/ Expected Date	Supplier	Funding	Quantity	Status	Commodity Requirements	Commitment by Commodity		2016 Commodity Gap	Unit Cost	2016 Funding Requirements	Cost of commited commodities		2016 Funding Gap
							GF	USAID				GF	USAID	
Artesunate 60mg vial	1/31/2016	Unknown	None Selected	41476	Planned									
Artesunate 60mg vial	3/31/2016	UNOPS	Global Fund	5000	Ordered									
Artesunate 60mg vial	6/30/2016	Unknown	None Selected	24595	Planned									
Artesunate 60mg vial	10/31/2016	Unknown	None Selected	21025	Planned									
Artesunate 60mg vial				92096		92,096	5,000		87,096	$3.800	$349,964.80	$19,000.00	$0.00	$330,964.80
Artesunate suppository 200mg	1/31/2016	Unknown	None Selected	2154	Planned									
Artesunate suppository 200mg	6/30/2016	Unknown	None Selected	1012	Planned									
Artesunate suppository 200mg	11/30/2016	Unknown	None Selected	1254	Planned									
Artesunate suppository 200mg				4420		4,420			4,420	$0.625	$2,762.50	$0.00	$0.00	$2,762.50
Artesunate suppository 50mg	1/31/2016	Unknown	None Selected	264	Planned									
Artesunate suppository 50mg	6/30/2016	Unknown	None Selected	110	Planned									
Artesunate suppository 50mg	10/31/2016	Unknown	None Selected	134	Planned									
Artesunate suppository 50mg				508		508			508	$0.350	$177.80	$0.00	$0.00	$177.80
Artesunate/Mefloquine 100/200mg X 3 tablets	1/31/2016	Unknown	None Selected	280	Planned									
Artesunate/Mefloquine 100/200mg X 3 tablets	3/31/2016	USAID	USAID	1042	Ordered									
Artesunate/Mefloquine 100/200mg X 3 tablets	11/30/2016	Unknown	None Selected	574	Planned									
Artesunate/Mefloquine 100/200mg X 3 tablets				1896		1,896		1,042	854	$2.170	$4,114.32	$0.00	$2,261.14	$1,853.18
Artesunate/Mefloquine 100/200mg X 6 tablets	1/31/2016	Unknown	None Selected	3229	Planned									
Artesunate/Mefloquine 100/200mg X 6 tablets	3/31/2016	UNOPS	Global Fund	12182	Ordered									
Artesunate/Mefloquine 100/200mg X 6 tablets	3/31/2016	USAID	USAID	19799	Ordered									
Artesunate/Mefloquine 100/200mg X 6 tablets				35210		35,210	12,182	19,799	3,229	$3.400	$119,714.00	$41,418.80	$67,316.60	$10,978.60
DHA-PPQ X 9 tablets	3/31/2016	UNOPS	Global Fund	15379	Ordered									
DHA-PPQ X 9 tablets	3/31/2016	UNOPS	Global Fund	15379	Ordered									
DHA-PPQ X 9 tablets				30758		30,758	30,758		0	$0.930	$28,604.94	$28,604.94	$0.00	$0.00
Doxycycline 100mg capsule	1/31/2016	Unknown	None Selected	170313	Planned									
Doxycycline 100mg capsule	6/30/2016	Unknown	None Selected	65505	Planned									
Doxycycline 100mg capsule	11/30/2016	Unknown	None Selected	66297	Planned									
Doxycycline 100mg capsule				302115		302,115			302,115	$0.011	$3,262.84	$0.00	$0.00	$3,262.84
G6PD RDT	1/31/2016	Unknown	None Selected	37601	Planned									
G6PD RDT	7/31/2016	Unknown	None Selected	24522	Planned									
G6PD RDT	12/31/2016	Unknown	None Selected	14906	Planned									
G6PD RDT				77029		77,029			77,029	$0.450	$34,663.05	$0.00	$0.00	$34,663.05
Primaquine 15mg X 100tabs bottle	1/31/2016	Unknown	None Selected	2809	Planned									
Primaquine 15mg X 100tabs bottle	3/31/2016	UNOPS	Global Fund	5932	Ordered									
Primaquine 15mg X 100tabs bottle	6/30/2016	Unknown	None Selected	4607	Planned									
Primaquine 15mg X 100tabs bottle	10/31/2016	Unknown	None Selected	3823	Planned									
Primaquine 15mg X 100tabs bottle				17171		17,171	5,932		11,239	$1.582	$27,164.52	$9,384.42	$0.00	$17,780.10
Primaquine 3.75mg X 100 tabls bottle	1/31/2016	Unknown	None Selected	835	Planned									
Primaquine 3.75mg X 100 tabls bottle	6/30/2016	Unknown	None Selected	398	Planned									
Primaquine 3.75mg X 100 tabls bottle	11/30/2016	Unknown	None Selected	483	Planned									
Primaquine 3.75mg X 100 tabls bottle				1716		1,716			1,716	$1.582	$2,714.71	$0.00	$0.00	$2,714.71
Primaquine 7.5mg X 100 tabs bottle	1/31/2016	Unknown	None Selected	1375	Planned									
Primaquine 7.5mg X 100 tabs bottle	6/30/2016	Unknown	None Selected	641	Planned									
Primaquine 7.5mg X 100 tabs bottle	10/31/2016	Unknown	None Selected	689	Planned									
Primaquine 7.5mg X 100 tabs bottle				2705		2,705			2,705	$1.995	$5,396.48	$0.00	$0.00	$5,396.48
Quinine 300mg tablet	1/31/2016	Unknown	None Selected	638726	Planned									
Quinine 300mg tablet	7/31/2016	Unknown	None Selected	333244	Planned									
Quinine 300mg tablet	11/30/2016	Unknown	None Selected	316618	Planned									
Quinine 300mg tablet				1288588		1,288,588			1,288,588	$0.042	$54,120.70	$0.00	$0.00	$54,120.70
Quinine 600mg/2ml ampoule	1/31/2016	Unknown	None Selected	5234	Planned									
Quinine 600mg/2ml ampoule	7/31/2016	Unknown	None Selected	3370	Planned									
Quinine 600mg/2ml ampoule	12/31/2016	Unknown	None Selected	2079	Planned									
Quinine 600mg/2ml ampoule				10683		10,683			10,683	$0.204	$2,179.33	$0.00	$0.00	$2,179.33
RDT - Bioline*	3/31/2016	UNOPS	Global Fund	110077	Ordered									
RDT - Bioline*	4/30/2016	Unknown	None Selected	242249	Planned									
RDT - Bioline*	8/31/2016	Unknown	None Selected	438539	Planned									
RDT - Bioline*				790865		790,865	110,077		680,788	$0.450	$355,889.25	$49,534.65	$0.00	$306,354.60
											$990,729.24	**$147,942.81**	**$69,577.74**	**$773,208.69**

Appendix 6. 2017 Public Sector Commodity and Funding Requirements

Product	Receive/ Expected Date	Supplier	Funding	Quantity	Status	2017 Commodity Requirements	Commitment by Commodity		2017 Commodity Gap	Unit Cost	2017 Funding Requirements	Cost of commited commodities		2017 Funding Gap
							GF	USAID				GF	USAID	
Artesunate 60mg vial	3/30/2017	UNOPS	Global Fund	6000	Ordered									
Artesunate 60mg vial	6/30/2017	Unknown	None Selected	22436	Planned									
Artesunate 60mg vial	10/31/2017	Unknown	None Selected	24403	Planned									
Artesunate 60mg vial				52839		52,839	6000		46,839	$3.800	$200,788.20	$22,800.000	$0.000	$177,988.20
Artesunate suppository 200mg	6/30/2017	Unknown	None Selected	937	Planned									
Artesunate suppository 200mg	10/31/2017	Unknown	None Selected	1092	Planned									
Artesunate suppository 200mg				2029		2,029			2,029	$0.625	$1,268.13	$0.000	$0.000	$1,268.13
Artesunate suppository 50mg	6/30/2017	Unknown	None Selected	127	Planned									
Artesunate suppository 50mg	10/31/2017	Unknown	None Selected	134	Planned									
Artesunate suppository 50mg				261		261			261	$0.350	$91.35	$0.000	$0.000	$91.35
Artesunate/Mefloquine 100/200	3/31/2017	Unknown	None Selected	411	Planned									
Artesunate/Mefloquine 100/200	6/30/2017	Unknown	None Selected	798	Planned									
Artesunate/Mefloquine 100/200	10/31/2017	Unknown	None Selected	792	Planned									
Artesunate/Mefloquine 100/200mg X 3 tablets				2001		2,001			2,001	$2.170	$4,342.17	$0.000	$0.000	$4,342.17
Artesunate/Mefloquine 100/200	3/30/2017	UNOPS	Global Fund	12440	Ordered	12,440	12440		0	$3.400	$42,296.00	$42,296.000	$0.000	$0.00
DHA-PPQ X 6 tablets	9/30/2017	Unknown	None Selected	1627	Planned	1,627			1,627	$1.460	$2,375.42	$0.000	$0.000	$2,375.42
DHA-PPQ X 9 tablets	3/30/2017	UNOPS	Global Fund	14513	Ordered									
DHA-PPQ X 9 tablets	3/30/2017	UNOPS	Global Fund	14513	Ordered									
DHA-PPQ X 9 tablets	9/30/2017	Unknown	None Selected	25741	Planned									
DHA-PPQ X 9 tablets				54767		54,767	29026		25,741	$0.930	$50,933.31	$26,994.180	$0.000	$23,939.13
Doxycycline 100mg capsule	4/30/2017	Unknown	None Selected	67942	Planned									
Doxycycline 100mg capsule	9/30/2017	Unknown	None Selected	66515	Planned									
Doxycycline 100mg capsule				134457		134,457			134,457	$0.011	$1,452.14	$0.000	$0.000	$1,452.14
G6PD RDT	5/31/2017	Unknown	None Selected	16110	Planned									
G6PD RDT	10/31/2017	Unknown	None Selected	19618	Planned									
G6PD RDT				35728		35,728			35,728	$0.450	$16,077.60	$0.000	$0.000	$16,077.60
Primaquine 15mg X 100tabs bot	3/30/2017	UNOPS	Global Fund	5598	Ordered									
Primaquine 15mg X 100tabs bot	11/30/2017	Unknown	None Selected	5355	Planned									
Primaquine 15mg X 100tabs bottle				10953		10,953	5598		5,355	$1.582	$17,327.65	$8,856.036	$0.000	$8,471.61
Primaquine 3.75mg X 100 tabls b	7/31/2017	Unknown	None Selected	518	Planned									
Primaquine 3.75mg X 100 tabls b	12/31/2017	Unknown	None Selected	290	Planned									
Primaquine 3.75mg X 100 tabls bottle				808		808			808	$1.582	$1,278.26	$0.000	$0.000	$1,278.26
Primaquine 7.5mg X 100 tabs bo	6/30/2017	Unknown	None Selected	717	Planned									
Primaquine 7.5mg X 100 tabs bo	10/31/2017	Unknown	None Selected	696	Planned									
Primaquine 7.5mg X 100 tabs bottle				1413		1,413			1,413	$1.995	$2,818.94	$0.000	$0.000	$2,818.94
Quinine 300mg tablet	7/31/2017	Unknown	None Selected	335277	Planned									
Quinine 300mg tablet	11/30/2017	Unknown	None Selected	315103	Planned									
Quinine 300mg tablet				650380		650,380			650,380	$0.042	$27,315.96	$0.000	$0.000	$27,315.96
Quinine 600mg/2ml ampoule	6/30/2017	Unknown	None Selected	2345	Planned									
Quinine 600mg/2ml ampoule	10/31/2017	Unknown	None Selected	2636	Planned									
Quinine 600mg/2ml ampoule				4981		4,981			4,981	$0.204	$1,016.12	$0.000	$0.000	$1,016.12
RDT - Bioline*	3/30/2017	UNOPS	Global Fund	290262	Ordered									
RDT - Bioline*	6/30/2017	Unknown	None Selected	423223	Planned									
RDT - Bioline*	10/31/2017	Unknown	None Selected	408388	Planned									
RDT - Bioline*				1121873		1,121,873	290262		831,611	$0.450	$504,842.85	$130,617.900	$0.000	$374,224.95
											$874,224.08	**$231,564.116**	**$0.000**	**$642,659.97**

Appendix 7. 2016 Private Sector Commodity and Funding Requirements

Product	Receive/ Expected Date	Supplier	Funding	Quantity	Status	2016 Commodity Requirements	Commitment by Commodity		2016 Commodity Gap	Unit Cost	2016 Funding Requirements	Cost of commited commodities		2016 Funding Gap
							GF	USAID				GF	USAID	
DHA-PPQ X 3 tablets	3/30/2016	UNOPS	Global Fund	4,800	Ordered	4,800	4,800		0	$1.98	$9,504.00	$9,504.00		$0.00
DHA-PPQ X 6 tablest	3/30/2016	UNOPS	Global Fund	6,600	Ordered	6,600	6,600		0	$1.46	$9,636.00	$9,636.00		$0.00
DHA-PPQ X 9 tablets	3/30/2016	UNOPS	Global Fund	48,600	Ordered	48,600	48,600		0	$0.93	$45,198.00	$45,198.00		$0.00
Doxycycline 100mg capsule	1/31/2016	Unknown	None Selected	8,577	Planned									
Doxycycline 100mg capsule	6/30/2016	Unknown	None Selected	8,100	Planned									
Doxycycline 100mg capsule	11/30/2016	Unknown	None Selected	8,184	Planned									
Doxycycline 100mg capsule				24,861		24861			24,861	$0.01	$268.50	$0.00		$268.50
G6PD RDT	1/31/2016	Unknown	None Selected	2,019	Planned									
G6PD RDT	6/30/2016	Unknown	None Selected	1,905	Planned									
G6PD RDT	11/30/2016	Unknown	None Selected	1,917	Planned									
G6PD RDT				5,841		5841			5,841	$0.45	$2,628.45	$0.00		$2,628.45
Primaquine 15mg X 100tabs	1/31/2016	Unknown	None Selected	48,644	Planned									
Primaquine 15mg X 100tabs	6/30/2016	Unknown	None Selected	45,955	Planned									
Primaquine 15mg X 100tabs	11/30/2016	Unknown	None Selected	46,519	Planned									
Primaquine 15mg X 100tabs				141,118		141118			141,118	$1.58	$223,248.68	$0.00		$223,248.68
Primaquine 3.75mg X 100 tabs	1/31/2016	Unknown	None Selected	4,463	Planned									
Primaquine 3.75mg X 100 tabs	7/31/2016	Unknown	None Selected	5,064	Planned									
Primaquine 3.75mg X 100 tabs	12/31/2016	Unknown	None Selected	4,314	Planned									
Primaquine 3.75mg X 100 tabs				13,841		13841			13,841	$1.58	$21,896.46	$0.00		$21,896.46
Primaquine 7.5mg X 100 tabs	1/31/2016	Unknown	None Selected	7,343	Planned									
Primaquine 7.5mg X 100 tabs	6/30/2016	Unknown	None Selected	6,940	Planned									
Primaquine 7.5mg X 100 tabs	11/30/2016	Unknown	None Selected	7,048	Planned									
Primaquine 7.5mg X 100 tabs				21,331		21331			21,331	$2.00	$42,555.35	$0.00		$42,555.35
Quinine 300mg tablet	1/31/2016	Unknown	None Selected	35,214	Planned									
Quinine 300mg tablet	6/30/2016	Unknown	None Selected	33,260	Planned									
Quinine 300mg tablet	11/30/2016	Unknown	None Selected	33,656	Planned									
Quinine 300mg tablet				102,130		102130			102,130	$0.04	$4,289.46	$0.00		$4,289.46
											$359,224.89	**$64,338.00**		**$294,886.89**

Appendix 8. 2017 Private Sector Commodity and Funding Requirements

Product	Receive/ Expected Date	Supplier	Funding	Quantity	Status	2017 Commodity Requirements	Commitment by Commodity		2017 Commodity Gap	Unit Cost	2017 Funding Requirements	**Cost of commited commodities**		2017 Funding Gap
							GF	USAID				GF	USAID	
DHA-PPQ X 3 tablets	3/30/2017	UNOPS	Global Fund	4000	Ordered	4000	4000		0	$1.98	$7,920.00	$7,920.00		$0.00
DHA-PPQ X 6 tablest	3/30/2017	UNOPS	Global Fund	5500	Ordered	5500	5500		0	$1.46	$8,030.00	$8,030.00		$0.00
DHA-PPQ X 9 tablets	3/30/2017	UNOPS	Global Fund	40500	Ordered	40500	40500		0	$0.93	$37,665.00	$37,665.00		$0.00
Doxycycline 100mg capsule	4/30/2017	Unknown	None Selected	8413	Planned									
Doxycycline 100mg capsule	9/30/2017	Unknown	None Selected	8225	Planned									
Doxycycline 100mg capsule				16638		16638			16638	$0.01	$179.69	$0.00		$179.69
G6PD RDT	3/31/2017	Unknown	None Selected	1598	Planned									
G6PD RDT	8/31/2017	Unknown	None Selected	1935	Planned									
G6PD RDT				3533		3533			3533	$0.45	$1,589.85	$0.00		$1,589.85
Primaquine 15mg X 100tabs	4/30/2017	Unknown	None Selected	47663	Planned									
Primaquine 15mg X 100tabs	9/30/2017	Unknown	None Selected	46665	Planned									
Primaquine 15mg X 100tabs				94328		94328			94328	$1.58	$149,226.90	$0.00		$149,226.90
Primaquine 3.75mg X 100 tabs	5/31/2017	Unknown	None Selected	4345	Planned									
Primaquine 3.75mg X 100 tabs	10/31/2017	Unknown	None Selected	4273	Planned									
Primaquine 3.75mg X 100 tabs				8618		8618			8618	$1.58	$13,633.68	$0.00		$13,633.68
Primaquine 7.5mg X 100 tabs	4/30/2017	Unknown	None Selected	7189	Planned									
Primaquine 7.5mg X 100 tabs	10/31/2017	Unknown	None Selected	8448	Planned									
Primaquine 7.5mg X 100 tabs				15637		15637			15637	$2.00	$31,195.82	$0.00		$31,195.82
Quinine 300mg tablet	4/30/2017	Unknown	None Selected	34493	Planned									
Quinine 300mg tablet	9/30/2017	Unknown	None Selected	33770	Planned									
Quinine 300mg tablet				68263		68263			68263	$0.04	$2,867.05	$0.00		$2,867.05
RDT	1/17/2017	Unknown	None Selected	152018	Planned									
RDT	7/17/2017	Unknown	None Selected	192252	Planned									
RDT				344270		344270			344270	$0.45	$154,921.50	$0.00		$154,921.50
											$391,279.47	**$37,665.00**		**$353,614.47**

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