Assessment of the Availability and Quality of Antimalarials in the Public and Private Sectors of Ghana

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Strategic Objective 5

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About RPM Plus

RPM Plus works in more than 20 developing and transitional countries to provide technical assistance to strengthen drug and health commodity management systems. The program offers technical guidance and assists in strategy development and program implementation both in improving the availability of health commodities—pharmaceuticals, vaccines, supplies, and basic medical equipment—of assured quality for maternal and child health, HIV/AIDS, infectious diseases, and family planning and in promoting the appropriate use of health commodities in the public and private sectors.

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CONTENTS

ACRONYMS AND ABBREVIATIONS

ACT	artemisinin-based combination therapy
CC	community clinic
CMS	Central Medical Stores
DAS	Drug Availability Study
DHA	District Health Administration
DHMT	District Health Management Team
EML	essential medicines list
FDB	Food and Drugs Board
HC	health center
HPLC	high-performance liquid chromatography
ICB	international competitive bidding
IM	intramuscular
IP	International Pharmacopoeia
IPT	intermittent preventive treatment
IV	intravenous
MAC	Malaria Action Coalition
MIP	malaria in pregnancy
MoH	Ministry of Health
MSH	Management Sciences for Health
NMCP	National Malaria Control Programme
PMM	Pharmaceutical Management for Malaria
RBM	Roll Back Malaria
RMS	Regional Medical Store
RPM Plus	Rational Pharmaceutical Management Plus
SDP	Service Delivery Point
SP	sulfadoxine-pyrimethamine
USAID	U.S. Agency for International Development
USP	United States Pharmacopeia
USP DQI	United States Pharmacopeia Drug Quality and Information
WHO	World Health Organization

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- Staff, Food and Drugs Board
- Staff of public health facilities visited

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Ms. Irene Oppong
Ms. Gina Asare Odei
Mrs. Nana Yaa Mensah

EXECUTIVE SUMMARY

Purpose and Scope

The development of resistance to antimalarial medicines has prompted many countries, including Ghana, to review their antimalarial treatment policies to incorporate artemisinin-based combination therapies (ACTs). Currently ACTs are considered the best treatment for uncomplicated *plasmodium falciparum* malaria; however, successful implementation of such new antimalarial treatment policies is dependent on the level and efficiency of the health care delivery system, including the country's pharmaceutical management system. Without efficient pharmaceutical management systems, efforts to ensure that ACTs reach those without adequate resources will be compromised; yet wide coverage and accessibility by Ghanaians to recommended antimalarial medicines in both public and private sectors is essential to register ACT impact.

Since April 2003, Management Sciences for Health (MSH) has been working to support the Ghana National Malaria Control Programme (NMCP) within the Malaria Action Coalition (MAC)[1] in adopting initial appropriate policy for the treatment of malaria and the control of malaria in pregnancy (MIP). Following appropriate policy adoption in 2004, MSH is currently working to provide the NMCP and its support stakeholders with tools and technical assistance to obtain appropriate quality antimalarials, implement policy, and improve access to and promote the rational use of antimalarial commodities and services.

To obtain the relevant information for guiding effective implementation of Ghana's new antimalarial treatment policy, this assessment focused on providing data on the availability and quality of antimalarials used for preventing and treating malaria under Ghana's new antimalarial medicine policy.

Methods

The Rational Pharmaceutical Management (RPM) Plus assessment was done in two parts: (1) assessment of antimalarial availability, and (2) assessment of antimalarial quality.

The methodology for this assessment was based on the *Pharmaceutical Management for Malaria (PMM) Manual*, an indicator-based assessment tool developed by the Rational Pharmaceutical Management project in collaboration with the U.S. Agency for International Development (USAID). This assessment was limited to the PMM Drug Availability Study (DAS). The DAS was conducted to determine the degree to which the antimalarial medicines required for treating and preventing malaria are available.

[1] The MAC is a partnership among the Centers for Disease Control and Prevention, the MSH/Rational Pharmaceutical Management-Plus Program, the JHPIEGO/ACCESS Program, and the World Health Organization (both Geneva and AFRO offices).

The DAS was expanded to include the collection of samples of three main antimalarial medicines recommended by Ghana's new antimalarial treatment policy. Samples were collected at facilities surveyed for the DAS. The assessment took place from July 19 through July 30, 2004.

RPM Plus used four data collection techniques for the assessment: document reviews, key informant interviews, physical inventory checks, and sample collection. Data collection was carried out at the national, district, and health-facility levels in the public sector as well as the hospital and pharmaceutical retail outlet levels in the private sector. Analysis for the availability assessment took place in September 2004, and quality testing of sample antimalarials was done in July 2005.

Results, Conclusions, and Recommendations

Overall, almost two-fifths of the tracer antimalarial medicines investigated were absent in the facilities assessed. Some medicines, despite being on Ghana's essential medicines list (EML), were never available in any facility. A pattern of decreasing availability of medicines with increasing distance from the center of the distribution system was noted, with availability being higher at the Regional Medical Store (RMS) level and district/subdistrict store level and lower at the health facility level.

Analysis revealed that, overall, antimalarial medicines were out of stock 46.1 percent of the time over the study period. The overall average percentage of days out of stock appears high in facilities assessed, which does not indicate relatively ready access to antimalarial medicines for the Ghanaian population in the event of a policy change. A decreasing percentage correspondence of stock records for antimalarial medicines with physical counts was observed from the center of the distribution system to periphery.

The following results were obtained in antimalarial sample quality testing. Of 25 samples of sulfadoxine-pyrimethamine tested, 3 samples failed assay for sulfadoxine content. All the samples passed assay for pyrimethamine content. Four of the 25 samples failed dissolution for sulfadoxine, but none of the samples failed dissolution for pyrimethamine. Of 8 amodiaquine hydrochloride samples analyzed, 2 samples failed assay and 3 failed dissolution. A total of 12 artemisinin derivatives were identified as containing their respective active ingredients. Of these, 2 of 9 samples failed assay for artesunate. No artesunate sample failed dissolution. The only β-artemether sample analyzed failed assay. Dissolution did not apply to this sample as the product was a soft gelatin capsules. Two dihydroartemisinin tablet forms were analyzed. One failed dissolution.

As can be seen, the assessment revealed that the pharmaceutical management system responsible for the assurance of an uninterrupted supply of antimalarials to health facilities in Ghana is facing some challenges, which are evidenced by—

- Poor availability of antimalarial medicines in health facilities
- Stock-outs of antimalarial medicines within the public health system
- Inadequate inventory management at peripheral health facilities

In addition, the assessment revealed important quality deficiencies in sampled antimalarials that demonstrated a failure rate of 35.5 percent (16 of a total 45 antimalarial samples analyzed).

In light of such findings, the recommendations made in this report focus on improving pharmaceutical management and intensifying regulatory measures needed to maintain high quality of antimalarials.

INTRODUCTION

Background

Malaria, one of the major causes of poverty and low productivity, is hyperendemic and accounts for over 44 percent of reported outpatient visits and an estimated 22 percent of under-five mortality in Ghana (WHO 2005). To advance continuing malaria control efforts, in 1999 Ghana committed itself to the Roll Back Malaria (RBM) Initiative and developed a strategic framework to guide implementation. Overall, the Ghana RBM emphasizes strengthening health services and making effective prevention and treatment strategies more widely available. One of the four component strategies being pursued is improved case management—improving access to prompt and effective treatment. The effectiveness of this intervention is highly reliant on antimalarial medicines, which should be not only safe and effective, but also available, affordable, and acceptable to the population at risk.

Until 2004, chloroquine was the first-line therapy nationally recommended for the treatment of uncomplicated malaria in Ghana while sulfadoxine-pyrimethamine (SP) was reserved for use as second-line therapy. The emergence and spread of *P. falciparum* resistance to chloroquine in the country and the rapid spread of resistance to replacement sulfadoxine-pyrimethamine led to strong consensus in 2004 for making available and affordable a combination therapy for use in the first-line treatment of malaria. Currently, Ghana recommends artesunate + amodiaquine for the treatment of uncomplicated malaria. The new antimalarial treatment policy, which includes the use of sulfadoxine-pyrimethamine for intermittent preventive treatment (IPT) of malaria is summarized in Table 1.

Table 1. Ghana Antimalarial Treatment Policy

Condition	Recommendation	Dosage Form	Strength
Uncomplicated malaria (first-line treatment)	Artesunate + amodiaquine	Tablet	75 mg artesunate + 150 mg amodiaquine
Uncomplicated malaria (second-line treatment)	Quinine	Tablet	300 mg
Severe and complicated malaria	Quinine	Injection (intravenous [IV] or intramuscular [IM])	300 mg/ml in 2 ml ampoule
Prevention of malaria in pregnancy	IPT using SP	Tablet	Sulfadoxine 500 mg; pyrimethamine 25 mg
Treatment of uncomplicated malaria in pregnancy	Trimester 1: Quinine Trimesters 2 and 3: Quinine or artesunate + amodiaquine	Tablet Tablet Tablet	300 mg 300 mg 75 mg artesunate + 150 mg amodiaquine
Treatment of complicated malaria in pregnancy	The treatment of pregnant women with severe malaria shall be the same as the treatment of severe malaria for the general population.		

The treatment regimens are indicated in Table 2.

Table 2. Ghana Antimalarial Treatment Policy

Condition	Treatment Regimen
Uncomplicated malaria (first-line treatment)	Oral amodiaquine + artesunate Amodiaquine 10 mg/kg body weight + artesunate 4 mg/kg body weight daily for 3 days
Uncomplicated malaria (second-line treatment)*	Oral quinine *Child's dose:* 10 mg/kg body weight 8 hourly for 7 days + supportive therapy *Adult dose:* 600 mg 8 hourly for 7 days + supportive therapy
Severe and complicated malaria	*Outpatient management with quinine before referral:* 10 mg/kg body weight every 8 hours given intramuscularly over 4–8 hours in both children adults + supportive treatment and referral *Hospital management:* IV administration of quinine 10mg/kg body weight of salt (max. 600 mg) IV 8 hourly in 5–10 ml/kg of 4.3% dextrose in 0.18% normal saline or in 5% dextrose over 4–8 hours + supportive therapy. IM administration of quinine Deep IM injection at a dose of 10 mg/kg body weight 8 hourly using 100 mg/ml quinine (dilute 2 mls of 600 mg quinine in 4 mls of water for injection or saline) + supportive therapy. Oral administration Oral quinine at 10 mg per kg body weight every 8 hours to complete 7 days of treatment
Prevention of malaria in pregnancy	Under direct observation three treatment doses of SP *First dose:* First prenatal clinic visit after quickening (after 16 weeks of gestation) *Second dose:* At least one month after the first dose *Subsequent dose:* At least one month after the last dose but at least one month before delivery
Treatment of uncomplicated malaria in pregnancy	Trimester 1: Quinine tablets 600 mg 8 hourly for 7 days Trimester 2: Same as for trimester 1 or amodiaquine 10mg/kg body weight + artesunate 4mg/kg body weight daily for 3 days
Treatment of complicated malaria in pregnancy	Same as treatment for severe and complicated malaria above
Chemoprophylaxis	Proguanil 3 m/kg body weight daily

*Second-line treatment is administered for treatment failure and in cases where first-line treatment cannot be administered, such as when an adverse drug reaction or drug interaction occurs or any inherent condition prevents the use of the recommended first-line treatment.

Availability of Antimalarial Medicines

Medicines are an essential component of health care in Ghana, particularly in the case management of disease throughout the country. Effective case management for malaria requires that effective antimalarials are available and used appropriately in the correct formulations and amounts and according to an appropriate recommended regimen (RPM Plus 2004). When antimalarial medicines are unavailable, effective case management cannot be achieved and subsequent ineffective treatment can lead to recrudescent infections, thus requiring additional treatment, which can lead to increased cost and loss of productivity, complications, or death, and the development of resistance to limited antimalarial medicines.

Ensuring the availability of effective antimalarial medicines for the entire population is therefore a key element of the current Antimalarial Drug Policy in Ghana. The policy recognizes that without the availability of safe and effective antimalarial medicines at all levels of the health care system, appropriate recommended treatment regimens cannot be provided to patients when they need them. Ultimately, this failure would lead to a loss of confidence in the health system and seriously affect the health status of the population.

In addition to the public sector, the rapidly growing private sector in Ghana sees a significant proportion of patients. Private hospitals, pharmacies, chemical seller's shops, and private maternity homes provide the additional interface between medicines and patients or clients. The Antimalarial Drug Policy is cognizant of this interaction and aims to ensure an uninterrupted supply of antimalarials in private sector facilities as well.

Quality of Antimalarial Medicines

As in many developing countries, the poor quality of antimalarials presents an obstacle to malaria control in Ghana. Poor medicine quality also contributes to the growing resistance of the major parasite, *P. falciparum,* to cheap and affordable antimalarial therapies. Studies conducted by the World Health Organization (WHO 2003) identified several significant incidents of substandard antimalarial medicines within the Ghana pharmaceutical distribution chain. Medicines collected from the Ghanaian market displayed a high percentage of content failure and poor results on dissolution tests: 5 percent of chloroquine syrup, 66.7 percent of chloroquine tablets, and 37.5 percent of sulfadoxine-pyrimethamine tablets failed the content test; and 20 percent of chloroquine tablets and 75 percent of sulfadoxine-pyrimethamine tablets failed the dissolution test. At the time of the survey, Ghana was using chloroquine for first-line treatment of uncomplicated malaria.

When antimalarial medicines are of poor quality, resistance emerges to the medicines. Low bioavailability of the active ingredient in an antimalarial will lead to underdosage, which inevitably promotes the development of resistance to the respective medicine. In view of the potential danger that substandard antimalarial medicines are already posing in the fight against malaria in Ghana, and in midst of the change to new first-line medicines, consensus exists among

stakeholders[2] that definitive measures should be taken to make antimalarial medicines available and to strengthen quality control of the recommended medicines in the country. These stakeholders are currently working to ensure the accessibility of high quality, effective pharmaceuticals in the appropriate formulations and amounts and the appropriate use of these pharmaceuticals according to a correct regimen.

Since April 2003, Management Sciences for Health has been working to support the Ghana NMCP within the MAC initially to adopt appropriate policy for the treatment of malaria and the control of MIP and, since adoption of an appropriate policy in 2004, is currently working to provide the NMCP and its support stakeholders with tools and technical assistance for obtaining appropriate quality antimalarials, implementing policy, improving access to and promoting the rational use of antimalarial commodities and services.

Rationale for the Assessment

To obtain the relevant information to guide effective implementation of Ghana's new antimalarial treatment policy, this assessment focused on providing data on the availability and quality of antimalarials used for preventing and treating malaria under the new antimalarial drug policy in Ghana.

[2] The National Malaria Control Programme and the Reproductive Health unit of the Ghana Health Service; the Procurement and Supplies Directorate, Ministry of Health; and the Food and Drugs Board, Ghana's drug regulatory authority.

METHODOLOGY

The RPM Plus assessment was done in two parts: (1) assessment of antimalarial availability, and (2) assessment of antimalarial quality.

Methodology for the Assessment of Antimalarial Availability

The methodology for this assessment was based on the *Pharmaceutical Management for Malaria Manual* (RPM Plus 2004), an indicator-based assessment tool developed by the Rational Pharmaceutical Management project in collaboration with USAID. The *PMM Manual* is designed to guide the review of medicine availability and patterns of use of medicines for malaria treatment in public health facilities of the Ministry of Health (MoH) and in private facilities, pharmacies, and pharmaceutical retail outlets. Such reviews help diagnose existing or emergent problems in malaria pharmaceutical management and provide the evidence required for making decisions on how to improve access to, as well as the use of, antimalarial medicines in both the public and private sectors.

This particular assessment was limited to the PMM Drug Availability Study. The purpose of conducting the DAS was to determine the degree to which the antimalarial medicines required for treating and preventing malaria are available. In this study, three PMM indicators focusing on procurement and distribution were used to assess the availability of antimalarial medicines for the treatment of malaria within the public and private sectors of Ghana.

- Average percentage of a set of unexpired PMM antimalarial medicines available in MoH storage and health facilities

- Average percentage of time out of stock for a set of PMM antimalarial medicines in MoH storage and health facilities

- Average percentage of stock records that correspond with physical counts for a set of PMM antimalarial medicines in MoH storage and health facilities

RPM Plus used three data collection techniques for this aspect of the assessment: document reviews, key informant interviews, and physical inventory checks. Data collection was carried out at the national, district, and health-facility levels in the public sector as well as the hospital and pharmaceutical retail outlet levels in the private sector.

Table 3 provides a summary of the methodology for the antimalarial availability assessment.

Table 3. Summary of DAS Methodology

Methodology	Activities
National-level key informant interview and assessment of procurement and supply	**Target sites**: Procurement and Supply Directorate, Ministry of Health (Procurement, Central Medical Stores, Drug Policy Unit); National Malaria Control Program; Global Fund Secretariat; Food and Drugs Board; USAID, Health Population and Nutrition Office and WHO country office Collected background information on malaria epidemiology, malaria control, drug resistance, and existing malaria policies and reviewed reports relevant to antimalarials and the antimalarial pharmaceutical management system. Obtained overview of the MoH pharmaceutical management operations to identify any major problems that affect the movement of antimalarial medicines through the procurement and distribution system.
Regional-level key informant interviews	**Target persons**: RMS manager, Regional Medical Administrator Collected background information on malaria epidemiology, malaria control, drug resistance, and existing malaria policies and reviewed reports relevant to antimalarials and the antimalarial pharmaceutical management system. Obtained overview of the MoH pharmaceutical management operations to identify any major problems that affect the movement of antimalarial medicines through the procurement and distribution system.
Regional-level assessment of procurement and supply	**Target sites**: Regional Medical Stores Examined inventory records to determine basic elements of antimalarial stock on hand, quantity issued/dispensed, and losses and adjustments from April 2001 to March 2004. Examined stock cards and records and determined periods of stock-outs.
District-level assessment of procurement and supply	**Target sites**: District medical stores and district hospital medical stores Examined inventory records to determine basic elements of antimalarial stock on hand, quantity issued/dispensed, and losses and adjustments from April 2001 to March 2004. Examined stock cards and records and determined periods of stock-outs.
Ministry of Health facility assessment of procurement and supply	**Target sites**: District hospital/health center/community clinic Examined inventory records to determine basic elements of antimalarial stock on hand, quantity issued/dispensed, and losses and adjustments from April 2001 to March 2004. Examined stock cards/records and determined periods of stock-outs.

Methodology	Activities
Mission hospital key informant interviews and assessment of procurement and supply	**Target sites:** Mission hospitals and health centers Examined inventory records to determine basic elements of antimalarial stock on hand, quantity issued/dispensed, and losses and adjustments from April 2001 to March 2004. Examined stock cards/records and determined periods of stock-outs.
Private pharmaceutical retail outlet assessment of procurement and supply	**Target sites:** Private pharmacy/chemical seller's shops Examined inventory records to determine basic elements of antimalarial stock on hand.

Development of Tracer List

The development of a list of commonly used antimalarials (detailing formulation and strength) that should be available in the medical stores, at each level of MoH health facilities, in the private health facilities and in the pharmaceutical retail outlets was achieved. The tracer list, consisting of 17 antimalarial medicines was attained by obtaining inputs from the National Malarial Control Program and partners at the national level including the Head, Central Medical Stores, and is shown in Box 1.

Box 1. PMM Tracer Medicine List

Amodiaquine 50 mg/5 ml syrup
Amodiaquine HCL 200 mg tablet
Artemether injection, 80 mg/ml in 1 ml
Artesunate tablet 200 mg
Artesunate tablet 50 mg
Chloroquine injection 40 mg/ml in 5 ml
Chloroquine syrup, 80 mg (base)/5 ml
Chloroquine tablet 150 mg (base)
Dihydroartemisinin tablet, 80 mg
Halofantrine suspension, 100 mg/5 ml
Halofantrine tablet, 250 mg
Proguanil tablet, 100 mg
Pyrimethamine tablet, 50 mg
Quinine dihydrochloride injection 300 mg/ml in 2 ml ampoule
Quinine sulfate 300 mg tablet
SP 500 mg/12.5 mg suspension in 5 ml
SP 500 mg/25 mg tablet

Sampling

Sampling involved three steps: selection of the national and regional sites sample, selection of the health facilities sample (MoH and formal private sector facilities), and selection of the pharmaceutical retail outlet sample (formal and informal).

Selection of National and Regional Sites Sample

Of the 10 regions in Ghana, 4 were sampled for the assessment. The Greater Accra region was purposely selected as well as three other regions—one randomly selected from each of the three geographical belts of the country (northern, middle, southern).

Selection of Districts

Within each of the four sampled regions, two districts were randomly selected from a list of RBM and Global Fund to Right AIDS, Tuberculosis and Malaria districts for the assessment. Table 4 shows sampled regions and districts.

Table 4. Districts Sampled for the Assessment

Belt	Regions	Selected Regions	Sampled Districts
Northern	Upper West Upper East Northern	Upper East	Bawku East Kassena Nankana
Middle	Brong-Ahafo Ashanti Eastern	Brong-Ahafo	Techiman Atebubu
Southern	Volta Central Western Greater Accra*	Volta	Hohoe Keta Dangme West Ga

*This is the capital region of Ghana.

Selection of the Public Health Facilities Sample

The four RMSs serving districts within each of the four sampled regions were visited.

A total of 41 public health facilities were sampled within the assessment; approximately 5 from each of the eight selected districts. The rationale for selecting a sample size of at least 20 health facilities is based on previous studies and using methodologies extrapolated from WHO Expanded Programme on Immunization and International Network for Rational Use of Drugs studies and the study design factors.

Within each district, the district hospital was selected as one of the health facilities to be visited. In districts where there was more than one district hospital in the district, one hospital was randomly selected. Mission hospitals in Ghana form a part of the public health sector and were included in the sample of hospitals.

Two health centers were selected at random and then for each of these two health facilities selected, one geographically close health post/community health clinic was selected. The result was paired sets of health facilities and health posts within the district.

Selection of the Private Facilities and Pharmaceutical Retail Outlet Sample

For the purposes of the assessment, private health facilities were defined as private hospitals and clinics, and pharmaceutical retail outlets such as pharmacies and chemical seller's shops.

The sample size used here was a total of 40 facilities, approximately 5 from each of the eight districts selected. From a sample frame of private facilities, a sample was randomly selected of one private hospital or clinic and two pharmacies. As in the case of the public health facilities, for each of the two pharmacies selected, one chemical seller's shop that was geographically close was selected. The result was paired sets of pharmacies and chemical seller's shops within the district.

For both the selection of public and private health facilities, after the initial facilities were selected, a nearby "backup outlet" was selected for each, which the data collection teams visited when the selected outlet was either closed or nonexistent. A code was assigned for each outlet, which data collectors used on data collection forms to ensure confidentiality of the data source.

The breakdown of facilities visited is shown in Table 5.

Table 5. Facilities Surveyed

District	District Hospital	Health Center	Health Post/ Community Clinic	Private Hospital	Pharmaceutical Retail Outlet		Total Number of Facilities
					Pharmacy	Chemical Sheller's Shop	
Bawku East	1	3	2	1	2	2	**11**
Kassena Nankena	1	2	2		2	2	**9**
Techiman	1	4		1	2	2	**10**
Atebubu	1	2	2	1	2	2	**10**
Hohoe	1	2	1	1	2	3	**10**
Keta	1	2	2	1	0	4	**10**
Dangbe West	1	3	2	1	2	2	**11**
Ga	1	2	2	1	2	2	**10**
Total	**8**	**20**	**13**	**7**	**14**	**19**	**81**

Preparation of Data Collection Tools

Data collection tools were obtained from RPM Plus's *PMM Manual* for this assessment. Those tools included Inventory Data forms (DAS-2) and Stock-Out Data forms (DAS-3). A medical stores questionnaire was developed, piloted, and adapted for use at the Regional Medical Stores.

The data collection tools used at the various sites are listed below.

Regional Medical Stores

- Medical Stores Questionnaire
- DAS-2D: Inventory Data Form
- DAS-3D: Stock-Out Data Form

District Hospitals

- DAS-2C: Inventory Data Form
- DAS-3C: Stock-Out Data Form

Health Centers

- DAS-2B: Inventory Data Form
- DAS-3B: Stock-Out Data Form

Health Posts/Community Clinics

- DAS-2A: Inventory Data Form
- DAS-3A: Stock-Out Data Form

Private Hospitals

- DAS-2C: Inventory Data Form
- DAS-3C: Stock-Out Data Form

Pharmaceutical Retail Outlets

- DAS-2E: Inventory Data Form

The medical stores questionnaires that were administered explored areas of procurement (quantification, tendering, supplier performance, and monitoring), distribution, transport, receiving orders (port clearance), quality assurance, inventory control, storage system, infrastructure and equipment at medical stores (security), management information systems and information flow, communications, drug information, and human resources.

Inventory data tools investigated existing inventory control systems, record count of medicines on the tracer list, unposted receipts and issues, physical count, and expired stock of available antimalarials.

Stock-out data tools investigated the number of days tracer antimalarials were out of stock for each month. Data were collected for a three-year retrospective period.

Methodology for the Assessment of Antimalarial Quality

The Drug Availability Study was expanded to include the collection of samples of three main antimalarials in the new antimalarial treatment policy for Ghana. Samples were collected at facilities surveyed for the DAS.

These samples included sulfadoxine-pyrimethamine preparations; amodiaquine preparations; and artemisinin derivatives (artesunate, β-artemether, and dihydroartemisinin). Samples of any combination of the three types of medicines (for example, artesunate-amodiaquine) were also collected when the two active components were presented in one tablet. Samples were collected regardless of strength of preparation.

Sampling Method and Procedures

Sample size: The size of any sample was defined as one that should be sufficient to carry out all anticipated test procedures.[3] One sample consisted of 50 tablets, and two samples of each product were collected; that is 100 tablets total[4] per product from one lot/batch[5] from the same source.

Table 6. Medicine Sample Names and Size/Quantity

Item	Number of Units Collected (50 units for each lab)
Artesunate tablet	100
SP tablet	100
Amodiaquine tablet	100

[3] Tests and assays were carried out according to major pharmacopeias—United States Pharmacopeia (USP), British Pharmacopoeia, European Pharmacopoeia, and International Pharmacopoeia. The medicines sampled were tested for identity, dosage, dissolution, and uniformity of dosage units. The testing procedures were developed by USP DQI in collaboration with FDB laboratory.

[4] It was agreed that samples would be collected in two sets (one for USP DQI and one for the FDB laboratory). FDB had recently been trained by USP DQI, and it was hoped that analysis of the samples collected would yield equivalent results.

[5] A lot or batch was defined as a quantity of any medicine produced during a given cycle of manufacture under the same manufacturing conditions.

Sampling record: a written record of the sampling operations carried out is shown in Annex 1. This form was filled out and signed for each sample collected.

General Precautions Taken during Sampling Operations

All operations related to sampling were performed with care. Each sample obtained according to the sampling procedure was carefully packed, transported, and stored in such a way to prevent any deterioration, contamination, and adulteration. Samples collected were stored in accordance with storage instructions for the respective medicine; closures and labels were of a kind that allowed detection of unauthorized opening.

The sampling team members[6] had at their disposal all the tools needed to open the packages and containers—such as knives, pliers, sealable plastic bags, and brushes to remove dust—and material to reclose the packages (sealing tape), as well as self-adhesive labels to make any special notes.

Packaging and Labeling of Samples

The container used to store samples did not interact with the already sampled material to avoid contamination. The samples were kept in their original "unit" packaging and labeling, where applicable. As required by the storage directions for the material sampled, samples were protected from light, air, moisture, and the like. As a general rule, the containers were sealed and tamperproof. The containers were properly labeled and contained the information as described in the sample receipt form shown in Box 2. Medicine samples were kept in their original packaging.

Transportation of Samples to USP and FDB Laboratories

Adequate measures were taken to ensure the safe transport of samples to the testing labs. Appropriate care was taken to ensure adequate packaging to protect samples during transportation, either by totally filling the container with cotton batting or foam or by filling any residual space with a suitable material. All containers were sealed and appropriately labeled.

Samples were transported to the FDB laboratories in Accra by the RPM Plus consultant. Samples destined for the USP laboratories were transported to USAID Ghana offices and forwarded by the Mission to the USP DQI laboratories in Washington, D.C.

[6] The sampling team consisted of the data collection team supervisor and a field officer from the FDB.

Box 2. Sample Receipt Form

Serial number:_____

A copy of this form is to be kept with/attached to each sample set before sealing the plastic bag.

Name and address of place where sample is taken
……...
……...
……...

Date of sampling:
……...

Names of the sample collector (s)
1…….
2…….
3…….

Name of the pharmaceutical product ……
Dosage form (tablet, capsule, etc.) ……
Batch number:…….
Registration number (if applicable):……...
Name of the manufacturer:…….
Address of manufacturer: ……...
Number of units per sample…….
Expiration date……
Manufacture date (if applicable) ……...

Signature of the Sampling Team Leader

……..

Training of Data Collectors

Data collectors were trained for fieldwork over a three-day period at the Erata Hotel in Accra. RPM Plus staff members facilitated training. The three-day training gave the data collectors a brief background on the malaria situation in Ghana and the purpose of the assessment of antimalarial medicine availability and quality. The team thoroughly reviewed the data collection tools and data collection techniques relevant to the assessment.

A list of the facilities sampled and their locations was shared with the data collectors, and four teams were constituted. Each team was headed by an experienced data collector and each team was assigned to two districts during fieldwork. The list of teams, schedule of work, and sequence of fieldwork was discussed and finalized. The training session provided an excellent opportunity to build the teams on the basis of qualification and aptitude of the data collectors.

On the final day of training, a field test was carried out at the Central Medical Stores in Tema, outside Accra. The field test exposed data collectors to the practicalities of administering the tools and provided a good review of data collection techniques, such as record reviews and physical inventory checks, as well as insight into what to expect during the actual assessment.

Logistics and administrative matters were addressed before the teams traveled into the field.

Data Collection

Data and sample collection were conducted from July 19 through July 30, 2004. National-level audits of procurement and supply took place in the preceding two weeks.

No major problems arose during the data collection period. In general, the data collection teams observed that although official letters had been sent ahead of data collection teams to notify Regional and District Health Administrations of the assessment, the letters had often not been received and shared with administrative authorities at the majority of facilities visited. Nevertheless, the collaboration of staff in the field was excellent after they were briefed on the objectives of the assessment.

Data Collation and Management

Data for the assessment of antimalarial availability were edited, coded, and cleaned by RPM Plus over a three-day period in Nairobi, Kenya. Inventory management, stock-outs, and price data were entered into an Excel database. Data analysis was done using Microsoft Excel. Medicine availability indicators were generated, and general trends were observed.

Samples collected for the assessment of antimalarial quality were divided into two portions and analyzed in the Food and Drugs Board laboratory and the United States Pharmacopeia laboratory in the United States. The FDB sample analysis was conducted in May 2005 and findings from the analysis were reported in July 2005.

FINDINGS ON PHARMACEUTICAL MANAGEMENT OPERATIONS IN GHANA

Structure of the Health Care System in Ghana

Health services in Ghana are delivered in primary, secondary, and tertiary health systems. The primary health care system is equivalent to the district health system. It incorporates all institutions (clinics, health centers, and hospitals) and individuals whether private, public, or traditional. All districts have also been subdivided into four to six subdistricts, and each subdistrict covers a defined geographic area containing 20,000–30,000 people (RBM Ghana Strategic Plan 2000–2010).

The health center is responsible for providing clinical, public health, and maternity services to the catchment population using a combination of clinic-based, regular outreach, and mass campaigns in close collaboration with communities, community institutions and leaders, and village-based health workers and health institutions.

The district hospital serves as the first referral point in the primary health service. It provides clinical (outpatient and inpatient) and maternity services and serves as backup for health centers in the district. The regional hospital is the second referral level. It acts as the technical focal point for specialized clinical and diagnostic care in broad specialized areas like medicine, general surgery, pediatrics, and obstetrics and gynecology.

The teaching hospitals form the apex of specialized care in the country. They are the leading training and research institutions, and offer undergraduate and postgraduate training for doctors and other professions.

Management of Health Services

Health management in Ghana is fairly decentralized within the MoH, a nested approach involving District Health Management Teams (DHMTs), Regional Health Management Teams, and headquarters. Complementing these arrangements are institutional/health facility management teams. Each of these management levels is a budget and management center with the responsibility for a defined program of work supported by a defined operational budget.[7]

As part of the health reform process, the Ghana Health Service, which is an autonomous government agency responsible for service delivery, has been formed—thus leaving the Ministry of Health to focus on health policy and regulation. Currently, a sectorwide approach to health delivery exists in Ghana. The principles underlying implementation of the sectorwide approach in Ghana include an agreement between the Government of Ghana and health partners on an agreed and coordinated program of work, an integrated approach to funding, and common implementation and evaluation arrangements.

[7] Decentralization of management has been a feature of Ghana's health sector since the establishment of the DHMTs in 1978, and a key aspect of Ghana's decentralization has been the establishment of budget management centers that can autonomously set and manage budgets. Although guidelines exist, procurement decisions have been decentralized to the RMS and service delivery point managers.

Under this arrangement, the MoH prepares an annual program of work, which is funded from Government of Ghana funds, internally generated funds, and pooled donor funds. The MoH and partners meet twice a year to review and plan sectorwide performance.

A few donors, for various reasons, are outside the common pot and continue to earmark funds. Even those contributing to the pot earmark a proportion of their funds disbursed out of the common pot.

Number and Distribution of MoH Facilities

Health services in Ghana are provided by both the public and private sectors, including mission hospitals supported by faith-based organizations. The public sector, which is supported by the government, accounts for over 70 percent of the institutions.

The country has 1,887 health facilities, including with two teaching hospitals and three psychiatric hospitals. Nine Regional hospitals, 86 district hospitals, 11 polyclinics, and 927 health centers under the Ghana Health Service represent about 55 percent of the total health facilities. Distribution of health facilities varies from region to region, as indicated in Table 7.

Table 7. Number and Distribution of MoH Facilities

Region	Regional Hospital	District and Other Hospitals			Polyclinics			Health Centers and Clinics			Total
		Government	Mission	Private	Government	Mission	Private	Government	Mission	Private	
Upper West	1	3	4	1	0	0	0	47	13	5	**74**
Upper East	1	2	2	1	0	0	0	46	5	2	**59**
Northern	1	6	3	3	0	0	0	95	20	5	**133**
Brong-Ahafo	1	5	9	13	0	0	0	110	1	37	**176**
Volta	1	10	9	3	1	0	0	201	8	8	**241**
Ashanti	0	23	14	44	0	0	0	116	32	81	**310**
Western	1	11	4	7	2	0	0	108	20	85	**238**
Central	1	8	4	1	0	0	0	51	8	50	**123**
Greater Accra	1	6	1	67	8	0	0	35	1	165	**284**
Eastern	1	12	5	5	0	0	0	118	16	87	**244**

Source: MoH 2004.

The Private Sector Pharmaceutical Distribution System

The private sector pharmaceutical distribution pipeline comprises the manufacturers of medicines, wholesalers, the retail outlets, and the transportation network linking all three levels. It is not unusual to have a combination of wholesale and retail units operating as a conglomerate or a business concern that has a manufacturing unit as well as wholesale and retail outlets.

The distribution of pharmacies is demand driven. They are mostly located in the large urban centers and densely populated regions with Greater Accra and Ashanti Regions accounting for over 85 percent of pharmacies nationally.

Table 8. Number and Distribution of Pharmacies in Ghana*

Region	Wholesale	Retail	Wholesale/Retail	Total
Ashanti	27	141	59	227
Central	1	14	9	24
Eastern	0	15	13	28
Greater Accra	68	402	169	639
Northern	3	4	2	9
Upper West	0	2	1	3
Upper East	0	1	4	5
Volta	0	9	5	14
Western	5	15	12	32
Brong-Ahafo	1	3	19	23
Total	**105**	**606**	**293**	**1,004**

*As of December 2003.

The disproportionate distribution of chemical seller's shops in favor of the most populated regions of Ghana is not very different from that of pharmacies (Table 9).

Table 9. Regional Distribution of Chemical Seller's Shops*

Region	Chemical Seller's Shops
Ashanti	1,903
Central	983
Eastern	1,522
Greater Accra	1,188
Northern	536
Upper West	162
Upper East	203
Volta	770
Western	1,240
Brong-Ahafo	1,202
Total	**9,709**

*As of December 2003.

The status of registered chemical seller's shops is very unstable, making difficult the ascertainment of the number of those that are functional.

Public Sector Distribution of Antimalarial Medicines

Effective distribution systems for commodities for the prevention and treatment of malaria, including medicines, are essential to enable supply flow from one institution to another and within institutions from one department to another.

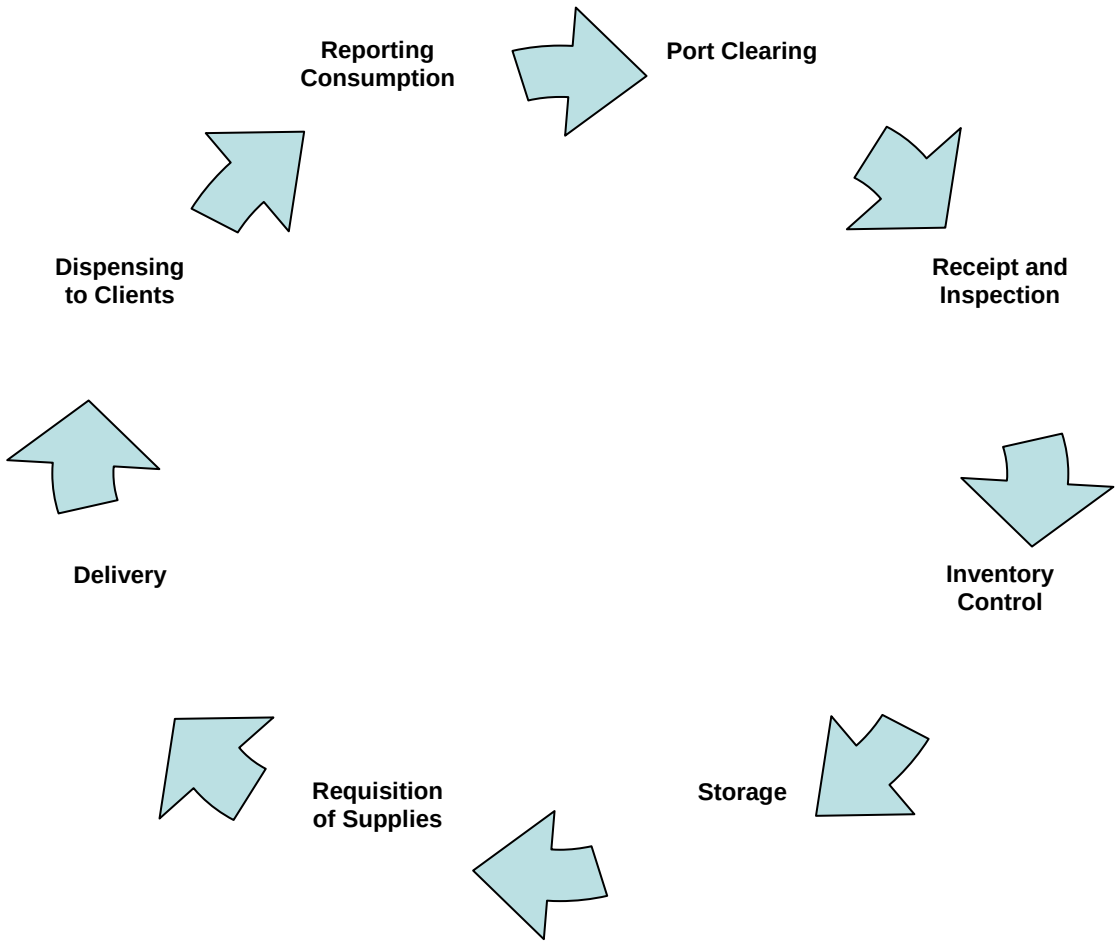

Figure 1. The Distribution Cycle

The long-term objective of the distribution of medicines as envisaged by the Ghanaian Ministry of Health is to ensure that patients receive their needed treatment. For the long-term objective to be met, the short-term objective—"to have the correct medicine of proven quality in the required place at the right time and in sufficient quantity"—has to be met.

The Ghana public health sector operates a three-tier system for the management of health commodities. The Central Medical Stores (CMS), the Regional Medical Stores, and service delivery points (SDPs) together with the transportation network constitute the pipeline for the supply chain. The customers here are either *internal* (for CMS the customers are the RMSs, and for the RMSs the customers are the SDPs), or *external* (patients and clients who seek services at the health facilities). The interactions within the tiers lead to the exchange of health commodities (goods) and/or services, and these transactions have to be properly documented, followed, audited, and/or reviewed through a systematic supervisory and monitoring schedule.

The CMS, a unit of the Procurement and Supply Directorate of the MoH, is responsible for the receipt, storage, and distribution of all commodities procured by the MoH until supplies are requested by facilities at the lower levels of the supply chain.

To achieve the objective of making available a continuous supply of essential and affordable medicines of appropriate quality, many factors have to be taken into consideration. The complexity of these various factors and their relationships underpin the distribution system and focus on the following—

- Maintaining a constant supply of antimalarials and all other medicines that would also be needed
- Keeping the medicines in good condition throughout the distribution process
- Minimizing losses caused by spoilage and expiry
- Maintaining accurate inventory records
- Reducing the number of storage points
- Using available transportation resources as efficiently as possible
- Providing information for forecasting medicine needs

Maintaining Medicine Supplies

The system design for maintaining medicine supplies (antimalarials included) requires a mix of push and pull ordering at all levels of the distribution system. The "push" system is usually adopted by the CMS in the initial phase of new programs. Program personnel determine quantities to be ordered, issued, and used in each district or facility. This level of centralization in the initial phase is necessary because consumption data may be unavailable and also because only a selected number of districts will start using the medicines until more districts are phased into the program.

As more data on consumption are generated, changing to a "pull" system becomes necessary, which allows facilities to determine and order the quantities of health commodities they will require.

Storage

Optimal storage conditions exist at the CMS and the RMS compared to SDPs. Much variation exists, however, in design, storage conditions, material handling, and cooling equipment at most SDPs.

Proper organization and maintenance of storage equipment are needed to maintain medicine quality, minimize wastage, and ensure a regular supply to health facilities.

Every facility in the supply chain distribution system is encouraged to conduct visual inspection of health commodities at all times. In addition to ensuring that products have visible expiration or manufacturing dates stores, personnel are required to store products so that the first to expire

are the first out or dispensed. Management of inventory by expiration (that is, first to expire, first out, or FEFO), particularly for medicines, ensures that the medicines near their expiry are issued or dispensed first, thus minimizing wastage that could occur through expiration. At the CMS, RMSs, and SDPs old stocks that may expire first are moved or rotated to the front of the shelf, thus making them more accessible.

Visual inspection of stocks is conducted when SDPs receive new supplies or when physical inventory is carried out and supplies show signs of damage. Storage procedures are followed at all levels. Job aids have been developed and are available in the Standard Operating Procedures manual for the management of health commodities in public health facilities.

Inventory Control

An efficient inventory control system minimizes spoilage and expiry at all levels. Maximum and minimum levels are established at all level for medicines and other health commodities.

The commonly practiced Periodic Ordering, or Forced Ordering, inventory control at the RMSs and SDPs ensures that at the end of each review period (quarterly for most RMSs and monthly for SDPs) logistics personnel at those levels review all stock levels and order enough to bring levels up to the maximum. Although ensuring uniformity in inventory control may be necessary, each SDP is required to establish local inventory control mechanisms that include a stock status assessment (measured in months' of stock) and also to establish an emergency order point when an order must be placed for a medicine even if the end of the review period is not near.

Establishing and maintaining effective inventory records and procedures are the basis of coordinating the flow of medicines in the distribution system and the primary protection against leakage and wastage. Inventory control is used for requisitioning and issuing health commodities, for financial accounting, and for preparing the consumption and stock balance reports necessary for procurement.

The CMS coordinates with the Procurement Unit within the Procurement and Supply Directorate to ensure near-term availability of all health commodities for the management of malaria.

Reducing the Number of Storage Points

The CMS is institutionalizing the delivery of medicines and other health commodities from the upper levels to the lower levels through a scheduled delivery system. This system has started in three regions (Central, Eastern, and Western Regions) and will commence in the other regions soon. RMSs will be required to deliver health commodities directly to the SDPs.

To effectively realize the full benefits of this system, SDPs send their requisitions before a deadline while they prepare for payment for earlier deliveries. The RMSs are required to communicate the deadlines of prescribed activities, such as submission of orders from all SDPs in their regions, to ensure smooth implementation of the scheduled delivery of health commodities.

Overestimation or underestimation of districts' needs may occur at the early stages of the implementation of any new program because consumption data are unavailable; so districts could be either overstocked or understocked. Monitoring teams within each district may need to report stock status of medicines to the Senior Medical Officer (Public Health) and the Director of Pharmaceutical Services for the respective region so that steps can be taken to move stocks within districts to minimize expiration and ensure accessibility of antimalarials within each locality.

Coordination between the transport units of each region and the RMS ensures minimal delays in deliveries to the SDPs.

Information System

No distribution system can be successful without good communication between the supplier and the user. Currently in Ghana, information flow of reporting is from the lower levels to the upper levels.

Information on consumption and stock balances is communicated to the Regional Directorates after submissions are made to the DHMTs. The reports are also forwarded to the Office of the Chief Pharmacist on a quarterly basis. Reporting of this information needs to be synchronized with the reports required to be sent to the NMCP. Information on consumption for all health commodities for the management of malaria needs to be channeled to NMCP and the medicine component should go to the Office of the Chief Pharmacist and the Director, Procurement and Supply Directorate. For purposes of planning, these offices need to share information to ensure efficient and effective logistics management for antimalarials and other health commodities.

Transport Arrangements Linking Storage and Health Facilities

Currently, lower-level facilities (especially the health centers) rely on the District Health Administrations (DHAs) to provide transport. The DHAs usually use a four-wheel-drive double cabin pickup truck. Each DHA has at least one double cabin pickup truck.

At the regional level, all Regional Health Administrations—to which the RMSs are administratively linked—have 7-ton trucks to cart health commodities from the CMS to the RMS. Transportation of commodities from the CMS to the RMS should be the responsibility of the CMS so that RMS trucks can be used to deliver health commodities to the SDPs.

The CMS is currently working toward providing no-charge transportation to the RMS through a scheduled delivery system using 7-ton trucks. The RMS in turn would focus the use of its trucks to transport health commodities to the SDPs. At present, however, the CMS has only five 7-ton trucks and a 35-ton articulated truck, which are used to transport all health commodities to the regions.

No contract arrangements exist for transport for the Regional or District Health Administrations with parastatal or commercial agencies.

Sources of Antimalarials Flowing through the Distribution System

Currently, medicines are purchased by the CMS through international competitive bidding (ICB) and through local private suppliers. The RMSs and teaching hospitals are meant to procure medicines through the CMS and from the local private sector in cases of unavailability. All the regional hospitals and SDPs are in turn meant to procure from the RMS in their respective regions. The budget for antimalarials is currently provided through the Global Fund to Fight AIDS, Tuberculosis and Malaria; how much of the total antimalarial procurement outlay for the country is derived from the Global Fund is unclear.

Cost-Recovery System for Medicines Dispensed in MoH Health Facilities

The Ministry of Health has an official policy for determining the markup level, or margin, that each level of the Ghana Health Service facilities should levy on medicine sales. At the regional and service delivery levels, the amount added to sales is intended to maintain the viability of the facility's Revolving Drug Fund. The main premise is to allow the facilities to generate sufficient funds to maintain procurement capacity, a hedge against inflation and losses.

At the Central Medical Stores, margins are also intended to cover other costs associated with pharmaceutical management and distribution, which that includes but is not exclusively limited to warehousing, packaging, duties, and taxes associated with ICB imported medicines.

The current Ghana MoH markup policy for medicines is that at the CMS, the margins are 20 percent for ICB plus 25 percent duty and VAT, adding 45 percent to ICB prices. If medicines are sourced through local procurements, the margin is 15 percent.

The Regional Medical Stores operate on a 10 percent margin, and the SDPs, or health facilities, apply a 10 percent margin.

The official policy on margins, therefore, allows a cumulative 40–45 percent margin to be charged on medicines procured through the public sector system, which is made up of a 20–25 percent margin (depending on source, local or ICB) at the CMS and 10 percent at both the RMS and SDP.

The MoH has adopted a comprehensive exemption policy to address equity and affordability in its user-fee system. The basis of the policy was the realization that user fees for health services were a major disincentive for the poor and other vulnerable groups to seek health care.

The current MoH categories of exemption cover individuals, specific diseases, and classes of medicines. The exemptions cover (1) adults over 70 years of age; (2) prenatal care; (3) children under 5 years of age; (4) paupers or the indigent; (5) patients with tuberculosis, leprosy, Buruli ulcer, and cholera; (6) snake-bite and dog-bite victims; (7) citizens with psychiatric disorders; and (8) accident victims.

The administration of the exemption policy allows SDPs to exempt, compile returns of the policy beneficiaries, and submit these returns and bills to the Regional Health Administration for

reimbursement through the DHAs. The source of funding is through Government of Ghana budgets.

Major Problems Affecting the Movement of Medicines through the Procurement and Distribution System

The main areas in distribution subject to problems are recognized as being communications, storage, and delivery. Although mentioned as a problem, storage facilities and conditions are not as much of a problem affecting distribution as the other two areas—communications and delivery.

The problems affecting the movement of medicines through the distribution system may be visualized from the position of a distributor or from the position of a user of the system.

Problems for the Distributor

Order forms are not correctly completed—

- The product strength is missing.
- Items have been written in the wrong section of the form.
- Brand names have been used instead of generic.
- The order is signed by an unauthorized person or else unsigned.
- Writing and requests are not clear.

Requests are unrealistic—

- The same item was ordered in the previous week or month and supplied in large quantity.
- Items that had previously never been requested appear without explanation.
- Unauthorized items are requested.
- No stock reports are received to explain or verify orders.

Timing of orders—

- Orders are received late or out of sequence.
- Nearby institutions approach the distributor daily for a few "emergency" items.

Transport—

- Vehicles are unavailable because of breakdowns.
- Vehicles are unavailable because they have been removed for other purposes.
- Vehicles are unavailable.

Problems for the User

A major difficulty for users in Ghana is that in their opinion receiving is more important than ordering. Ordering and correctly completing the order form at the right time is seen by users as a waste of time.

Style of the order form—

- Users complain that the order form is too complicated.
- Users cannot remember all the details for each product.
- Users complain that they do not have enough time to check on everything every time.

Timing for submitting the order form—

- Authorized signatory is not always available.
- Time period for delivery by distributor is too long, resulting in an "out of stock" situation.
- User would prefer more flexibility associated with ordering emergency items.

Out-of-stock items—

- Not enough quantities of product at the suppliers' store so users feel the need to order extra amounts as a precautionary measure.
- No clear instructions exist with respect to reordering out-of-stock items.

Extra items—

- Sometimes unneed donated items are supplied to SDPs in large quantities.

Information about the CMS or RMS store—

- No regular information is made known about stock levels in the CMS and RMS stores.
- No advance warning is given to SDPs of low stocks and of reduced quantities.
- No advice is volunteered on the arrival of new stocks.
- No explanation is made with respect to changes made to the order form.

As can be seen, both the distributor and the user have problems. The user cannot always understand the difficulties of the distributor in maintaining inventory levels, but the user might be able to understand better if more information were given.

The distributor cannot always understand the problems that the user has when completing the order form, but with good communications it might be possible for the distributor to understand the user's difficulties.

FINDINGS OF THE ASSESSMENT OF THE AVAILABILITY OF ANTIMALARIALS IN GHANA

The findings of this aspect of the assessment help identify problems in the antimalarial pharmaceutical management system in Ghana using the indicators discussed below.

Average Percentage of a Set of Unexpired PMM Antimalarial Medicines Available in (a) Ministry of Health Storage and Health Facilities, (b) Formal Private Health Facilities, and (c) Retail Pharmaceutical Outlets

Description and Use of the Indicator

The indicator measures the availability of the PMM tracer list at the time of the study. A medicine is defined as available if even one unit of unexpired product is in stock. Because expired medicines are inappropriate for use in almost all situations, they are not counted as stock available for use. Theoretically, all, or 100 percent, of the antimalarial medicines investigated should be unexpired and available all of the time at the different levels of health care. However, this indicator provides only a snapshot of the availability of medicines for malaria at the time of the study. The desired change over time of this indicator is an increase.

Methodology

To determine the percentage availability, existing inventory control systems—including manual ledgers and tally/bin/stock record cards—were examined.[8] Where none of those inventory control systems existed, monthly returns, vouchers, and pharmaceutical requisition forms were examined. Antimalarials normally stocked at each level were first established. The assessment then determined which of the normally stocked antimalarials were available.

Results

The assessment revealed that an average of 39.7 percent of tracer medicines was found at the RMS and an average of 44.8 percent of tracer medicines was found in the district or subdistrict hospitals visited. An average of 83.1 and 25.0 percent, respectively, of tracer medicines was found in the mission and private hospitals/clinics. The public sector health centers and community clinics/health posts demonstrated 23.5 and 16.6 percent of tracer medicines, respectively.

[8] All the Regional Medical Stores visited during the assessment had computerized inventory control systems.

Table 10. Availability of Antimalarial Medicines on the Tracer List at the Health Facilities

Facility Type	Number of Facilities	Average Percentage of Tracer List Available
Health post/community clinic	17	16.6
Health center	20	23.5
District/subdistrict hospital	13	44.8
Mission hospital	7	83.1
Private hospital/clinic	4	25.0
Regional medical store	4	39.7

An average of 48.6 percent of tracer medicines was found in the private pharmacies/ pharmaceutical retail outlets visited. In all, 34 pharmacies/pharmaceutical retail outlets were surveyed in the eight districts. Compared with the findings in Table 10, the availability of antimalarial medicines is higher in the private pharmacies/pharmaceutical retail outlets than in any of the public sector health facilities excluding mission hospitals.

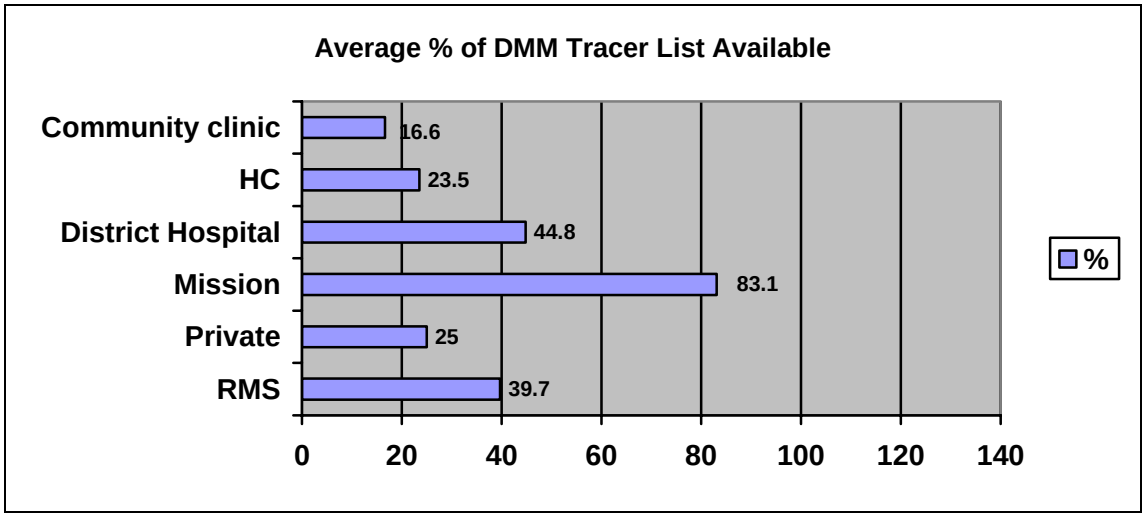

Figure 2. Antimalarial stock availability within the Ghana health system

The graph in Figure 2 indicates average percentage of PMM tracer list available in the surveyed facilities.

Discussion

Overall, almost two-fifths of the tracer antimalarial medicines investigated were absent in the visited government facilities. Some medicines, despite being on the EML, were never available in any facility.

A pattern was noted of decreasing availability of medicines with increasing distance from the center of the distribution system, with availability being higher at the RMS level and

district/subdistrict store level and lower at the health facility level. This analysis was done using the 17 tracer medicines as the denominator. Ideally, the availability of medicines should be lowest at the center of storage and highest at peripheral levels where patients are treated. Availability at the periphery—in this case, the community clinic level—depends on the distribution system from the regional and district hospital medical store levels.

To determine why availability of antimalarials in Ghana is below 50 percent requires further analysis. Some explanations might be problems in the areas of budgeting, theft, wastage, quantification, delivery, or inventory management. When the specific causes have been identified, potential interventions can be developed.

Average Percentage of Time Out of Stock for a Set of PMM Antimalarial Medicines in Ministry of Health Storage and Health Facilities

Description and Use of the Indicator

A corresponding indicator of availability is a measure of stock-outs during a period of time. Used in tandem with the previous indicator, the stock-out indicator allows for a stronger analysis of the stock situation over time. The percentage of time out of stock for a set of PMM antimalarial medicines gives a measure of the procurement and distribution system's performance in maintaining a constant supply of medicines. The successful treatment of malaria is dependent on the medicines being available. The ideal target for this indicator is 0 percent, or no stock-outs, and the desired change is a decrease from whatever is measured.

Methodology

The information for this indicator was gathered from tally/bin/stock cards as well as manual ledgers in some instances. Where none of those records was available, store receipt vouchers, drug revolving fund requisition forms, receipts of purchase, and monthly returns were used.

Time out of stock was defined as the number of days that a product was not present in a warehouse or health facility over a recent 36-month period. The time period set for this assessment was from April 2001 to March 2004. To be considered a stock-out, none of an unexpired medicine should be in stock.

Results

Analysis revealed that overall, antimalarial medicines were out of stock 46.1 percent of the time over the indicated period. This percentage was determined by first calculating the total number of days out of stock for all **stocked** medicines at each facility. Then the following calculation was applied to determine the average percent time out of stock:

$$\frac{\text{Total number of days out of stock for all stocked medicines} \times 100}{365} \times \text{Total number of products stocked}$$

The average time out of stock for all facilities was then calculated.

In the sample of facilities assessed, the PMM antimalarials were out of stock an average of 46.1 percent of the time. In the sample of community clinics, the PMM antimalarials were out of stock an average of 18.43 percent of the time, and in the sample of health centers, the PMM antimalarials were out of stock an average of 47.6 percent of the time within the specified years.

Analysis revealed that, overall, in district/subdistrict hospitals, antimalarial medicines were out of stock 54.1 percent of the time over the indicated period. Mission hospitals and private hospitals showed an average percentage of 36.82 and 37.0 days out of stock, respectively.

Table 11. Average Percentage of Days Out of Stock of Antimalarial Medicines by Facility Type

Facility Type	Number of Facilities	Average Percentage of Days Out of Stock
Health post/community clinic	14	18.43
Health center	22	47.6
District/subdistrict hospital	13	54.1
Mission hospital	5	36.82
Private hospital/clinic	4	37.0
Regional medical store	4	83.2

Figure 3 depicts the average percentage of time out of stock of tracer PMM medicines at the four regional medical stores assessed.

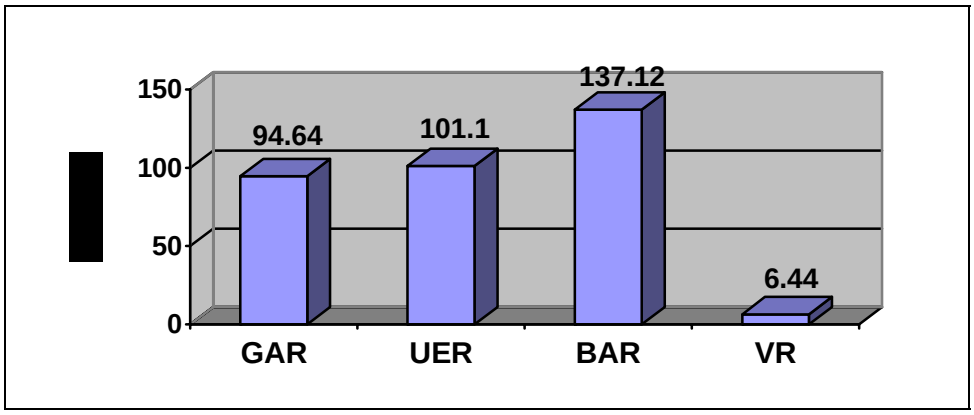

Figure 3. Average percentage of time out of stock for PMM medicines at individual Regional Medical Stores

Discussion

The overall average percent of days out of stock appears high in health facilities, which does not indicate relatively ready access to medicines for the Ghanaian population in the event of a policy change. Table 11 indicates that the shortest time out of stock is seen at the community clinic level (18.43 percent), which is a good indication. However, the RMS level demonstrated a high percentage of stock-outs of antimalarial medicines (83.2 percent). This finding needs further investigation, which might include an examination of changes in stock levels that correlate with procurement activities and with stock levels at the district hospitals to determine if problems exist in the distribution pipeline.

Average Percentage of Stock Records that Correspond with Physical Counts for a Set of PMM Antimalarial Medicines in Ministry of Health Storage and Health Facilities

Description and Use of the Indicator

The average percentage of stock records that correspond with physical counts is a measure of the quality of the stock record-keeping system. This indicator helps reveal inventory management problems and may point to the need for further assessments of problems such as wastage, pilferage, and poor record-keeping, all of which contribute to poor service delivery and financial losses. The indicator calculates the average percentage of in-stock PMM antimalarial inventory records that corresponds exactly with a physical stock count for a set of PMM antimalarial medicines.

Methodology

Data collectors reviewed the most-accurate stock records of current stock level for each of the PMM antimalarial medicines. Where stock records and physical counts did not correspond, recent issues or receipts that had not been posted were reviewed and adjusted stock records were calculated.

Results

After adjusting for issue and receipt tickets not yet recorded in the RMS, the percentage of records for the tracer list of 17 antimalarials that corresponds with physical counts was 64.5 percent (Table 12). Data collectors reviewed the most-accurate stock records of current stock levels for each of the PMM antimalarial medicines. Where a noncorrespondence occurred between stock records and physical counts, recent issues or receipts that had not been posted[9] were reviewed and adjusted stock records were calculated.

[9] The most common reason for medicine issues or receipts not being posted was shortage of personnel to make regular updates to stock records.

Table 12. Percentage of Records Corresponding with Physical Counts in the Regional Medical Stores

Regional Medical Store	Number of Records Examined	Number of Records with No Discrepancy	Percentage of Records Corresponding with Physical Stock Counts
Upper East RMS	6	5	83.3
Brong-Ahafo RMS	8	1	12.5
Volta RMS	5	5	100.0
Greater Accra RMS	8	5	62.5

For a sample of medical storage and dispensary units of 12 district hospitals (DHs) for which the sum of percentages of stock records that correspond exactly with physical count is 679.4 percent, the average percentage of PMM antimalarials that correspond exactly with physical counts is 56.6 percent (Table 13).

Table 13. Percentage of Records Corresponding with Physical Counts in District Hospitals

District Hospital	Number of Records Examined	Number of Records with No Discrepancy	Percentage of Records Corresponding with Physical Stock Counts
Holy Family Hospital (Mission DH) – Medical Stores	10	2	20.0
Holy Family Hospital (Mission DH) – Dispensary	10	2	20.0
District Hospital, Atebubu – Medical Stores	7	0	0
District Hospital, Atebubu – Dispensary	7	0	0
District Hospital, Hohoe – Medical Stores	9	4	44.4
District Hospital, Hohoe – Medical Stores	10	2	20.0
Keta District Hospital – Medical Stores	8	8	100
Keta District Hospital – Dispensary	8	6	75.0
Mission District Hospital, Bawku – Medical Stores	8	8	100
Mission District Hospital, Bawku – Dispensary	9	9	100
War Memorial Hospital (DH) – Medical Stores	3	3	100
War Memorial Hospital (DH) – Medical Stores	3	3	100

After adjusting for issue and receipt tickets not yet entered in the records at six mission hospitals, for between 5 and 10 PMM antimalarials confirmed to be normally stocked (median = 8.5), the average percentage of mission hospital records corresponding with physical counts was 53.7 percent, with a standard deviation of 40.965 and range among these facilities from 0 to 100 percent (Table 14).

Table 14. Percentage of Records Corresponding with Physical Counts in Mission Hospitals

Mission Hospital	Number of Records Examined	Number of Records with No Discrepancy	Percentage of Records Corresponding with Physical Stock Counts
St. Mathias Hospital, Yeji, Atebubu	10	6	60
Abaase Mission Hospital	5	2	40
St. Andrews Catholic Clinic, Kordiabe	6	0	0
Alpha Medical Centre, Madina	9	2	22.2
Sacred Heart Mission Hospital, Abor	8	8	100
Mission Hospital, Keta	9	9	100

Again, after adjusting for issue and ticket receipts not yet entered into the records, Table 15 shows finding at the private hospitals, health centers, and community clinics visited during the assessment.

Table 15. Percentage of Records Corresponding with Physical Counts at Private Hospitals; Public Health Centers, and Community Clinics

Facility Type	Median Number of PMM Antimalarials Confirmed to Be Normally Stocked	Average Percentage of Records Corresponding with Physical Counts	Standard Deviation	Range
Private Hospital	4.5	35.0	47.28	0–100
Health Centre	4	27.8	28.79	0–100
Community Clinic	4	19.3	30.57	0–100

Discussion

The decreasing percentage of correspondence from the RMS (64.5 percent) to the district hospitals (56.6 percent) to health center (27.8 percent) and community clinic level (19.3 percent) may suggest a need to develop skills in the record-keeping system. Training may be needed in stock record-keeping, inventory procedures, or both, particularly as one moves down the distribution system from center to periphery.

FINDINGS OF THE ASSESSMENT OF QUALITY OF ANTIMALARIALS IN GHANA

Summary of Methodology

Forty-five (45) antimalarial preparations were sampled from the three varied regional climatic zones (northern, middle belt, and southern) of the Ghanaian market. The objective of the sampling plan[10] detailed earlier in this report was to take cognizance of the different climatic zones and to ascertain the effect of transportation and environmental factors on product quality and stability. Coding and packaging of samples for transportation to the laboratories of the Food and Drugs Board and the USP DQI for quality evaluation were done according to the agreed protocol.

The preparations included sulfadoxine-pyrimethamine tablets, amodiaquine hydrochloride tablets, artesunate tablets, dihydroartemisinin tablets, and β-artemether soft gelatin capsule.

Table 16. Number of Antimalarial Sample Preparations Collected

Preparation	Number within Sample
Sulfadoxine-pyrimethamine tablets	50
Amodiaquine hydrochloride tablets	18
Artemisinin derivatives	
o Artesunate	18
o 1,2-Dihydroartemisinin	4
o Artemether	2

The total number of samples was divided into two equal portions; before distribution for testing, samples were kept in the storage facility of the FDB Laboratory. One-half was shipped to the USP laboratory in Washington, D.C., through USAID Ghana offices, and the other half was evaluated in the FDB laboratory in Accra. Each laboratory received 25 samples of sulfadoxine-pyrimethamine tablets, 9 samples of amodiaquine hydrochloride tablets, 9 samples of artesunate tablets, 2 samples of dihydroartemisinin tablets, and 1 sample β-artemether soft gelatin capsule.

Quality parameters measured were the identification of active ingredients, determination of uniformity of weights, establishment of content of active ingredients, determination of dissolution rate (for only tablet forms), and detection of related substances where applicable.

[10] Samples were collected randomly following sampling protocol agreed between the Ghana FDB and Management Sciences for Health.

Method of Analysis

The methods of analyses that were used for the assessment are described below.

Method for Assay of Sulfadoxine-Pyrimethamine Tablets

The content of sulfadoxine-pyrimethamine was determined by the modified USP 24 high-performance liquid chromatography (HPLC) method agreed upon by the USP DQI laboratory and the FDB laboratories undertaking quality evaluation.

The chromatographic parameters are as follows—

HPLC column:	Princeton Sphere C18, 25 cm x 4.6 mm, 5 µ
Mobile phase:	Acetonitrile–0.1M Phosphate buffer (pH 4.0) (70:30)
Flow rate:	2 ml/min
Injection volume:	10 µl
Temperature:	Ambient

The performance parameters were as follows—

Specificity:	Specific for sulfadoxine and pyrimethamine as per USP
Precision:	percent relative standard deviation < 2
Peak symmetry:	percent relative standard deviation < 1
Resolution:	percent relative standard deviation > 2

No interfering peaks were observed during the analysis.

Method of Assay for Amodiaquine Hydrochloride Tablets

The content of amodiaquine base in amodiaquine hydrochloride tablet was determined by the USP 28 assay method for amodiaquine hydrochloride tablet.

Method for Assay of Artesunate Tablets

The content of artesunate was determined by means of modified HPLC method for assay for artesunate tablet described in the third edition of the International Pharmacopoeia (IP, vol. 5).

The chromatographic parameters are as follows—

HPLC column:	Princeton Sphere C18, 25 cm x 4.6 mm, 5 µ
Mobile phase:	Acetonitrile–Phosphate buffer (pH 3.0) (50:50)
Flow rate:	2 ml/min
Injection volume:	20 µl
Temperature:	30^{o}C

The performance parameters were as follows—

Specificity:	Specific for artesunate as per International Pharmacopoeia
Precision:	percent RSD < 1
Peak symmetry:	percent RSD < 1
Resolution:	percent RSD > 5

Method for the Assay of Dihydroartemisinin Tablet and B-Artemether Soft Gelatin Capsule

The content of dihydroartemisinin was determined by the assay method for artemisinin described in the International Pharmacopoeia (3rd ed., vol. 5).

The chromatographic conditions applied were—

HPLC column:	Princeton Sphere C18, 100A, 25 cm x 4.6 mm, 5 µ
Mobile phase:	Acetonitrile-water (60:40)
Flow rate:	2 ml/min
Injection volume:	20 µl
Temperature:	30°C

Table 17 summarizes the method of analysis of the various preparations.

Table 17. Summary of Methods of Analysis of Antimalarial Preparations Sampled

Preparation	Method of Analysis
Sulfadoxine-pyrimethamine tablets	Modified USP method involving use of HPLC for assay and dissolution
Amodiaquine hydrochloride tablets	As per USP for both assay and dissolution
Artemisinin derivatives	Modified IP method involving use of HPLC for the assay and ultraviolet for dissolution

Dissolution Testing

Dissolution Method for Sulfadoxine and Pyrimethamine

The modified method and apparatus of the USP 24/FDB were used for testing the dissolution characteristics of sulfadoxine and pyrimethamine tablets according to their dissolution monograph.

The dissolution parameters for sulfadoxine and pyrimethamine were—

Dissolution medium:	900 ml phosphate buffer, pH 6.8
Apparatus:	2

Speed:	75 rpm
Time:	30 minutes

Six weighed tablets were introduced into the dissolution vessels. A 20 ml filtered portion of the dissolution solution was withdrawn after 30 minutes into a 50-millileter volumetric flask and 9 milliliters of 0.5 mg/ml standard solution of pyrimethamine (USP, reference standard) was added diluted to volume. The solution was analyzed according to the prescribed sulfadoxine and pyrimethamine tablets modified assay method.

The amount of sulfadoxine and pyrimethamine released after 30 minutes is expressed as a percentage of the label claim.

Dissolution Method for Amodiaquine Tablets

The dissolution parameters for amodiaquine hydrochloride tablets as per USP 28 were as follows—

Dissolution medium:	900 ml of water
Apparatus:	2
Speed:	50 rpm
Time:	30 minutes

Six weighed tablets were each introduced into the dissolution medium in each vessel. Ten milliliters of the filtered portion of the dissolving medium was withdrawn into a 100-milliliter volumetric flask and made to volume with water. The content of amodiaquine hydrochloride dissolved was analyzed by the prescribed USP 24 monograph for dissolution testing of amodiaquine hydrochloride. The amount of amodiaquine hydrochloride dissolved was expressed as a percentage of the label claim.

Dissolution Method for Artesunate Tablet

The modified method and apparatus of IP (3rd ed., vol. 5) was used for testing the dissolution characteristics of artesunate tablets. The dissolution parameters were—

Dissolution medium:	900 ml of water
Apparatus:	2
Speed:	100 rpm
Time:	30 minutes

Six weighed tablets were introduced in the dissolution medium in the vessels. A 20-milliliter aliquot of the filtered dissolving medium was put into a 25-milliliter volumetric flask; 2.5 milliliters of 0.1 molar sodium hydroxide was added and then made to volume with water. The solution and a 0.044 mg/ml standard artesunate (USP, RS) solution were placed in a water bath maintained at 50 ± 1^{o}C for 45 minutes. The samples and standard solutions were rapidly cooled and the absorbencies were measured at 289 nanometer wavelength within 20 minutes.

The content of artesunate dissolved after 30 minutes was expressed as a percentage of the label claim.

Dissolution Method for Dihydroartemisinin

The dissolution parameters and amount dissolved for artesunate was adapted for the dissolution of dihydroartemisinin tablet as follows—

Dissolution medium:	900 ml of water
Apparatus:	2
Speed:	100 rpm
Time:	30 minutes

Results

The results of the antimalarials analyzed were expressed as percentages of the label claim.

Table 18. Results of Analysis of Sampled Sulfadoxine-Pyrimethamine Tablets

Serial No.	Assay (%)			Mean Assay		Mean Dissolution		Conformity to USP Specification
	First Replicate	Second Replicate	Third Replicate	Sulfadoxine-Pyrimethamine	Remarks <90–110%>	Sulfadoxine-Pyrimethamine (%)	REMARKS <60+5 %	
GR/DW/CS 001	94.7/101.5	95.6/100.6	94.3/99.3	94.9/100.5	passed	74.4/90.3	passed	Yes
GR/DW/HS 003	99.5/103.3	100.9/103.3	100.8/103.0	100.4/103.2	passed	64.3/92.8	failed	No
GR/DW/CS 005	99.7/98.0	102.0/99.0	102.0/99.3	101.2/98.8	passed	89.9/91.2	passed	Yes
GR/DW/CS 006	98.4/99.8	97.4/96.6	97.5/96.6	97.8/97.7	passed	52.5/89.7	failed	No
GR/AM/CS 007	98.2/95.2	98.4/95.6	98.8/95.7	98.5/95.5	passed	73.0/93.8	passed	Yes
GR/GA/PH 009	97.6/100.7	98.9/98.5	95.6/97.1	97.4/98.8	passed	96.2/90.0	passed	Yes
GR/GA/PH 011	100.5/101.8	99.5/101.9	100.1/101.4	100.0/101.7	passed	49.8/87.3	failed	No
GR/GA/PH 013	93.0/96.5	94.6/97.0	93.5/96.7	93.7/96.7	passed	76.5/93.5	passed	Yes
GR/GA/PH 016	101.2/102.4	101.8/102.7	101.9/103.1	101.6/102.7	passed	70.1/94.4	passed	Yes
GR/GA/PH 018	89.2/103.2	88.8/103.5	88.9/103.5	89.0/103.4	failed	90.0/89.3	passed	Yes
GR/GA/PH 019	97.1/98.3	95.4/98.0	95.1/97.2	95.9/97.8	passed	89.9/96.9	passed	Yes
BA/001	103.6/98.1	99.7/97.9		101.6/98.0	passed	85.0/90.6	passed	Yes
BA / 005	97.5/99.8	97.0/100.2		97.3/99.9	passed	83.4/90.6	passed	Yes
BA / 006	98.3/99.9	96.7/99.3		97.5/99.6	passed	71.0/83.6	passed	Yes
BA/ 008	99.5/100.0	99.5/100.8		100.2/100.4	passed	94.0/89.4	passed	Yes
BA / 009	96.2/100.3	100.1/101.1	100.1/100.5	98.8/100.6	passed	96.0/91.9	passed	Yes
BA / 010	95.4/95.65	96.7/99.5	99.6/100.4	97.2/98.5	passed	94.4/99.4	passed	Yes
BA / 012	91.8/109.0	86.9/109.0	88.6/107.3	89.1/108.4	failed	58.4/89.4	failed	No
BA / 013	86.8/98.2	85.7/98.1	86.6/97.0	86.4/97.8	failed	87.7/90.5	passed	Yes
BA / 014	100.4/97.0	102.6/98.6	102.4/98.0	101.8/97.9	passed	84.8/95.4	passed	Yes
BA / 015	99.5/99.5	101.3/100.6		100.4/100	passed	88.4/93.5	passed	Yes
UE/KN/PH 01	101.5/98.1	100.5/98.1		101.0/98.1	passed	71.0/93.2	passed	Yes
UE/KN/PH/05	98.3/97.5	99.1/97.5		98.7/97.5	passed	94.7/90.5	passed	Yes
UE/KN/HC/06	100.0/99.8	99.3/99.9	101.9/99.9	100.4/99.86	passed	81.2/96.2	passed	Yes
UE/BE/HC/012	101.8/100.2	103.6/100.9		102.7/100.6	passed	92.8/90.3	passed	Yes

Table 18 shows that all 25 samples worked on were identified as containing sulfadoxine and pyrimethamine. Three samples failed assay for sulfadoxine content. All the samples passed assay for pyrimethamine content. Four of the 25 samples failed dissolution for sulfadoxine, while none of the samples failed dissolution for pyrimethamine.

Of the three sulfadoxine assay failures, one sample was from the southern belt and two from the middle belt of the country. The three tablets failing sulfadoxine assay were locally manufactured by three different manufacturers.

Of the four samples failing dissolution, three samples were from the southern belt and one from the middle belt. Three of the four samples were from local manufacturers, and two samples came from the same company. In all, four samples did not comply with the pharmacopeia specifications.

Table 19. Results of Analysis of Amodiaquine Hydrochloride Samples

Serial No.	Assay (%)			Mean Assay <93–107%>	Dissolution Test		Conformity to USP Specification
	First Replicate	Second Replicate	Third Replicate		Of Six Vessels (%)	Remarks <80 %	
GR/DW/CS 002	102.7	101.2	103.1	102.3	39.9	Failed	No
GR/DW/MH 004	9.32	9.48	9.35	9.38	2.4	Failed	No
GR/GA/PH 014	104.6	103.0	101.3	102.9	80.2	Passed	Yes
GR/GA/PH 020	104.9	104.8	103.0	104.2	80.5	Passed	Yes
BA/002	98.7	99.5	97.3	98.5	81.0	Passed	Yes
BA/011	105.1	106.7	106.1	106.0	82.7	Passed	Yes
BA/017	108.7	105.6	107.4	107.4	80.4	Passed	Yes
UEBEDH 11	9.7	9.8	9.7	9.7	1.7	Failed	No

Table 19 shows that eight amodiaquine hydrochloride samples were analyzed, of which two samples failed assay and three failed dissolution. Three of the eight samples were from local manufacturers, and two came from the same company. Two of the eight samples were not registered with the Food and Drugs Board. In both the assay and dissolution tests, three samples did not conform to the pharmacopeia specification.

Table 20. Results of Analysis of Artemisinin Derivatives Sampled during the Assessment

Serial No.	Assay (%)			Mean Assay <90–110%>	Mean DissolutionTest		Related Substances	Conformity to IP Specification
	First Replicate	Second Replicate	Third Replicate		Of Six Vessels (%)	Remarks <60% Release		
GR/GA/PH/008	99.6	99.1	100.1	99.6	98.8	passed		yes
GR/GA/PH/010	83.1	83.3	82.3	82.9	118.2	passed		no
GR/GA/PH/012	93.6	94.2	94.4	94.0	58.5	failed		no
GR/GA/PH/015	93.3	93.6	89.2	92.0	64.1	passed		yes
BA/003	99.1	97.5	99.0	98.5	86.1	passed		yes
BA/007	93.5	94.6	94.1	94.0	102.6	passed		yes
BA/016	87.5	83.6	89.9	87.0	62.4	passed		no
UE/KN/PH/03	80.9	78.9	80.5	80.1	—	—		no
UE/KN/PH/07	94.6	95.0	95.4	95.0	84.9	passed		yes
UE/KN/PH/08	91.0	93.4	94.8	93.0	90.4	passed		yes
UE/KN/PH/09	97.9	97.4	97.5	97.6	66.7	passed		yes
UE/KN/PH.010	98.8	97.5	98.1	98.1	71.6	passed		yes

Table 20 shows that all 12 artemisinin derivatives were identified as containing their respective active ingredients. Two of the nine samples failed assay for artesunate. No artesunate sample failed dissolution. Of the two failures, one sample was from the southern belt and one from the middle belt of Ghana. No failures occurred of samples obtained from the northern belt of Ghana. One of the failing samples was from a local manufacturer and the other an imported product from China.

The only β-artemether sample analyzed failed assay. Dissolution did not apply to this sample because the product is a soft gelatin capsule.

Two dihydroartemisinin tablet forms were analyzed. One failed dissolution.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The development of resistance to antimalarial medicines has prompted many countries, including Ghana, to review their antimalarial treatment policies to incorporate artemisinin-based combination therapies. Currently, ACTs are considered the best treatment for uncomplicated *P. falciparum* malaria; however, successful implementation of such new antimalarial treatment policies is dependent on the level and efficiency of the country's health care delivery system, including the pharmaceutical management system. Without efficient pharmaceutical management systems, efforts to ensure that ACTs reach those without financial resources will be compromised. Yet wide coverage and accessibility by Ghanaians to recommended antimalarial medicines in both public and private sectors is essential to register ACT impact.

This assessment has revealed that the pharmaceutical management system responsible for the assurance of an uninterrupted supply of antimalarials to health facilities in Ghana is facing some challenges, as evidenced by—

- Poor availability of antimalarial medicines in health facilities
- Stock-outs of antimalarial medicines within the public health system
- Inadequate inventory management at peripheral health facilities

In addition, the assessment revealed important quality deficiencies in sampled antimalarials. Assays demonstrated a failure rate of 35.5 percent (16 of a total of 45 antimalarial samples analyzed).

Recommendations

The findings presented in this report indicate specific problems in the availability and quality of antimalarial medicines in Ghana. The indicators in the DAS should be viewed as the first step in a process of investigation of the problems that have been discussed in the report. The findings can help MoH managers and district health managers focus attention on the most acute problem areas of availability and use of antimalarial medicines and discuss them with key stakeholders in pharmaceutical management and ACT policy implementation. The feedback of these meetings should be presented and shared with policy and decision makers.

Before implementing any appropriate interventions, further investigation should be done to determine the causes of the problems identified in both the availability and quality assessments in order to effectively target interventions. This investigation can take the form of focus group discussions, peer group work, and key informant interviews.

To achieve efficient implementation of an ACT policy in Ghana, the following major recommendations are made for improving availability and quality of antimalarial medicines—

Improvement of Pharmaceutical Management of Malaria

Training in Inventory Management

Accurate and current stock records are essential to good inventory management, and stock records are a key source of information used to calculate needs. It follows that inaccurate records will produce inaccurate needs estimations and problems with stock-outs, leaks, and expiry.

Staff training within the public sector pharmaceutical system is recommended. The different cadres of pharmaceutical management staff should be trained together to emphasize the importance of collaboration in preserving the continuity of the antimalarial medicines supply chain and strengthening all links.

Institution of a Program of Performance Monitoring for Efficient Distribution

Pharmaceutical distribution within the health care system in Ghana is likely to be challenged by problems such as the lack of funds for adequate transportation and fuel, bad roads, and poor communications, as is the case in most developing countries. A well-run distribution system should maintain a constant supply of medicines, keep medicines in good condition, minimize losses cause by spoilage and expiry, minimize pharmaceutical shortage points, use available transport as effectively as possible, reduce theft and fraud, and provide information for forecasting medicine needs.

It is recommended that a program of performance monitoring be instituted to ensure that the distribution system works as intended in Ghana. Senior managers within the Central Medical Stores and the National Malaria Control Program should regularly monitor the cost and performance of the distribution system as important indicators that the operations of Ghana's health system are well structured.

Intensification of Necessary Regulatory Measures to Maintain the High Quality of Antimalarials

The Food and Drugs Board in its role as the regulatory authority with statutory responsibility for assuring the safety and quality of all pharmaceuticals available for the market in Ghana is encouraged to undertake the following—

- Constant monitoring of the quality of all products that it registers, including future manufactured and imported antimalarial product applications in support of the new ACT policy
- Organization of a training program for local industries on good formulation practices and validation methods for production
- Further collaborative work on product testing with the USP DQI in other therapeutic areas

- Intensification of postmarketing surveillance
- Monitoring and implementation of measures that will ensure close relationships between manufacturing industries and the Food and Drugs Board analytical laboratory after marketing authorization is given
- Education of manufactures and importers on—
    - Good procurement practices (raw materials sourcing and prequalification of Active Pharmaceutical Ingredients suppliers)
    - Good formulation practices
    - Quality assurance systems (GMP and quality control)
    - Process validation
    - Good storage and warehousing practices
    - Stocking and selling registered products that conform to agreed specifications

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ANNEX 1. DATA COLLECTION TOOLS

Background Information

This information is required to provide an overview of the MoH pharmaceutical management operations within each state.

MoH Pharmaceutical Management Operations
Numbers and distribution of MoH health facilities, pharmacies, and warehouses
Numbers and distribution of pharmaceutical retail outlets
Numbers and distribution of drug wholesalers, distributors, and manufacturers
Diagram showing system of pharmaceutical procurement and distribution for malaria drugs. The diagram should also include the offices responsible for managing procurement of malaria products (by both purchase and donation), storage facilities, and health facilities.
List of sources of malaria drugs flowing through the distribution system and estimated values for each source, including budgets, and contributions of donors and nongovernmental organizations (NGOs)
Summary of transport arrangements linking storage and health facilities. This should be as specific as possible, indicating numbers and types of vehicles available by geographic zone. If transport is through contract arrangements with parastatal or commercial agencies, describe those arrangements and indicate the budgets.
Copy of National Drug Formulary/Essential Medicines List (NDF/EML) or a list of the malaria drug products and whether these are consistent with the standard treatment guidelines
Copy of Standard treatment guidelines for malaria
Copy of any recent or proposed changes made to antimalarial drug policy not reflected in STG/NDF/EDL
Is there a system(s) for recovering the cost of drugs dispensed in MoH health facilities? Identify the system(s).
What are the major problems that affect the movement of drugs through the procurement and distribution system?

Medical Store Questionnaire

Rational Pharmaceutical Management Plus Program
Central Medical Stores Assessment

Names of Interviewer: _____ Date of Interview: ___/___/2004

_____

Time of Interview: _____

Name of Facility: _____

Designation of interviewees: (1) _____ (2) _____

(3) _____ (4) _____

Section A: Procurement

1. Do you have written procedures for procurement?
   - □ (1) Yes → *seen* □
     not seen □
   - □ (2) No

2. Is procurement centrally managed or is authority decentralized?
   - □ (1) Centralized
   - □ (2) Decentralized

3. Who is responsible for -

   Procurement of medicines _____ *(designation)*

   - Procurement of Malaria related pharmaceuticals _____ *(designation)*

   Procurement of non-drug items _____ *(designation)*

   Procurement of laboratory reagents etc _____ *(designation)*

4. Is there a procurement committee at this institution? □ (1) Yes
   □ (2) No

   If yes, how often does it meet? (per month or per year) _____times per _____

   What is the date of the minutes of the last meeting? _____

5. Are there written procedures for the committee's actions?

□ (1) Yes → *seen* □
not seen □
□ (2) No

6. Who approves procurement of -

Drugs _____ *(designation)*

- Antimalarials _____ *(designation)*

Laboratory Supplies _____ *(designation)*

Medical Supplies _____ *(designation)*

7. Have financial ceilings for procurement been set? □ (1) Yes
□ (2) No

If yes, what are they? _____

_____

8. Do you have a written procurement plan? □ (1) Yes → *seen* □
not seen □
□ (2) No

If yes, does the procurement plan include a budget (or a financial plan)?

□ (1) Yes → *seen* □
not seen □
□ (2) No

9. Do you keep copies of purchase orders (or do you keep a separate record of all purchase orders made)?

□ (1) Yes → *seen* □
not seen □
□ (2) No

10. Are you always able to purchase all your requirements? □ (1) Yes
□ (2) No

If no, what are the reasons? _____

_____

_____

11. Is information on international and domestic drug prices readily available?
    - □ (1) Yes
    - □ (2) No

    If yes, list sources.

    _____

    _____

    _____

    _____

12. Do you have a copy of the 2004 version of the Ghana Essential Drug List?
    - □ (1) Yes → *seen* □ *not seen* □
    - □ (2) No

    If no, do you have a copy of another version of the Ghana EDL?
    - □ (1) Yes → *seen* □ Year_____ *not seen* □
    - □ (2) No

13. Do you have a standard list of medical supplies available?
    - □ (1) Yes → *seen* □ *not seen* □
    - □ (2) No

14. Do you maintain a "Priority Stock List"? □ (1) Yes → *seen* □ *not seen* □
    - □ (2) No

15. Since the beginning of this year, have you bought any drugs outside the Ghana EDL?
    - □ (1) Yes
    - □ (2) No
    - □ (3) Don't know

    If yes, please specify the five most important items in terms of value

    a. _____

    b. _____

    c. _____

    d. _____

    e. _____

16. List routine procurement reports? *(Inspect)*

    a. _____

    b. _____

    c. _____

Quantification

17. Do you have written procedures for determining order quantities?

    □ (1) Yes → *seen* □
    not seen □
    □ (2) No

18. What methods are used to determine quantities to order?

    □ (1) Past Consumption
    □ (2) Morbidity
    □ (3) Previous procurement quantities
    □ (4) Other, specify _____

19. What records or reports are used for deciding how much to order?

    a. _____

    b. _____

    c. _____

    d. _____

20. Who has ultimate decision on procurement quantities for -

    Drugs _____ *(designation)*

    - Antimalarials _____ *(designation)*

    Laboratory Supplies _____ *(designation)*

    Medical Supplies _____ *(designation)*

21. Who has ultimate decision on procurement source for -

    Drugs _____ *(designation)*

    - Antimalarials _____ *(designation)*

    Laboratory Supplies _____ *(designation)*

    Medical Supplies _____ *(designation)*

22. Are there any problems with quantification?

□ (1) Yes
□ (2) No

If yes, explain

_____

_____

_____

_____

Tendering

23. What procurement methods are used to obtain supplies, and what percent of supplies were obtained in 2003 under each method by value? *(check all that apply)*?

□ (1) International open tenders _____%
□ (2) National open tenders _____%
□ (3) Restricted tenders _____%
□ (4) Shopping/Quotation/Buy out _____%
□ (5) Sole Source/Direct _____%
□ (6) Other _____%

24. Do you have written procedures for tendering?

□ (1) Yes → *seen* □
not seen □
□ (2) No

25. Are procedures for tendering based on law or written policies?

□ (1) Yes → *seen* □
not seen □
□ (2) No

26. Do you have standard tendering documents?

□ (1) Yes → *seen* □
not seen □
□ (2) No

27. Is there prequalification for suppliers?

□ (1) Yes
□ (2) No

28. If prequalification is done, are there documented procedures and criteria?

□ (1) Yes → *seen* □
not seen □
□ (2) No

29. How often do you conduct open tenders?
    - □ (1) Once a year
    - □ (2) Twice a year
    - □ (3) When needed (_____approximate frequency)
    - □ (4) Other: _____

30. How many different suppliers normally compete in tenders? _____

31. How many different suppliers normally win tender contracts? _____

32. What is the usual basis for selecting the contract supplier?
    - □ (1) Lowest price with no exception
    - □ (2) Lowest price from pre-qualified supplier
    - □ (3) Lowest price of products deemed to be of acceptable quality
    - □ (4) Other _____

33. Is the store obliged to buy tender items from the winning bidder?
    - □ (1) Yes
    - □ (2) No

If no, explain

_____

_____

_____

_____

34. Are there any major problems with tendering?
    - □ (1) Yes
    - □ (2) No

If yes, explain

_____

_____

_____

_____

Supplier Performance and Monitoring

35. Do you have written procedures for supplier and contract monitoring?
    - □ (1) Yes → *seen* □
      not seen □
    - □ (2) No

36. Who is responsible for contract monitoring? _____ *(Designation)*

37. Do suppliers comply with contract conditions?
    - □ (1) Comply all of the time
    - □ (2) Comply more than 50% of the time
    - □ (3) Comply less than 50% of the time
    - □ (4) Never comply

38. If suppliers do not comply, are the prescribed sanctions applied?
    - □ (1) Applied all of the time
    - □ (2) Applied more than 50% of the time
    - □ (3) Applied less than 50% of the time
    - □ (4) Never applied

Section B: Distribution and Transport

39. Does your institution deliver supplies to clients?
    - □ (1) Yes
    - □ (2) No

40. If yes, do you have written procedures for distribution of goods?
    - □ (1) Yes → *seen* □
      not seen □
    - □ (2) No

41. How many facilities are served by the store?
    - □ (1) Health facility (ies) _____
    - □ (2) Other Store(s) _____

42. Is there a schedule for the supply of supplies to the various facilities?
    - □ (1) Yes → *seen* □
      not seen □
    - □ (2) No

    Is the schedule followed? *(check schedule against actual dispatch days for past year)*
    - □ (1) Yes
    - □ (2) No

If no state the major reason(s) for deviation

a. _____

b. _____

c. _____

d. _____

43. What information/records/documentation do you require before drugs are supplied?

    a. _____

    b. _____

    c. _____

    d. _____

44. What is the average time between receiving a requisition and providing the drugs to the facility?
    _____days/weeks/months/years

45. Do you have any vehicles to transport drugs? □ (1) Yes
    □ (2) No

    If yes, how many vehicles are used to transport drugs? _____ vehicles

    Specify type and condition.

Type of Vehicle	Vehicle Capacity (Tons)	Condition		
		New	Good	Running, but needs repair

46. Indicate number of facilities regularly served by the medical store at each level of the logistics system

Type of Facility	Number Served
Regional Stores	
Regional Government Hospitals	
District Hospitals	
Sub-district Hospitals	
Health Facilities	
Others (Specify)	

47. Indicate the nearest and the furthest institution from the store?

	Name of Facility	Distance (Km)	Turn Around Time (days)
Nearest			
Furthest			

48. Does the store use a set of standard distribution routes?

□ (1) Yes *(obtain a list of routes)*
□ (2) No

If yes, indicate

Route	Frequency of Servicing Route (Times Per Year)	Turnaround Time Per Route (Days)	Ideal Truck Size/Capacity for Route

49. Is there a rainy season/bad weather period during which drugs cannot be distributed on any route?

□ (1) Yes
□ (2) No

If yes, indicate affected routes and period(s)

a. _____

b. _____

c. _____

d. _____

50. In addition to the fleet of trucks, are other forms of transport used for distributing supplies?

□ (1) Yes
□ (2) No

If yes, specify

□ (1) Air
□ (2) Train
□ (3) Hired vehicles
□ (4) Public transportation
□ (5) Courier services
□ (6) Other_____

51. What is the source of funding used to pay for transportation costs?

□ Funds of this facility
□ GRN funds held by this facility
□ Other, specify _____

52. How much was spent on transportation in the last financial year?

_____

53. For CMS vehicles, do you have your own workshop for maintenance?
□ (1) Yes
□ (2) No

If yes, does it include major overhauls? □ (1) Yes
□ (2) No

If no, where is heavy maintenance/repair undertaken?_____

54. What is the actual cost of drug transport for a ton/km for the last financial year?

_____

55. Is a vehicle always available when needed to transport drugs?
□ (1) Yes
□ (2) No

If no, what is the main problem? _____

_____

56. Are there any prevailing concerns about transportation safety?
□ (1) Yes
□ (2) No

If yes, specify
□ (1) Poor quality roads
□ (2) Diversion
□ (3) Highway robbery
□ (4) Other_____

Receiving Orders

57. Do you have written procedures for receiving goods? □ (1) Yes → *seen* □
not seen □
□ (2) No

58. Who is responsible for receiving orders? _____ (Designation)

59. When receiving goods, do you always check the quantity received against the requisition/order?
□ (1) Yes
□ (2) No

If yes, have there been any discrepancies since the beginning of this year?
□ (1) Yes, specify _____
□ (2) No

60. When receiving goods, do you check the price against the quoted price?
□ (1) Yes
□ (2) No

If yes, have there been any discrepancies since the beginning of this year?
□ (1) Yes, specify _____
□ (2) No

61. When receiving goods, do you always check the quantity received versus the receipt voucher?
□ (1) Yes
□ (2) No

If yes, have there been any discrepancies since the beginning of this year?
□ (1) Yes, specify _____
□ (2) No

62. Since the beginning of the year, has there been any defective or substandard delivery of goods?
□ (1) Yes
□ (2) No
If yes, specify: _____

How do you deal with these defective deliveries financially? _____

How do you dispose of these defective deliveries? _____

63. Do you always check the expiry dates when goods are received? □ (1) Yes
□ (2) No

64. Are expiry dates monitored per batch? □ (1) Yes
□ (2) No

65. Have you received any expired goods since the beginning of this year?
□ (1) Yes, specify _____
□ (2) No

66. Do you currently have any expired goods in your store? □ (1) Yes
□ (2) No

If yes, do you have a list of them? □ (1) Yes → *seen* □
not seen □
□ (2) No

If there is a list, what are the expired items? _____

Is there a total value? □ (1) Yes N$_____
□ (2) No

67. How do you deal with expired goods financially? _____

68. How do you dispose of expired goods? _____

69. Do you have written procedures for dealing with expired/damaged goods?

□ (1) Yes → *seen* □
not seen □
□ (2) No

Port Clearance

70. Who is responsible for clearing goods at the port? _____ (Designation)

71. What are the major ports for international deliveries?

Nairobi _____%

Mombasa _____%

Other _____%

72. Do you pay customs duties, taxes, VAT or other clearing charges?
□ (1) Yes
□ (2) No

If yes specify;

	Rate	Total Spent last financial year
Custom Duty		
VAT		
Clearing charges		

73. How long does it take clear goods from the port?

Nairobi _____ Days/Weeks/Months

Mombasa _____ Days/Weeks/Months

Other _____ Days/Weeks/Months

74. What is the lead time for delivery by source?

International Supplier _____days

Local Supplier _____days

Quality Assurance

75. Do you follow the WHO certification scheme?
    - □ (1) Yes
    - □ (2) No

76. What documents are required from bidders to prove quality of products?
    - □ (1) GMP Certificate
    - □ (2) Certificate of Analysis
    - □ (3) Manufacturer's Licence
    - □ (4) Other _____*(Specify)*

77. How many products were submitted for testing during the last financial year? _____

78. How many of the products submitted for testing during the last financial year failed the test? _____

79. What criteria are used to select products for testing?
    - □ (1) Every procurement batch
    - □ (2) New suppliers
    - □ (3) Random
    - □ (4) Other_____

(obtain random samples for testing)
(obtain testing records for last financial year)

Inventory Control

80. Do you have written procedures for inventory control?
    - □ (1) Yes → *seen* □
      not seen □
    - □ (2) No

81. What types of inventory records are used?

    _____

    _____

    _____

    _____

82. Do you have written procedures for stock management?
    - □ (1) Yes → *seen* □
      not seen □
    - □ (2) No

83. What is the method of product circulation in the store
    - □ (1) FIFO
    - □ (2) FEFO
    - □ (3) Other _____*(Specify)*

84. Have you established maximum and minimum stock levels for each individual item?
    - □ (1) Yes
    - □ (2) No

85. Have you established a reorder stock level for each individual item?
    - □ (1) Yes
    - □ (2) No

    If yes, when did you last update reorder stock levels? _____/_____ (month/year)

86. How often do you take stock? ____ times per _____

87. Is the last stock taking sheet available? □ (1) Yes → *seen* □ *not seen* □
    □ (2) No

88. How many items are now in stock of?
    - A. Essential Drugs [_|_|_|_]
    - B. Antimalarials [_|_|_|_]
    - C. Medical Supplies [_|_|_|_]
    - D. Laboratory Supplies [_|_|_|_]
    - E. Other [_|_|_|_]

89. How many items in stock are not on the officially-approved stock list?
    - A. Essential Drugs [_|_|_|_]
    - B. Antimalarials [_|_|_|_]
    - C. Medical Supplies [_|__||_]
    - D. Laboratory Supplies [_|_|_|_]
    - E. Other [_|_|_|_]

90. Have certain drugs been regularly out of stock or in short supply at this facility during the past year?
    - □ (1) Yes
    - □ (2) No

If yes, list the items that have been out of stock for more than a cumulative period of one month (30 days) in the past year

a. _____

b. _____

c. _____

d. _____

e. _____

91. Does an approved list of therapeutic substitutions exist?
    - □ (1) Yes → *seen* □
      not seen □
    - □ (2) No

92. If yes, do you have written procedures for effecting therapeutic substitutions?
    - □ (1) Yes → *seen* □
      not seen □
    - □ (2) No

93. Who is responsible for establishing the list? _____ *(designation)*

94. Is the list regularly updated?
    - □ (1) Yes
    - □ (2) No

If yes,

How often is it updated? _____

When was the last update done _____

95. If therapeutic substitution is done when ordered drugs are out of stock, provide examples of substitutions which occurred within the past year. List drug requested and drug sent.

Drug Requested	Drug Supplied
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

96. If an item is in short supply, what is the procedure for allocating distributions?

_____

_____

97. In cases of stock-outs or shortages, are transfers or barters between facilities done?
    - □ (1) Yes
    - □ (2) No

If yes, provide examples from past year.

_____

_____

_____

_____

Storage System

98. Comment on space available for storage:

	Good Condition	Needs To Be Repaired	Needs To Be Replaced
Space			
Pallets			
Storage cabinets			
Shelves			
Forklifts			
Handling Equipment			
Fire Extinguishers			

99. Are there any constraints to proper storage?
    - □ (1) Yes
    - □ (2) No

If yes, describe.

_____

_____

_____

_____

100. What is the general appearance of the storage area?
    - □ (1) Adequate
    - □ (2) Needs Improvement
    - □ (2) Bad
    - □ (3) Other _____*(Specify)*

101. What sources of electrical power supply are available?

□ (1) National Grid
□ (2) Generator
□ (3) Other _____*(Specify)*

102. Are there constraints to a reliable power supply?

□ (1) Yes
□ (2) No

If yes, describe.

_____

_____

_____

_____

Infrastructure and Equipment at CMS

103. Comment on the structural condition of infrastructure and equipment

	Good Condition	Needs To Be Repaired	Needs To Be Replaced
Walls			
Floors			
Ceiling			
Roof			
Office Equipment			
Furniture			

104. Is ventilation and air circulation adequate in the drug storage areas?

□ (1) Yes
□ (2) No

If no, describe problems.

_____

_____

_____

_____

105. Describe the types of heating and cooling equipment in use in the warehouse storage areas, and the condition of the equipment.

_____

_____

_____

_____

106. Is temperature control adequate?

□ (1) Yes
□ (2) No

If no, describe problems.

_____

_____

_____

_____

107. How often is the temperature checked?

_____time(s) per hour/day/week/month

108. How often is the temperature recorded?

_____time(s) per hour/day/week/month

109. Is temperature record chart available and appropriately maintained?

□ (1) Yes → *seen* □
not seen □
□ (2) No

110. Do you have written procedures for temperature control?

□ (1) Yes → *seen* □
not seen □
□ (2) No

111. Do you have written procedures for maintenance and replacement of infrastructure and equipment?

□ (1) Yes → *seen* □
not seen □
□ (2) No

Security

112. Is security adequate for the:

A.	Compound	□ (1) Yes	□ (2) No
B.	Records/Office	□ (1) Yes	□ (2) No
C.	Receiving Area	□ (1) Yes	□ (2) No
D.	Storage Area	□ (1) Yes	□ (2) No
E.	Dispatch Area	□ (1) Yes	□ (2) No

113. Is drug leakage a reported problem at any stage in the supply system?

□ (1) Yes
□ (2) No

If yes, describe problems.

_____

_____

_____

_____

114. Has there been any major problem of theft within the past three (3) years?

□ (1) Yes
□ (2) No

If yes, describe.

_____

_____

_____

_____

115. Are systems in place to control theft and leakage?

□ (1) Yes
□ (2) No

If yes, describe.

_____

_____

_____

116. Do you have written security procedures?

□ (1) Yes → *seen* □
not seen □
□ (2) No

117. Are there dust control procedures or systems in place?

□ (1) Yes
□ (2) No

If yes, describe.

_____

_____

_____

_____

118. Are there pest control procedures or systems in place?

□ (1) Yes
□ (2) No

If yes, describe.

_____

_____

_____

_____

119. Do you have problems with dust, pests, and effectiveness of control procedures?

□ (1) Yes
□ (2) No

If yes, describe.

_____

_____

_____

_____

120. Do you have written procedures for pest and dust control?

□ (1) Yes → *seen* □
not seen □
□ (2) No

121. Describe the types, numbers and condition of CMS cold storage/chain equipment

	Number	Good Condition	Needs To Be Repaired	Needs To Be Replaced
Cold Rooms				
Freezers				
Refrigerators				

MIS and Information Flow

122. Do you get written information, for example a bulletin, on items available at the Medical Stores?

□ (1) Yes → *seen* □
not seen □
□ (2) No

If yes, from which level do you get this information? □ (1) Central Medical Stores
□ (2) Regional Medical Stores

How many times have you received information since the beginning of this year?

_____ times

Does the information include prices? □ (1) Yes
□ (2) No

123. Does the medical store use a computerized system for any of the following? *(check all that apply)*

□ (1) Tracking orders
□ (2) Tracking deliveries
□ (3) Accounting/financial
□ (4) Inventory control
□ (5) Other: _____

124. Describe current software used, and attach sample reports from system (if available)

a. _____

b. _____

c. _____

d. _____

125. Are staff adequately trained and familiar with the software?
   a. □ Yes □ No □ Needs Improvement
   b. □ Yes □ No □ Needs Improvement
   c. □ Yes □ No □ Needs Improvement
   d. □ Yes □ No □ Needs Improvement

126. What type of inventory records does the store maintain?
   □ (1) Bin cards
   □ (2) Registry/Kardex
   □ (3) Computer
   □ (4) Other

127. Are the tally cards (bin cards) up to date? *(Inspect)* □ (1) Yes
   □ (2) No

128. Are ledgers up to date? *(Inspect)* □ (1) Yes
   □ (2) No

Communications

129. How far is the facility from the CMS and/or MoH Headquarters?

   _____miles from CMS

   _____miles from MoH Headquarters

130. Does the facility have any of the following communication devices?

	Good Condition	Needs To Be Repaired	Needs To Be Replaced	Number/address
Telephone				
Fax				
Telex				
email				
Website				
Radio Transmitter				
IDD				

131. Are there any communications constraints?

□ (1) Yes
□ (2) No

If yes, describe.

_____

_____

_____

_____

Drug Information

132. Do you provide any drug information service?

□ (1) Yes
□ (2) No

If yes, describe.

_____

_____

_____

_____

133. Do you have access to drug information resources?

□ (1) Yes
□ (2) No

If yes, describe.

_____

_____

_____

_____

Human Resources

134. Is there an approved organizational structure for the medical store?

□ (1) Yes *(obtain a copy)*
□ (2) No

135. List approved positions and job descriptions and positions filled

Position	Number Approved	Number Filled
Chief Pharmacist		
Tender Pharmacist		
Distribution Pharmacist		
Pharmacists		
Pharmacy Assistants		
Accountant		
Accounts Clerks		
Clerks		
Drivers		
Cleaners		
Porters		
Security Personnel		

136. What are the major training needs of medical store staff?

a. _____

b. _____

c. _____

d. _____

137. What are the key problems related to human resource development?

a. _____

b. _____

c. _____

d. _____

138. Is there anything else that may be important for me to know?

_____

_____

_____

_____

_____

_____

THIS MARKS THE END OF THE INTERVIEW

General Questionnaire

Health Facilities—Hospitals/Health Centers/Health Posts *[page 1 of 5]*

Facility Code:	**Data Collector Code:**	**Facility Type:**	
Location:	**Date:**	**Currency Used:**	**One U.S. Dollar =**

1. Does the facility have a copy of the national malaria treatment guidelines?

   Yes □ No □

   If yes, what year?_____

   Seen Yes □ No □ Where: _____

2. Does the facility have a copy of the national essential drugs list?

   Yes □ No □

   If yes, what year?_____

   Seen Yes □ No □ Where: _____

   Data collected from: _____

   _____

   _____

Health Facilities *[page 2 of 5]*

Facility Code:	**Data Collector Code:**

3. Does the health facility charge user fees?

   Yes □ No □

   If yes, what are the general charges? Consultation for OPD _____

   Payment for Card _____

   Overall standard fee_____

4. What are the charges for malaria treatment/prescription charges (Cedis):

	Charges for seeing clinical officer	Charges for antimalarial drugs
Adults	_____	_____
Children		
< 5 year	_____	_____
5 yr +	_____	_____
Pregnant women	_____	_____

Health Facilities *[page 3 of 5]*

Facility Code:	**Data Collector Code:**

5. What are the charges for return treatment for the same illness (malaria) within a month?

6. What are the charges for malaria laboratory tests (Cedis)?

   a. Blood slide _____

   b. Haemoglobin Test _____

7. How are stock levels of antimalarials managed?

   a. Monthly - Yes □ No □

   b. Bi-annual - Yes □ No □

   c. Annual - Yes □ No □

8. Do you operate strategic levels of antimalarials such as….

   a. Strategic reserves - Yes □ No □

      What drugs _____

   b. Reorder level - Yes □ No □

      What drugs _____

Health Facilities *[page 4 of 5]*

Facility Code:	**Data Collector Code:**

9. Who decides the re-order level for antimalarials? ..

10. What is the minimum stock/re-order level for each antimalarial?

Antimalarial	Unit of re-order	Quantity re-ordered	Extra comments
Sulphadoxine 500mg+ Pyrimethamine 25mg Tablets			
Amodiaquine HCL 200mg Tablets			
Amodiaquine 50mg/50ml Syrup			
Dihydroartemisinin 60mg Tablets			
Dihydroartemisinin Syrup 10mg/5ml – 60ml			
Quinine Dihydrochloride BP Injection 600mg/2ml			
Quinine Sulphate 300mg Tablets film coated			
Quinine Paediatric Oral 10mg/drop (20%)			

11. Does the facility receive donated antimalarial drugs? ..

Drug	**From whom**	**For what period**

Health Facilities *[page 5 of 5]*

Facility Code:	**Data Collector Code:**

12. Does the facility procure antimalarial drug from source outside of CMS/RMS/DMS?

Antimalarial	From where?	Quantity re-ordered/period	Extra comments
Sulphadoxine 500mg+ Pyrimethamine 25mg Tablets			
Amodiaquine HCL 200mg Tablets			
Amodiaquine 50mg/50ml Syrup			
Dihydroartemisinin 60mg Tablets			
Dihydroartemisinin Syrup 10mg/5ml – 60ml			
Quinine Dihydrochloride BP Injection 600mg/2ml			
Quinine Sulphate 300mg Tablets film coated			
Quinine Paediatric Oral 10mg/drop (20%)			

13. Who decides what non-schedule antimalarials to be purchased?

DAS Forms

DAS-1. General Data Collection Preparation Checklist

Each data collector or data collection team will need all of the following items before starting the actual collection of data. The study coordinator will likely provide these items. Check (✓) each item as you receive it.

Item	Collected ✓
1. List of data collection teams and the sites to be visited	
2. Workplan and timetable for each data collection team	
3. Samples of information source documents (e.g., clinic record or medical chart, stock cards, bin cards, etc.)	
4. List of medical terms and symptoms used locally for diagnosing malaria	
5. List of equivalent drug names (brand and generic)	
6. Contact information for data collectors, team managers and study coordinators	
7. Copies of Letters of Authorization or Introduction	
8. Set of enough data collection forms	
9. Pens and other supplies	
10. Per diem for local expenses (add enough to purchase drugs for simulated purchases)	

DAS-2A. Inventory Data Form: Health Post/Community Clinic *[page 1 of 2]*

Facility Code:	**Data Collector Code:**	
Facility Type:	**Location:**	**Date:**

Existing inventory control systems:

Computerized	□
Manual Ledger	□
Tally / Bin / Stock Record Cards	□
Other (specify)	□

Data Collected from:

Computerized	□
Manual Ledger	□
Tally / Bin / Stock Record Cards	□
Other (specify)	□

Note:

- **Data collectors should not fill out the shaded rows or columns.**
- ALL blanks should be filled in on this data form.
- Enter N/Av if data for a particular item are not available from the records or from the health care workers.

DAS-2A. Inventory Data Form: Health Post/Community Clinic [page 2 of 2]

Product	Counting Unit	Record Count	Unposted Receipts	Unposted Issues	Adjusted Total	Physical Count	Expired Stock	Non-expired Stock Available
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9
1. Sulphadoxine 500mg+ Pyrimethamine 25mg Tablets	*Tablet*							
2. Amodiaquine HCL 200mg Tablets	*Tablet*							
3. Amodiaquine 50 mg/50ml Syrup	*Millilitre*							
4. Dihydroartemisinin 60 mg Tablets	*Tablet*							
5. Dihydroartemisinin Syrup 10 mg/5ml – 60ml	*Milliier*							
6. Quinine Dihydrochloride BP Injection 600 mg/2ml	*Ampoule(2 ml)*							
7. Quinine Sulphate 300mg Tablets film coated	*Tablet*							
8. Quinine Pediatric Oral 10 mg/drop (20%)	*15 ml bottle*							
Row 1: Total number of products where Col. 6 equals Col. 7:								
Row 2: (% of records corresponding with physical counts: number in Row 1 x 100 / total number of products stocked in Col. 1:								
Row 3: % of antimalarial drugs available:								

DAS-2B. Inventory Data Form: Health Center [page 1 of 2]

Facility Code:	**Data Collector Code:**	
Facility Type:	**Location:**	**Date:**

Existing inventory control systems:

Computerized	□
Manual Ledger	□
Tally / Bin / Stock Record Cards	□
Other (specify)	□

Data Collected from:

Computerized	□
Manual Ledger	□
Tally / Bin / Stock Record Cards	□
Other (specify)	□

Note:

- **Data collectors should not fill out the shaded rows or columns.**
- ALL blanks should be filled in on this data form.
- Enter N/Av if data for a particular item are not available from the records or from the health care workers.

DAS-2B. Inventory Data Form: Health Centre [page 2 of 2]

Product	Counting Unit	Record Count	Unposted Receipts	Unposted Issues	Adjusted Total	Physical Count	Expired Stock	Non-expired Stock Available
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9
1. Sulphadoxine 500mg+ Pyrimethamine 25mg Tablets	*Tablet*							
2. Amodiaquine HCL 200mg Tablets	*Tablet*							
3. Amodiaquine 50mg/50ml Syrup	*Millilitre*							
4. Dihydroartemisinin 60mg Tablets	*Tablet*							
5. Dihydroartemisinin Syrup 10mg/5ml – 60ml	*Millilitre*							
6. Quinine Dihydrochloride BP Injection 600mg/2ml	*Ampoule(2 ml)*							
7. Quinine Sulphate 300mg Tablets film coated	*Tablet*							
8. Quinine Paediatric Oral 10mg/drop (20%)	*15ml bottle*							
Row 1: Total number of products where Col. 6 equals Col. 7:								
Row 2: (% of records corresponding with physical counts: number in Row 1 x 100 / total number of products stocked in Col. 1:								
Row 3: % of antimalarial drugs available:								

DAS-2C. Inventory Data Form: District Hospital/Sub-District Hospital *[page 1 of 2]*

Facility Code:	**Data Collector Code:**	
Facility Type:	**Location:**	**Date:**

Existing inventory control systems:

Computerized	□
Manual Ledger	□
Tally / Bin / Stock Record Cards	□
Other (specify)	□

Data Collected from:

Computerized	□
Manual Ledger	□
Tally / Bin / Stock Record Cards	□
Other (specify)	□

Note:

- **Data collectors should not fill out the shaded rows or columns.**
- ALL blanks should be filled in on this data form.
- Enter N/Av if data for a particular item are not available from the records or from the health care workers.

DAS-2C. Inventory Data Form: District Hospital/Sub-District *[page 2 of 2]*

Product	Counting Unit	Record Count	Unposted Receipts	Unposted Issues	Adjusted Total	Physical Count	Expired Stock	Non-expired Stock Available
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9
1. Sulphadoxine 500mg+ Pyrimethamine 25mg Tablets	*Tablet*							
2. Amodiaquine HCL 200mg Tablets	*Tablet*							
3. Amodiaquine 50mg/50ml Syrup	*Millilitre*							
4. Dihydroartemisinin 60mg Tablets	*Tablet*							
5. Dihydroartemisinin Syrup 10mg/5ml – 60ml	*Millilitre*							
6. Quinine Dihydrochloride BP Injection 600mg/2ml	*Ampoule(2 ml)*							
7. Quinine Sulphate 300mg Tablets film coated	*Tablet*							
8. Quinine Paediatric Oral 10mg/drop (20%)	*15ml bottle*							
Row 1: Total number of products where Col. 6 equals Col. 7:								
Row 2: (% of records corresponding with physical counts: number in Row 1 x 100 / total number of products stocked in Col. 1:								
Row 3: % of antimalarial drugs available:								

DAS-2D. Inventory Data Form: Central Medical Store / Regional Medical Stores/District Stores *[page 1 of 2]*

Facility Code:	**Data Collector Code:**	
Facility Type:	**Location:**	**Date:**

Existing inventory control systems:

Computerized	□
Manual Ledger	□
Tally / Bin / Stock Record Cards	□
Other (specify)	□

Data Collected from:

Computerized	□
Manual Ledger	□
Tally / Bin / Stock Record Cards	□
Other (specify)	□

Note:

- **Data collectors should not fill out the shaded rows or columns.**
- ALL blanks should be filled in on this data form.
- Enter N/Av if data for a particular item are not available from the records or from the health care workers.

DAS-2D. Inventory Data Form: Central Medical Store / Regional Medical Stores/District Stores [page 2 of 2]

Product	Counting Unit	Record Count	Unposted Receipts	Unposted Issues	Adjusted Total	Physical Count	Expired Stock	Non-expired Stock Available
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9
1. Sulphadoxine 500mg+ Pyrimethamine 25mg Tablets	*Tablet*							
2. Amodiaquine HCL 200mg Tablets	*Tablet*							
3. Amodiaquine 50mg/50ml Syrup	*Millilitre*							
4. Dihydroartemisinin 60mg Tablets	*Tablet*							
5. Dihydroartemisinin Syrup 10mg/5ml – 60ml	*Millilitre*							
6. Quinine Dihydrochloride BP Injection 600mg/2ml	*Ampoule(2 ml)*							
7. Quinine Sulphate 300mg Tablets film coated	*Tablet*							
8. Quinine Paediatric Oral 10mg/drop (20%)	*15ml bottle*							
Row 1: Total number of products where Col. 6 equals Col. 7:								
Row 2: (% of records corresponding with physical counts: number in Row 1 x 100 / total number of products stocked in Col. 1:								
Row 3: % of antimalarial drugs available:								

DAS-3A. Stock-Out Data Form: Health Post/Community Clinic *[page 1 of 3]*

Facility Code:	**Data Collector Code:**	
Facility Type:	**Location:**	**Date:**
Record Type:		

For each product, write the number of days out of stock for each month.

Product	Mar 04	Feb 04	Jan 04	Dec 03	Nov 03	Oct 03	Sep 03	Aug 03	Jul 03	Jun 03	May 03	Apr 03	Total Days Out of Stock
1. Sulphadoxine 500mg+ Pyrimethamine 25mg Tablets													
2. Amodiaquine HCL 200mg Tablets													
3. Amodiaquine 50mg/50ml Syrup													
4. Dihydroartemisinin 60mg Tablets													
5. Dihydroartemisinin Syrup 10mg/5ml – 60ml													
6. Quinine Dihydrochloride BP Injection 600mg/2ml													
7. Quinine Sulphate 300mg Tablets film coated													
8. Quinine Paediatric Oral 10mg/drop (20%)													
Row 1: Sum total days out of stock for all stocked drugs:													
Row 2: Count total number of products stocked in Column 1:													
Row 3: Average % time out of stock = (number in Row 1 x 100) / (365 x number in Row 2):													

DAS-3A. Stock-Out Data Form: Health Post/Community Clinic [page 2 of 3]

Facility Code:	**Data Collector Code:**	
Facility Type:	**Location:**	**Date:**
Record Type:		

For each product, write the number of days out of stock for each month.

Product	Mar 03	Feb 03	Jan 03	Dec 02	Nov 02	Oct 02	Sep 02	Aug 02	Jul 02	Jun 02	May 02	Apr 0	Total Days Out of Stock
1. Sulphadoxine 500mg+ Pyrimethamine 25mg Tablets													
2. Amodiaquine HCL 200mg Tablets													
3. Amodiaquine 50mg/50ml Syrup													
4. Dihydroartemisinin 60mg Tablets													
5. Dihydroartemisinin Syrup 10mg/5ml – 60ml													
6. Quinine Dihydrochloride BP Injection 600mg/2ml													
7. Quinine Sulphate 300mg Tablets film coated													
8. Quinine Paediatric Oral 10mg/drop (20%)													
Row 1: Sum total days out of stock for all stocked drugs:													
Row 2: Count total number of products stocked in Column 1:													
Row 3: Average % time out of stock = (number in Row 1 x 100) / (365 x number in Row 2):													

DAS-3A. Stock-Out Data Form: Health Post/Community Clinic *[page 3 of 3]*

Facility Code:	**Data Collector Code:**	
Facility Type:	**Location:**	**Date:**
Record Type:		

For each product, write the number of days out of stock for each month.

Product	Mar 02	Feb 02	Jan 02	Dec 01	Nov 01	Oct 01	Sep 01	Aug 01	Jul 01	Jun 01	May 01	Apr 01	Total Days Out of Stock
1. Sulphadoxine 500mg+ Pyrimethamine 25mg Tablets													
2. Amodiaquine HCL 200mg Tablets													
3. Amodiaquine 50mg/50ml Syrup													
4. Dihydroartemisinin 60mg Tablets													
5. Dihydroartemisinin Syrup 10mg/5ml – 60ml													
6. Quinine Dihydrochloride BP Injection 600mg/2ml													
7. Quinine Sulphate 300mg Tablets film coated													
8. Quinine Paediatric Oral 10mg/drop (20%)													
Row 1: Sum total days out of stock for all stocked drugs:													
Row 2: Count total number of products stocked in Column 1:													
Row 3: Average % time out of stock = (number in Row 1 x 100) / (365 x number in Row 2):													

DAS-3B. Stock-Out Data Form: Health Centre [page 1 of 3]

Facility Code:	**Data Collector Code:**	
Facility Type:	**Location:**	**Date:**
Record Type:		

For each product, write the number of days out of stock for each month.

Product	Mar 04	Feb 04	Jan 04	Dec 03	Nov 03	Oct 03	Sep 03	Aug 03	Jul 03	Jun 03	May 03	Apr 03	Total Days Out of Stock
1. Sulphadoxine 500mg+ Pyrimethamine 25mg Tablets													
2. Amodiaquine HCL 200mg Tablets													
3. Amodiaquine 50mg/50ml Syrup													
4. Dihydroartemisinin 60mg Tablets													
5. Dihydroartemisinin Syrup 10mg/5ml – 60ml													
6. Quinine Dihydrochloride BP Injection 600mg/2ml													
7. Quinine Sulphate 300mg Tablets film coated													
8. Quinine Paediatric Oral 10mg/drop (20%)													
Row 1: Sum total days out of stock for all stocked drugs:													
Row 2: Count total number of products stocked in Column 1:													
Row 3: Average % time out of stock = (number in Row 1 x 100) / (365 x number in Row 2):													

DAS-3B. Stock-Out Data Form: Health Centre [page 2 of 3]

Facility Code:	**Data Collector Code:**	
Facility Type:	**Location:**	**Date:**
Record Type:		

For each product, write the number of days out of stock for each month.

Product	Mar 03	Feb 03	Jan 03	Dec 02	Nov 02	Oct 02	Sep 02	Aug 02	Jul 02	Jun 02	May 02	Apr 0	Total Days Out of Stock
1. Sulphadoxine 500mg+ Pyrimethamine 25mg Tablets													
2. Amodiaquine HCL 200mg Tablets													
3. Amodiaquine 50mg/50ml Syrup													
4. Dihydroartemisinin 60mg Tablets													
5. Dihydroartemisinin Syrup 10mg/5ml – 60ml													
6. Quinine Dihydrochloride BP Injection 600mg/2ml													
7. Quinine Sulphate 300mg Tablets film coated													
8. Quinine Paediatric Oral 10mg/drop (20%)													
Row 1: Sum total days out of stock for all stocked drugs:													
Row 2: Count total number of products stocked in Column 1:													
Row 3: Average % time out of stock = (number in Row 1 x 100) / (365 x number in Row 2):													

DAS-3B. Stock-Out Data Form: Health Centre [page 3 of 3]

Facility Code:	**Data Collector Code:**	
Facility Type:	**Location:**	**Date:**
Record Type:		

For each product, write the number of days out of stock for each month.

Product	Mar 02	Feb 02	Jan 02	Dec 01	Nov 01	Oct 01	Sep 01	Aug 01	Jul 01	Jun 01	May 01	Apr 01	Total Days Out of Stock
1. Sulphadoxine 500mg+ Pyrimethamine 25mg Tablets													
2. Amodiaquine HCL 200mg Tablets													
3. Amodiaquine 50mg/50ml Syrup													
4. Dihydroartemisinin 60mg Tablets													
5. Dihydroartemisinin Syrup 10mg/5ml – 60ml													
6. Quinine Dihydrochloride BP Injection 600mg/2ml													
7. Quinine Sulphate 300mg Tablets film coated													
8. Quinine Paediatric Oral 10mg/drop (20%)													
Row 1: Sum total days out of stock for all stocked drugs:													
Row 2: Count total number of products stocked in Column 1:													
Row 3: Average % time out of stock = (number in Row 1 x 100) / (365 x number in Row 2):													

DAS-3C. Stock-Out Data Form: District Hospital/Sub-District Hospital [page 1 of 3]

Facility Code:	**Data Collector Code:**	
Facility Type:	**Location:**	**Date:**
Record Type:		

For each product, write the number of days out of stock for each month.

Product	Mar 04	Feb 04	Jan 04	Dec 03	Nov 03	Oct 03	Sep 03	Aug 03	Jul 03	Jun 03	May 03	Apr 03	Total Days Out of Stock
1. Sulphadoxine 500mg+ Pyrimethamine 25mg Tablets													
2. Amodiaquine HCL 200mg Tablets													
3. Amodiaquine 50mg/50ml Syrup													
4. Dihydroartemisinin 60mg Tablets													
5. Dihydroartemisinin Syrup 10mg/5ml – 60ml													
6. Quinine Dihydrochloride BP Injection 600mg/2ml													
7. Quinine Sulphate 300mg Tablets film coated													
8. Quinine Paediatric Oral 10mg/drop (20%)													
Row 1: Sum total days out of stock for all stocked drugs:													
Row 2: Count total number of products stocked in Column 1:													
Row 3: Average % time out of stock = (number in Row 1 x 100) / (365 x number in Row 2):													

DAS-3C. Stock-Out Data Form: District Hospital/Sub-District Hospital [page 2 of 3]

Facility Code:	**Data Collector Code:**	
Facility Type:	**Location:**	**Date:**
Record Type:		

For each product, write the number of days out of stock for each month.

Product	Mar 03	Feb 03	Jan 03	Dec 02	Nov 02	Oct 02	Sep 02	Aug 02	Jul 02	Jun 02	May 02	Apr 02	Total Days Out of Stock
1. Sulphadoxine 500mg+ Pyrimethamine 25mg Tablets													
2. Amodiaquine HCL 200mg Tablets													
3. Amodiaquine 50mg/50ml Syrup													
4. Dihydroartemisinin 60mg Tablets													
5. Dihydroartemisinin Syrup 10mg/5ml – 60ml													
6. Quinine Dihydrochloride BP Injection 600mg/2ml													
7. Quinine Sulphate 300mg Tablets film coated													
8. Quinine Paediatric Oral 10mg/drop (20%)													
Row 1: Sum total days out of stock for all stocked drugs:													
Row 2: Count total number of products stocked in Column 1:													
Row 3: Average % time out of stock = (number in Row 1 x 100) / (365 x number in Row 2):													

DAS-3C. Stock-Out Data Form: District Hospital/Sub-District Hospital [page 3 of 3]

Facility Code:	**Data Collector Code:**	
Facility Type:	**Location:**	**Date:**
Record Type:		

For each product, write the number of days out of stock for each month.

Product	Mar 02	Feb 02	Jan 02	Dec 01	Nov 01	Oct 01	Sep 01	Aug 01	Jul 01	Jun 01	May 01	Apr 01	Total Days Out of Stock
1. Sulphadoxine 500mg+ Pyrimethamine 25mg Tablets													
2. Amodiaquine HCL 200mg Tablets													
3. Amodiaquine 50mg/50ml Syrup													
4. Dihydroartemisinin 60mg Tablets													
5. Dihydroartemisinin Syrup 10mg/5ml – 60ml													
6. Quinine Dihydrochloride BP Injection 600mg/2ml													
7. Quinine Sulphate 300mg Tablets film coated													
8. Quinine Paediatric Oral 10mg/drop (20%)													
Row 1: Sum total days out of stock for all stocked drugs:													
Row 2: Count total number of products stocked in Column 1:													
Row 3: Average % time out of stock = (number in Row 1 x 100) / (365 x number in Row 2):													

DAS-3D. Stock-Out Data Form: Central Medical Store/Regional Medical Stores/District Stores *[page 1 of 3]*

Facility Code:	**Data Collector Code:**	
Facility Type:	**Location:**	**Date:**
Record Type:		

For each product, write the number of days out of stock for each month.

Product	Mar 04	Feb 04	Jan 04	Dec 03	Nov 03	Oct 03	Sep 03	Aug 03	Jul 03	Jun 03	May 03	Apr 03	Total Days Out of Stock
1. Sulphadoxine 500mg+ Pyrimethamine 25mg Tablets													
2. Amodiaquine HCL 200mg Tablets													
3. Amodiaquine 50mg/50ml Syrup													
4. Dihydroartemisinin 60mg Tablets													
5. Dihydroartemisinin Syrup 10mg/5ml – 60ml													
6. Quinine Dihydrochloride BP Injection 600mg/2ml													
7. Quinine Sulphate 300mg Tablets film coated													
8. Quinine Paediatric Oral 10mg/drop (20%)													
Row 1: Sum total days out of stock for all stocked drugs:													
Row 2: Count total number of products stocked in Column 1:													
Row 3: Average % time out of stock = (number in Row 1 x 100) / (365 x number in Row 2):													

DAS-3D. Stock-Out Data Form: Central Medical Store/Regional Medical Stores/District Stores [page 2 of 3]

Facility Code:	**Data Collector Code:**	
Facility Type:	**Location:**	**Date:**
Record Type:		

For each product, write the number of days out of stock for each month.

Product	Mar 03	Feb 03	Jan 03	Dec 02	Nov 02	Oct 02	Sep 02	Aug 02	Jul 02	Jun 02	May 02	Apr 02	Total Days Out of Stock
1. Sulphadoxine 500mg+ Pyrimethamine 25mg Tablets													
2. Amodiaquine HCL 200mg Tablets													
3. Amodiaquine 50mg/50ml Syrup													
4. Dihydroartemisinin 60mg Tablets													
5. Dihydroartemisinin Syrup 10mg/5ml – 60ml													
6. Quinine Dihydrochloride BP Injection 600mg/2ml													
7. Quinine Sulphate 300mg Tablets film coated													
8. Quinine Paediatric Oral 10mg/drop (20%)													
Row 1: Sum total days out of stock for all stocked drugs:													
Row 2: Count total number of products stocked in Column 1:													
Row 3: Average % time out of stock = (number in Row 1 x 100) / (365 x number in Row 2):													

DAS-3D. Stock-Out Data Form: Central Medical Store/Regional Medical Stores/District Stores *[page 3 of 3]*

Facility Code:	**Data Collector Code:**	
Facility Type:	**Location:**	**Date:**
Record Type:		

For each product, write the number of days out of stock for each month.

Product	Mar 02	Feb 02	Jan 02	Dec 01	Nov 01	Oct 01	Sep 01	Aug 01	Jul 01	Jun 01	May 01	Apr 01	Total Days Out of Stock
1. Sulphadoxine 500mg+ Pyrimethamine 25mg Tablets													
2. Amodiaquine HCL 200mg Tablets													
3. Amodiaquine 50mg/50ml Syrup													
4. Dihydroartemisinin 60mg Tablets													
5. Dihydroartemisinin Syrup 10mg/5ml – 60ml													
6. Quinine Dihydrochloride BP Injection 600mg/2ml													
7. Quinine Sulphate 300mg Tablets film coated													
8. Quinine Paediatric Oral 10mg/drop (20%)													
Row 1: Sum total days out of stock for all stocked drugs:													
Row 2: Count total number of products stocked in Column 1:													
Row 3: Average % time out of stock = (number in Row 1 x 100) / (365 x number in Row 2):													

DAS-4. International Price Comparison Form *[page 1 of 3]*

Facility Code:	**Data Collector Code:**	**Facility Type:**	
Location:	**Date:**	**Currency Used: *Shilling***	**One U.S. Dollar =**

Note:

- **This form is to be used at the Central Medical Stores / Regional Medical Stores / District Stores**
- Prices must be written to four decimal places as the units are very small
- The prices written for each price should be the price for the last procurement

DAS-4. International Price Comparison Form [page 2 of 3]

Product	Date of Last Procure-ment	Other Names (Brand or Generic)	Compar-ison Unit	Number of Units per Pack	Procure ment Price per Pack	MOH Compari -son Unit Price	Exchang e Rate at Time of Payment	MOH Compari -son Unit Price (US$)	Internati onal Unit Price (US$)
Col. 1	**Col. 2**	**Col. 3**	**Col. 4**	**Col. 5**	**Col. 6**	**Col. 7**	**Col. 8**	**Col. 9**	**Col. 10**
1. Chloroquine 50 mg tablet			*Tablets*						
2. Chloroquine 75 mg tablet			*Tablet*						
3. Chloroquine 150mg tablet			*Tablet*						
4. Chloroquine 150 mg capsule			*capsule*						
5. Chloroquine 300mg tablet			*Tablet*						
6. Chloroquine 300mg capsule			*Capsule*						
7. Chloroquine injection 40mg/ml 5ml ampoule			*Ampoule*						
8. Chloroquine syrup 50mg/5ml			*Millilitre*						
9. Sulfadoxine-pyrimethamine (SP) 500mg/25mg tablet			*Tablet*						
10. Sulfadoxine-pyrimethamine (SP) 500mg/25mg 2.5ml ampoule			*Ampoule*						
11. Sulfadoxine-pyrimethamine (SP) 500mg/25mg in 5 ml syrup			*Millilitre*						
12. Pyrimethamine 25 mg tablet			*Tablet*						
13. Amodiaquine 200mg tablet			*Tablet*						
14. Quinine 300mg tablet			*Tablet*						
15. Quinine injection 300mg/ml in 2 ml ampoule			*Ampoule*						
16. Proguanil Hydrochloride 100 mg tablet			*Tablet*						

DAS-4. International Price Comparison Form [page 3 of 3]

Product	Date of Last Procure-ment	Other Names (Brand or Generic)	Compar-ison Unit	Number of Units per Pack	Procure ment Price per Pack	MOH Compari -son Unit Price	Exchang e Rate at Time of Payment	MOH Compari -son Unit Price (US$)	Internati onal Unit Price (US$)
Col. 1	**Col. 2**	**Col. 3**	**Col. 4**	**Col. 5**	**Col. 6**	**Col. 7**	**Col. 8**	**Col. 9**	**Col. 10**
17. Artemether injection 80mg/ml in 1 ml ampoule			*Ampoule*						
18. Artesunate 50mg tablet			*Tablet*						
19. Artesunate 200mg rectocap			*Rectocap*						
20. Dihydroartemisinin 80mg tablet			*Tablet*						
21. Halofantrine 250mg tablet			*Tablet*						
22. Mefloquine 250 mg tablet			*Tablet*						
23. Mefloquine/Sulfadoxine-Pyrimethamine 250mg/500mg-25mg tablet			*Tablet*						
24. Artemether / Lumefantrine 20 mg / 120 mg tablet			*Tablet*						