PHARMACEUTICAL MANAGEMENT AND PRESCRIBING PATTERN OF ANTIMALARIAL DRUGS IN THE PUBLIC HEALTH FACILITIES IN DAR-ES-SALAAM, TANZANIA

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By

Richard Sebastian Silumbe, B.Pharm

A dissertation submitted in partial fulfillment of the Requirements for the Degree of Master of Science in Pharmaceutical Management of Muhimbili University of Health and Allied Sciences.

Muhimbili University of Health and Allied Sciences

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CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled "***Pharmaceutical Management and Prescribing Pattern of Antimalarial drugs in the Public health facilities in Dar es salaam, Tanzania***" in (partial) fulfillment of the requirements for the degree of Master of Science in Pharmaceutical Management of Muhimbili University of Health and Allied Sciences.

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Dr. Appolinary A. Kamuhabwa

Supervisor

Date ……

DECLARATION AND COPYRIGHT

I, **Richard Sebastian Silumbe**, hereby solemnly declare that this dissertation is my original work and it has not been presented nor will it be presented to any other University for similar or any other degree award.

Signature ……..

Richard Sebastian Silumbe

Date …….

ACKNOWLEDGEMENT

"My son, if you accept my words and store up my commands within you, turning your ear to wisdom and applying your heart to understanding, and if you call out for insight and cry aloud for understanding, and if you look for it as for Silver and search for it as for hidden treasure, then you will understand the fear of the Lord and find the knowledge of God. For the Lord gives wisdom, and from his mouth comes knowledge and understanding" (Proverbs: 2:1-5).

All praise and glory to my loving savior Jesus Christ for giving me wisdom, strength and grace to complete this task successfully.

It is sense of honour for me to place on record, my sincere gratitude to my supervisor**, Dr. Kamuhabwa, A**; Senior lecturer - School of Pharmacy, MUHAS; for his research concepts taught to me, unique ability to present complex material simply but accurately, tolerance in corrections, valuable guidance and encouragement from the beginning up to the completion of my dissertations.

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I wish to express my heart-full thanks to all my friends who had contributed their time and efforts to support and encourage me during all time.

I am highly indebted to my wife, **Mrs. Anneth M. Silumbe** and My daughter, **Rianne** for unending love, faith, understanding, prayer and support throughout what is inevitable on continuing but exhibiting experience.

Richard Silumbe,

Principal Research investigator.

DEDICATIONS

I would like to dedicate this dissertation work to all stakeholders who are engaged to pharmaceutical supply chain management of antimalarial drugs, in the sense that these findings will contribute to the strengthening of pharmaceutical management of antimalarial drugs and prescribing pattern of such medicines at all facility levels, for the sake of improving rational use of medicines.

I would kindly like to dedicate this work to my family including my wife, **Anneth**, and my daughter, **Rianne**, for the support and serious encouragement they gave me all the time in order to conduct this study at the standard level.

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LIST OF ACRONYMS

ACT	**Artemisinin Combination Therapy**
ADR	**Adverse Drug Reactions/ Events**
AIDS	**Acquired Immunodeficiency Syndrome**
ALU	**Artemether – Lumefantrine tablets**
CPD	**Continuing Professional Development**
CMS	**Central Medical Store**
DHMT	**District Health Management Team**
EMF	**Essential Medicine Formulary**
FDC	**Fixed Dose Combination**
GFATM	**Global Fund to Fight AIDS, Tuberculosis and Malaria**
ILS	**Integrated Logistic System**
IPT	**Intermittent Preventive Treatment**
ITN	**Insecticide Treated Nets**
MOHSW	**Ministry of Health and Social Welfare**
MSD	**Medical Store Department**
MSH	**Management Sciences for Health**
NEML	**National Essential Medicine List**
NMCP	**National Malaria Control Program**
NSAID	**Non-Steroidal Anti-Inflammatory Drugs**

OPD	**Out-patient Department**
PHW	**Pharmaceutical Health Workers**
PMU	**Procurement Management Unit**
RA	**Research Assistants**
SP	**Metakelfin or Fansidar tablets**
STG	**Standard Treatment Guideline**
TB	**Tuberculosis**
TFDA	**Tanzania Food and Drugs Authority**
TSH	**Tanzania shillings**
WB	**World Bank**
WHO	**World Health Organization**

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EXECUTIVE SUMMARY

***Background*:** Despite the efforts of minimizing utilization of limited financial resources in Tanzania, there are still some factors that affect the whole system of supply chain of antimalarial medicines. The goals of Integrated Logistic System (ILS) have not been realized since still there is drug shortage and poor stock recording system in the health facilities. Inadequate knowledge of the pharmaceutical management and inappropriate use of antimalarial drugs always contribute to the poor quality and availability of the drugs in the health facilities and irrational use of the antimalarial drugs.

***Objectives*:** The main objective of the study was to assess the knowledge in practice of pharmaceutical management and prescribing pattern of antimalarial drugs in the public health facilities in Dar-es-salaam.

***Methodology*:** Descriptive retrospective cross-sectional study design was used to survey nine (9) public health facilities in Dar-es-salaam region. The health facilities included 4 hospitals and 5 Health Centers. A total of 32 pharmaceutical health workers (drug store managers and drug dispensers) were interviewed using structured questionnaires. Two different structured questionnaires were used to interview drug store managers and drug dispensers separately. Average stock-out time of antimalarial drugs from January to December 2010 was assessed using a designed form. A total of 4320 prescriptions were examined and recorded from all the selected public health facilities. Adequate storage conditions and handling of medicines procedures were also assessed. Since Medical Stores Department (MSD) is the main supplying source of the antimalarial drugs to these facilities, it was also included in this study as the special site for assessing availability of antimalarial medicines from the source.

Results: Among all nine (9) drug store managers, six (6) had poor knowledge on quantification concept, and seven (7) did not apply Integrated Logistic System indicating

that it is still confusing to be applied. All of drug store managers had inadequate knowledge on the concept of procurement, and there were no effective and efficient procurement systems in all the health facilities. In most of the facilities, BIN Cards and Stock ledger books were the most commonly used stock recording systems. . There are no Electronic Drug Recording systems in these facilities. A tedious and bureaurocratic process of expired drug disposal was cited as a reason for pilling up of expired drugs in the health facilities. Percentage time out of stock for the antimalarial drugs were 25% for Artemether-Lumefantrine (ALU) and 25.7% for Quinine tablets and 6.4% for injections All drug stores in the health facilities scored satisfactory marks in adequacy storage conditions and handling of antimalarial medicines. However, all facilities had no cold storage facilities with temperature charts; and medicines were kept directly on the floor in seven (7) out of 9 main drug stores and six (6) out of 15 dispensing rooms. Regarding rational dispensing of medicines, only 22 and 12 of all (32) interviewed drug dispensers had good knowledge on recommended doses and dosage regimen of ALU respectively. Regarding dispensing of ALU in pregnancy as special group, 19 drug dispensers were not able to provide correct information for use of ALU during pregnancy. The average number of drugs prescribed per prescriptions was 2.4±0.014, and 98 % of prescriptions contained only one antimalarial drug, among them 88.9 % was ALU. About 96.9 % of the prescriptions showed wrong prescribing pattern for ALU in terms of its dosage.

***Conclusion*:** Despite the government efforts in increasing public awareness of ALU and ensuring constant availability of such drugs at MSD, there is a significant stock-out period due to poor pharmaceutical management of antimalarial medicines in the public health facilities. Although adherence to the national malaria treatment guidelines is satisfactory, there is significant irrational prescribing of antimalarials among the prescribers. Based on these findings, it is proposed that regular on-job training and continuing education should be provided to drug dispensers and prescribers in the public health facilities.

CHAPTER ONE

BACKGROUND

1.0 INTRODUCTION:

There is a general concern that drugs are too costly for an individual, household, government health system and a country as a whole. Most of the health budgets from Ministries of health (MOH) are mostly consumed by the procurement of pharmaceuticals. In a survey done in Mali, it was found that 80% of household health expenditure was for modern medicines, 13% for traditional medicine, 5% for provider fees, and 2% for transportation costs (Diarra and Coulibaly, 1990). Also studies done in Pakistan and Ivory Coast showed that more than 90% of household health expenditures were related to drugs (World Bank, 1993). At the national level, pharmaceuticals (medicines and medical devices) represent 10-20% of health expenditures for leading industrialized countries. In most of the developing countries expenditure on pharmaceuticals may represent one-third to two-third of total public and private health expenditures (WHO/DAP, 1996).

Antimalarial drugs especially artemether-lumefantrine (ALU), as one of the artemisinin combination therapies (ACTs) for treating uncomplicated malaria, could be much costly to most of people in the third world countries. In Tanzania, the price of ALU has been subsidized so that the drugs can be easily accessible in terms of its affordability to the people. In the 2008 pharmaceutical market, ALU branded as Coartem® was sold by Tsh. 16,000 (10 USD) in private sector, but currently it is sold by Tsh. 1000 (0.625 USD). The increased availability of affordable ACTs intends to save lives by making ACTs more readily available and reducing the use of less effective treatments to which malaria parasites are becoming increasingly resistant. It also aims to reduce the use of

artemisinin monotherapies, thereby delaying the onset of resistance to that drug and preserving its effectiveness (WHO Malaria Report, 2010).

Although price of ALU has been subsidized to increase affordability, there are still other factors that may affect availability and rational use. For instant, most health care workers who are involved in pharmaceutical management are not trained pharmaceutical personnel (Kamuhabwa and Jalal, 2011). As a result it is likely that pharmaceutical management including ordering of drugs, storage and inventory control are not properly done. This could be one of the reasons for frequent stock-outs of essential medicines in the health facilities.

1.1 Pharmaceutical Management Concept

Pharmaceutical management is the set of practices aimed at ensuring the timely availability and appropriate use of safe, effective, quality medicines and related products and services in any health-care setting. It has four components that form a cycle, namely selection of the product, procurement, distribution and its use to the patients (MSH/WHO, 1997).

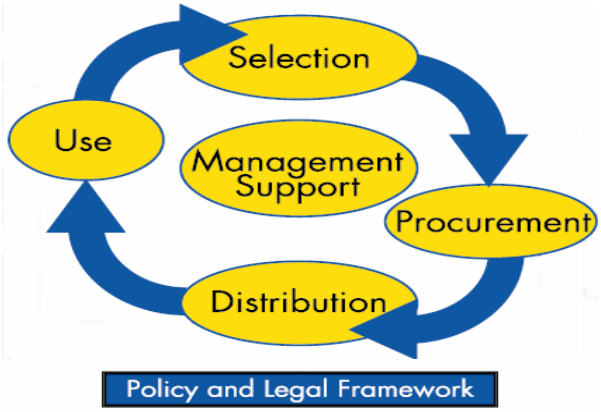


Figure 1: Pharmaceutical management components

Source: Management Sciences for Health

As it is seen from Figure 1, these components of pharmaceutical management are overseen by the national health policy and legal framework of the country.

1.1.1 Selection:

Selection of the essential medicines normally is done at the National level i.e. Ministry responsible for Health through its bodies, policy makers and other stakeholders, using National Essential Medicine List (NEML) and Essential Medicine Formulary (EMF). It can also be done at the health facilities. The rationale of selecting limited number of essential medicines is that it may lead to better supply, more rational use, and lower costs. The selection process normally starts with defining the list of the common diseases of the particular community (MSH/WHO, 1997). Since selection of the antimalarial drugs in Tanzania has been already done at national level, and for the purpose of this study, procurement or ordering from the Medical Stores Department (MSD), store management and dispensation of the drug to the patients will be analyzed at the selected health facilities.

1.1.2 Procurement:

This is the one of the component of the pharmaceutical management which deals with forecasting or Quantification of the medicines and all activities that involve preparation of tendering processes, choice of reliable suppliers until the medicines are available for use. An effective drug procurement process ensures the availability of the right drugs in the right quantities, at the reasonable prices, and at recognized standards of quality (MSH/WHO, 1997). In Tanzania, MSD is the central agency for procurement and distribution of pharmaceutical products to the public health facilities. Therefore procurement of drugs and medical devices at the health facility level is done from MSD and private pharmacies or agencies. In 2007, assessment of medicine supply study was done in Tanzania, and it was found that 33% of all pharmaceutical procurements in all Health Centers were procured exclusively from MSD; 45% was done from other sources such as private pharmacies and private pharmaceutical agents; and 22% did not show response (MOHSW, 2008). Antimalarial drugs like other medicines are also procured from MSD.

1.1.3 Distribution:

It is one of the four components of the Pharmaceutical management, which relies on good system design, information system, storage and delivery. At the health facility level, the distribution cycle normally starts at the point of dispatching of drugs by the MSD or other supplier and it ends when the drug consumption information is reported to the procurement unit.

Effective distribution of antimalarial drugs will reduce mortality and morbidity in a particular community, since it contributes to a greater extent in ensuring the constant availability of the drugs in the health facilities.

1.1.4 Appropriate Use

Pharmaceutical management has a role to ensure that antimalarial and other drugs are rationally consumed in the right dose and to the right patients. Malaria treatment guidelines have been established in almost all countries in the world, and also Standard Treatment Guidelines (STG) are well established and distributed to all stakeholders (health care workers, policy makers etc). Adherence to these guidelines is necessary in order to improve the rational use of the antimalarial and other drugs; and therefore cost of purchasing drugs can be reduced to large extent (MSH/WHO, 1997).

1.1.5. Pharmaceutical Inventory Control

Inventory Management refers to the process of managing inventory in order to meet patient demand at the lowest possible cost with the minimum of investment. It is an important component of the drug supply system. Unlike many factors in pharmacy, inventory is controllable, and the pharmacy department normally decides how much

inventory investment to make, when to reorder, and in what quantities (Blackburn, 2010). Accurate and current stock records are essential to good inventory management. They are the sources of information used to calculate the needs, and inaccurate records produce inaccurate needs estimations (and problems of stock outs and expiry) (Dobler et al, 1996). Therefore good pharmaceutical management of antimalarial and other essential medicines has great contribution in reducing the cost of purchasing medicines, both at the national and health facility levels.

1.1.6. Quality of Medicine

Apart from ensuring constant availability of antimalarial and other medicines, pharmaceutical management also focuses on the quality of pharmaceutical products (MSH/WHO, 1997). Quality control extends beyond testing whether medicinal products contain the right ingredients in the correct amount, to ensuring that they are properly stored and have not passed the expiry date. The latter measure is intended to ensure that, at the final distribution point, patients are getting high quality and efficacious drugs (WHO, 2006). Countries with tropical climates can experience difficulty in maintaining good drug storage conditions. Prevailing conditions of high temperature and humidity; common storage problems, such as storage on the floor; lack of systematic arrangement of stock; presence of dust and pests; inadequate protection from direct sunlight; and lack of provision of temperature monitoring charts and facilities to monitor room temperature can lead to degradation of drugs (WHO, 2006)

1.2. Prescribing pattern of antimalarial medicines

Prescribing pattern of antimalarial drugs may influence rational use of these medicines. Availability of essential medicines is greatly affected by the prescribing behavior of the medical officers in a particular health facility. Even though STGs are well

established, most of the medicines are prescribed to the patients without following these guidelines and steps for rational prescribing practices. As a result, most of prescriptions are irrationally dispensed to the patients (Aina et al, 2009).

In general, pharmaceutical management and prescribing pattern, do affect each other, and also they affect directly rational use of antimalarial medicines in the health facilities, especially in poor countries like Tanzania, which have scarce resources. Thus ensuring effective pharmaceutical management and rational prescribing is essential in the management of malaria. Such practices will certainly serve billions of money that are used to buy large quantities of antimalarial drugs and other medicines.

1.3. STATEMENT OF THE PROBLEM

Tanzania health budget from Ministry of Health and Social Welfare (MOHSW) is highly consumed by cost of purchasing pharmaceuticals, which include medicines and medical devices.

Lack of pharmaceutical management knowledge to the pharmaceutical health workers in Tanzania contributes to the interruption of the supply chain of antimalarial drugs (MSH/WHO, 1997). Poor forecasting and quantification processes, and poor procurement methods are among the common problems that affect availability and accessibility of medicines, including antimalarial drugs in most of health facilities in Tanzania.

Poor quantification and forecasting of medicines may lead to incorrect ordering, leading to under-stocking or overstocking of the medicines. Overstocking of medicines normally produce high number of expired medicines, high cost of storing excess stock

and high incidences of pilferage of high potent medicines and promotion of irrational use of medicines. Under stocking may also lead to increase in number of stock-out medicines, which then may raise the mortality and morbidity rates, increase of drug resistances, promoting irrational use of medicines (MSH/WHO, 1997).

Lack of efficient and effective procurement methods of pharmaceuticals in the health facilities may also lead to poor availability of medicines in the health facilities. Patients will miss or get inadequate number of their prescribed medicines required for their treatment. Poor availability of medicines may promote irrational use of medicines by promoting prescribers to prescribe medicines that are available, without following STGs.

Poor adherence to STGs in the malaria management is another area that commonly occurs in most of health facilities in Dar-es-salaam, Tanzania (WHO, 2002). Failure to adhere to STGs may produce wrong consumption data of medicines that may affect the process of good forecasting and quantification, which in turn may lead to under- or over-stocking of medicines in the health facilities.

In general, poor pharmaceutical knowledge and poor prescribing pattern of antimalarial drugs are among the factors that impair constant supply of such medicines.

For Dar-es-salaam region, the magnitude of poor pharmaceutical management knowledge and current prescribing pattern of antimalarial drugs in the health facilities is not well known. It is also not well documented if health care workers who are involved in pharmaceutical management of antimalarial drugs in the public health facilities in Dar es Salaam are well trained to effectively carry out their duties. Availability and use of STGs as well as prescribing patterns of antimalarial drugs in these facilities need also to be assessed.

1.4. SIGNIFICANCE OF THE STUDY

The main focus of this study was to assess the pharmaceutical management and prescribing pattern of antimalarial drugs in the public health facilities located in Dar-es-salaam. Therefore there was a need to conduct this research in order to determine the magnitude of the problem of pharmaceutical management and irrational prescribing of antimalarial drugs in the public health facilities. Findings from this study will help to formulate strategic plans that will help to minimize these problems so as to ensure constant and uninterrupted supply of antimalarial drugs in the public health facilities. Also the findings from this study will be useful to health facility managers, through planning for on-job training of health workers.

RESEARCH QUESTIONS

1. What are the knowledge levels of the of pharmaceutical health workers on antimalarial drug management in terms of quantification, procurement, distribution and use of ALU?

2. What are the average stock-outs of the antimalarial medicines at the public health facilities?

3. What are the methods that are used in inventory management of antimalarial drugs in the health facilities?

4. What are adequacy storage conditions and handling of antimalarial drugs in the health facilities?

5. What is the prescribing pattern of antimalarial drugs at the public health facilities?

6. What are challenges encountered in disposing expired medicines at the health facilities?

7. To what extent does ALU dispensing practice from the pharmaceutical health workers adhere to the National Malaria Treatment Guidelines?

1.5. OBJECTIVES:

Main Objectives

To assess pharmaceutical management and prescribing pattern of antimalarial drugs in Dar-es-salaam public health facilities.

Specific objectives:

1. To assess the knowledge in practice of pharmaceutical health workers on antimalarial drug management in terms of quantification, procurement, distribution and use of ALU.

2. To determine the average stock-outs of the antimalarial medicines at the health facilities.

3. To assess the methods that are used in inventory management of antimalarial drugs in the health facilities.

4. To assess adequacy storage conditions and handling of antimalarial drugs in the health facilities.

5. To identify the challenges encountered in disposing expired medicines at the health facilities

6. To assess the prescribing pattern of antimalarial drugs at the health facilities.

7. To assess the rational dispensing of ALU in relation to the national Malaria Treatment Guidelines.

CHAPTER TWO

LITERATURE REVIEW

It has been estimated that about 3000 malaria deaths occur among African children each day (Snow et al, 2005), with about 0.5 billion clinical malaria cases and 2-3 million severe malaria episodes occurring annually (Greenwood et al, 2005). The children who do not die from the severe form of malaria may suffer brain damage or experience cognitive and learning deficits (Murphy et al, 2001). The World Bank ranks malaria as a leading cause of most disability-adjusted life years in Africa with an estimated 35 million future life-years lost from disability and premature deaths (World Bank. 1993). The loss of growth in countries with endemic malaria is estimated at about 12 billion US Dollars annually (Samba et al, 2001). This has contributed to the cycle of poverty in sub-Saharan Africa.

Studies have highlighted the inadequacies of the public health sector in sub-Saharan African countries in providing appropriate malaria case management. A survey was done in Somalia in 2008 to investigate the readiness of the public health sector to provide the malaria case management (Noor et al, 2009). The results showed that 66.7% of public facilities did not have in stock the recommended first-line malaria therapy. Also despite the change of malaria treatment policy from chloroquine to ACT in 2005, only 62.3% of public health facilities prescribed the nationally recommended anti-malarial drug and 37.7% prescribed chloroquine as first-line therapy. The researcher recommended that efforts to strengthen the readiness of the health sector in Somalia to provide malaria case management should improve availability of drugs and diagnostic kits and provide appropriate information and training.

In most of the countries, availability of the antimalarial drugs at the health facility level depends on the availability of such medicines in their Central Medical Stores. A

study that was conducted in Kenya and Uganda to assess stock outs of Artemether-Lumefantrine (ALU) in 2008 showed that, despite the fact that the countries were receiving drugs from the Global Funds to Fight AIDS, Tuberculosis and Malaria (GFATM), they faced stock outs of ALU (Tren et al, 2009). Adoption of international competitive bidding processes, introduced recently by GFATM, has lead poor availability of some certain medicines such ALU in those countries. The researcher urged GFATM to review their international competitive bidding policies that will help to ensure selection of reliable supplier and un-interrupted supply of antimalarial and other essential drugs.

In addressing the same problem of antimalarial shortages, another study was done in Kenya, two years after introduction of ALU as the first line therapy for uncomplicated malaria (Kangwana et al, 2009). The researchers found that out of 164 surveyed facilities, one of every four facilities had none of the four ALU weight-specific treatment packs in stock; and three of four facilities were out of stock of at least one weight-specific ALU pack, thus leading health workers to prescribe a range of inappropriate alternatives. Poor knowledge of quantification and procurement needs, poor managing stock flows with limited information from the periphery and funding shortages are the main factors that cause shortage of ALU in the health facilities. But discussions with government stakeholders revealed that drug shortage was largely caused by a delayed procurement process.

The Medical Store Department (MSD) which is the structure responsible for procurement and distribution at the national level in Tanzania is a semi- autonomous, public, non-for-profit organization created in 1993. It operates as a self-sustaining revolving drug fund with 8 zonal stores. Data from the study that was conducted in Tanzania in 2007 found that stock availability of twenty (20) tracer medicines was at an average of 79% at the dates of evaluation in the Zonal Stores (MOHSW Report, 2007). The stock out situation measured by the number of days the item has been out of stock in

a year ranged between one (1) and one hundred eighty three (183) days. Lead times for delivery by sea on the average were long taking up to 8 months. In addition the time used to clear products from the port to the central warehouse was also long. Stock management techniques also were found to be weak except for traceability of batches (though this had been rated poor by the Tanzania Food and Drug Authority (TFDA) in previous quality inspections) and the definition of minimum stock levels. This could have contributed highly on the number of expired medicines and supplies which was found to be 3.7 % of sales for the year for 2006 at the central store.

Effective case management for malaria requires that effective antimalarial medicines are available and used appropriately in the correct formulations and amounts and according to an appropriate regimen (dose, frequency, duration) (MSH/WHO, 2005). Due to failure of effectiveness of the antimalarial drugs especially in treatment of uncomplicated malaria in most of endemic countries, WHO recommends that national malaria treatment policies should change from monotherapy to the artemisinin combination therapy (ACT) (WHO, 2004). Tanzania changed its malaria treatment policy in 2005, shifting from SP to ACT using ALU as the first line antimalarial drug for uncomplicated malaria (MOHSW, 2006).

A survey was done in Tanzania in 2007, and findings showed that ALU was available in more than 75% of the Public sector facilities, an indication that distribution of ALU was reaching the remote public health facilities (MOHSW, 2007) The availability of ALU in the Private and Religious health facilities was 50% and 47% respectively, and Sulphadoxine/Pyrimethamine (SP) was available in more than 50 % of health facilities in all the three sectors (MOHSW, 2007). The researchers recommended that national and international Funds to the MSD should be remitted in time to allow timely availability of the medicines at the health facilities. It was also recommended that medicines stock

control especially at the health facilities should improve, systems for supervision and monitoring of medicines at the district and regional levels be put in place, prices should be monitored regularly and policies which lead to the reduction in prices should be put in place so as to improve affordability and distribution of medicines.

Poor availability of antimalarial and other medicines have been studied from the different countries. One of the main reasons for the shortage of drugs is insufficient deliveries from the central medical stores. In Malawi, a study was conducted in 2007 and the results showed that average time out of stock for antimalarial drugs in the 137 health facilities was 42 to 138 days. The main reason was insufficient deliveries from the Regional Medical Stores (Lufesi and Andrew, 2007).

Another study was conducted in Ethiopia in 2002 to assess whether the target outcomes of the pharmaceutical sector (i.e. access, quality assurance and rational drug use) have been achieved and also to determine whether the country has the necessary structures and mechanisms in place for improving its pharmaceutical sector (WHO Report, 2003). This study showed that on the average, the score for storage conditions were 6 (55 %) and 8 (73 %) on a scale of 0-11 in public health facilities and regional drug stores, respectively. These results are equivalent to an acceptable quality of drugs (WHO Report, 2003). However, the significant variations between health facilities and regions indicated the need for handling individual cases separately. Also from the study findings, national averages for presence of expired drugs in facilities were found to be 8%, 2% and 3% in health facilities, regional drug stores and private drug retail outlets, respectively. It was then recommended that there was significant variation between health facilities and regions calls for precaution and further investigation.

Mugoyela and Ally, 2004 assessed the level of knowledge of drug dispensers on disposing expired medicines from 150 private pharmacies in Dar-es-salaam, Tanzania. The study results showed that about 66.7 % of drug dispensers had no such knowledge. Therefore it was suggested that more training through Continuing Professional

Development (CPD) should be provided to dispensers in order to achieve the quality of pharmaceutical services in private pharmacies.

Another study was done in Uganda to assess expiry of medicines in supply outlets at the public and private health facilities. The study reported that most of the respondents perceived the high contribution of the expiry medicines to be due to storing medicines that treat rare diseases (81.8 %), drug donation (56 %). Rigorous vigilance in inventory management and maintenance of minimum stock levels is the best approach to reduce expiry of these medicines. Although robust international guidelines for donation of medicines have been in existence since 1996 (WHO Report, 1999), national medicine regulatory authorities need to take control and enforce them in their own country.

Abe et al (1985) and Greenhalgh et al (1987) examined the prescribing and dispensing of medicines to patients by the public and private medical sectors and by private pharmacies in five Indian cities. Their studies showed that over-prescription by doctors in the private sector was common and that many of the drugs used and prescribed were doubtful and dangerous. They concluded that an essential drugs list is useless unless accompanied by intensive efforts to improve prescribing and dispensing of medicines.

Also in Gezira state in Sudan, most of the irrationally prescribing of the antimalarial drugs were contributed by general practitioners and "dispensing" pharmacists **(**Yousif et al, 2000**)**. The high rate of antimalarial prescribing by general practitioners indicates the potential involvement and role of this group of prescribers in primary health care, and therefore efforts should be made to update the knowledge of general practitioners about malaria and its treatment (Yousif et al, 2000).

Another study was done at Madhya Pradesh in India, assessing the prescribing pattern of the drugs (Bhartiy et al, 2008). It was found that prescribing pattern of the medicines was more of the irrational types like polypharmacy, overuse of some drugs like antibiotics and injection, and less number of generics and prescribed from the Essential

drug list. Therefore, researchers suggest that there was an urgent need of the interventions to overcome the problem.

In Nigeria, the prescribing pattern of drugs has been reported to be unsatisfactory (Adebayo and Hussain, 2010). It is characterized by the number of drugs per prescription, and high rate of irrational prescriptions. It was found that 90.5% of the interviewed prescribers were aware of the existence of National Essential drug list, but 58.1% of them did not use it as basis of prescriptions.

There is another study which was done in Kenya that assessed the factors that may influence prescribing practices ALU (Wasunna et al, 2008). The results showed that health workers generally perceived ALU as being tolerable and efficacious as compared to amodiaquine and sulphadoxine-pyremethamine. However, a number of key reasons for non-adherence were identified from the survey. Insufficient supply of ALU was a major issue and hence fears of stock outs and concern about ALU costs was an impediment to ALU prescription. Training messages that contradicted the recommended guidelines also led to non-adherence among health workers, compounded by a lack of follow-up supervision. In addition, the availability of non-recommended antimalarials such as amodiaquine caused prescription confusion. Some health workers and District Health Management Team (DHMT) members maintained that shortage of staff had resulted in increased patient caseload affecting the delivery of the desirable quality of care and adherence to guidelines. In order to ensure effective malaria case management, researchers recommended that it is essential to provide high quality training, effective work supervision and ensure constant drug supply.

Interventional studies that focused on building pharmaceutical management skills have been conducted in Tanzania, Rwanda, Kenya and Uganda in 2006 (Matowe et al, 2008). The baseline surveys in these studies showed that pharmaceutical management skills are limited among pharmaceutical personnel in terms of quantifying needs for medications and ordering, receiving and storing medications appropriately; recording

medications inventories accurately; distributing medications for use appropriately; and advising patients on how to use medications appropriately. The Regional Technical Resource Collaboration for Pharmaceutical Management (RTRC) was established to help address the problem of skills and shortage in pharmaceutical management in East Africa, but still little outcome has been observed.

In Tanzania, many efforts have been made for control and treatment of malaria. The National Malaria Control Program (NMCP) was established in 2007 and aimed to improve malaria treatment and awareness in Tanzania through multi-media such as television, radio, posters, and music. Raising public education with slogan "**Malaria haikubaliki**" was initiated by the President of Tanzania, Hon. Dr. Jakaya Kikwete in 2010, which aimed to promote the public awareness on treatment and prevention of Malaria. Apart from introduction of use of Insecticide Treated Nets, percentage of the health budget in Tanzania is spent for purchasing pharmaceutical products i.e. medicines and medical devices (MOH). Antimalarial drug intervention is still one of the major approaches for the reduction of death rates caused by malaria.

CHAPTER THREE

METHODOLOGY:

3.1. Study Design:

Descriptive retrospective cross-sectional design was used to conduct this study. Designed Questionnaires, stock-out data form, and prescribing and dispensing pattern data collecting tools were used to interview drug dispensers, prescribers and other personnel involved in handling drugs at the health facilities. Other forms were designed to collect data from drug registers and storage conditions status at the selected health facilities.

3.2. Study Sites:

The study was conducted in Dar es Salaam, the commercial capital of Tanzania. Administratively, Dar es Salaam is divided into 3 municipals namely Ilala, Kinondoni, and Temeke. This study was conducted in all the municipal public hospitals and Health Centers that are in Kinondoni, Ilala and Temeke. Currently in Temeke municipal there are two (2) hospitals and one (1) health centre; Ilala municipal has one (1) hospital and two (2) Health Centers; and Kinondoni municipal has one (1) hospital and two (2) Health Centers. Since the Medical Stores Department (MSD) is the main supplying source of the antimalarial drugs in these facilities, it was included in this study as the special study site for assessing availability, and quality of the drugs from the source. Therefore a total of nine (9) health facilities and MSD Dar-es-salaam Zonal office were visited. The names of these visited sites were;

1. Mwananyamala Municipal Hospital

2. Amana Municipal Hospital
3. Temeke Municipal Hospital
4. Sinza Health Center
5. Magomeni Health Centre
6. Kigamboni Health Center
7. Buguruni Health Center
8. Mnazi Mmoja Health Center
9. Vijibweni Hospital
10. Medical Store Department (MSD) - Dar-es-salaam zonal Office.

3.3. Study participants:

This study involved all pharmaceutical health workers i.e Pharmacists/drug Store managers, and other drug dispensers, who were available in each of the selected health facility during the time of the study. As study participants, they were interviewed through questionnaires, in order to get all the information required to achieve the objectives of the study.

3.4. Study Period:

This study took seven months for its completion. This period included preparation of proposal on December 2010; data collection on March and April 2011; and Final Report submission on July 2011

3.5. Sampling technique:

A convenient sampling technique was used to get the study sample size. This technique was used because of the small number of the pharmaceutical personnel. Therefore this study involved all pharmaceutical health workers that were available during the study survey in all of the selected health facilities. Prescriptions of uncomplicated malaria cases between January and December 2010 from Outpatient Departments (OPDs) were assessed for rational prescribing of antimalarial drugs. These prescriptions were selected using convenient random sampling. All health facilities were found to keep their prescriptions in daily basis. Therefore the prescriptions were randomly taken from three periods (i.e. early days, mid days and late days) from each selected month. This technique tried to increase the chances of reviewing all prescribing pattern from different prescribers.

3.6. Sample Size:

Sample size of this study was thirty two (32) pharmaceutical health workers (PHW) that were available in the health facilities during the survey. It included pharmacists, pharmaceutical technicians, pharmaceutical assistants and nurses who are drug dispensers. Comparing to exact number of drug dispensers in all selected health facilities, the sample size involved 54.2% of the target group.

The sample size of prescriptions was selected according to the WHO guidelines that require a minimum of 30 encounters from each selected health facility as sample size for the comparison study of drug use investigation, involving more than one health facilities (WHO Report, 1993). For this study, 480 prescriptions for uncomplicated malaria cases were collected and assessed (40 prescriptions from each selected month per facility) The total number of prescriptions collected from all selected health facilities was 4,320.

3.7. Instrument Pre-test:

Pre-testing of the data collection tools for their validity and appropriateness was conducted in Kisarawe District Hospital in the Coast Region. This health facility was selected as pilot site because it has the same service level as the selected municipal hospitals and it it is closer to Dar-es-salaam. Pharmacist/Drug Store managers and all drug dispensers were interviewed. Thereafter, pre-tested tools were revised and restructured for data collection.

3.8. *Data*:

3.8.1. *Data Collection Technique*:

Data collection was done by the Principal researcher and eight (9) Research assistants. These research assistants were fully trained on the objectives of the study, and detailed information on how to use questionnaires and other tools in order to get the intended data.

3.8.2. *Tools*:

3.8.2.1: *Structured Questionnaire*

Two different questionnaires were used to interview drug store managers and drug dispensers. These questionnaires contained information and questions designed to identify the influencing factors associated to supply chain of antimalarial drugs. Questionnaire attached as Appendix I basically congregated information that helped to assess the knowledge of the drug store manager (pharmacist, pharmaceutical technician or Pharmaceutical assistant) on pharmaceutical management of antimalarial drugs.

Questions in Part II were designed to assess knowledge of pharmaceutical personnel regarding quantification and methods of inventory management; antimalarial medicine expiry management; and sources of medicines (i.e. suppliers). Questions in questionnaire, attached as Appendix II, were used to assess the knowledge of drug dispensers regarding ALU during dispensing to patients, and also to identify the challenges facing the implementation of the National Malaria Treatment Guidelines. Apart from demographic data questions, a zero (0) point was given for an incorrect answer and one (1) point was given for the correct answer. Then the levels of knowledge were graded as shown below.

Table 3.1: ***Knowledge score chart***

Percentage Scores	**Knowledge level**
75 – 100	Excellent
50 – 74	Good
25 – 49	Poor
0 – 24	Very poor

3.8.2.2: *Stock-Out Data Form*

Stock out data forms (attached as Appendix III) was designed to collect the stock out days of antimalarial drugs from the main drug store records at the health facilities and MSD Dar-es-salaam Zonal office. All out-of-stock days from January 2010 up to December 2010 were recorded. This period of one year was purposely considered in order to reduce confounding factors of seasonal variation. According to the WHO, the

ideal average percentage time of stock out days must be zero (WHO, 2006). Therefore assessment was done with the reference from the WHO guidelines.

3.8.2.3: *Data collection tools for prescribing pattern of antimalarial drugs*

The designed form (Appendix IV) for collecting data about prescribing pattern of antimalarial drugs contained information about the total number of drugs prescribed; number and names of antimalarials prescribed; a correctness of prescribing ALU; concomitant prescribing of antimalarials together with analgesic and antibiotics . The average total number of drugs per prescription was assessed from each of the selected health facility. Also the average total number of antimalarial drugs per prescription was calculated. These items were assessed in comparison with the recommended figures using the WHO manual on how to investigate drug use (WHO Manual, 1993). Through this tool, adherence to the National Malaria Treatment Guidelines was assessed from each of the selected health facility.

3.8.2.4: *Data Collection Tool for Adequacy storage conditions and Handling of Medicines*

Quality of the medicines, adequate storage conditions and handling of medicines checklist is another tool that was used to assess factors that can possibly affect the quality and efficacy of the medicines stored in the selected health facilities. This tool is attached as Appendix V. Referring to the WHO indicators, nine (9) questions were adopted in the checklists, and the average score was calculated from each column results (i.e. from drug store and dispensing room).The following score chart was used.

Table 3.2: ***Score chart***

Percentage	Score
75 – 100	Very satisfactory
50 – 74	Satisfactory
25-49	Dissatisfactory
0-24	Very dissatisfactory

3.9. *Data Management and Analysis*

All the collected data were counter-checked for their clarity and validity. The coded data were analyzed using Statistical Package for Social Sciences (Version 16.0) computer analysis software.

Measure of the central tendency and dispersion were analyzed and reported by using descriptive statistics. A P-value of less than 0.05 was considered as statistically significance, at the 95% confidence interval.

Study variables that were considered for the purpose of this study were:

- Demographic data of the pharmaceutical health workers and patients from the prescriptions obtained.
- Knowledge in practice of pharmaceutical personnel regarding antimalarial drug management
- Percentage Average time Stock-out of ALU and other antimalarial medicines

- Knowledge of pharmaceutical personnel regarding inventory management methods
- Awareness of pharmaceutical drug store managers on Disposal system of expired medicines
- Adherence to the National Malaria Treatment Guidelines by prescribers and dispensers
- Challenges for the implementation of the Malaria Treatment Guidelines at the facility level

3.11. Study Limitations

This study was done in the Dar-es-salaam city, which is an urban area. Therefore the findings from the study may under-estimate the general pharmaceutical management practice in the rural areas whereby poor infrastructures, lack of good health systems and insufficient number of health professional workers are common issues, and worse than in urban areas.

3.12. *Ethical Consideration*

Study participants, namely drug dispensers and drug store managers, were informed on the purposes of the study, and they were asked if they will be willing to participate in the study. Written consent (Annex VI) was then obtained from the study participants. No names of study participants were recorded in the questionnaires and data were entered into the computer for analysis using code numbers assigned to each questionnaire.

Ethical clearance was obtained from the MUHAS Research and Publications Committee. Permission to conduct the study in the selected health facilities was sought from the Municipal Medical Officers In-charge of Kinondoni, Temeke and Ilala municipals.

CHAPTER FOUR

RESULTS

Results of this study have been categorized into two main parts namely pharmaceutical management and prescribing pattern of the antimalarial drugs.

4.1. PHARMACEUTICAL MANAGEMENT OF ANTIMALARIAL DRUGS

A total of 32 drug dispensers were available and voluntarily participated during study visits in all selected health facilities, and it is more than 50% of the actual number of the drug dispensers employed in all selected health facilities.

4.1.1 Socio demographic data

4.1.1.1 Age

Among 32 drug dispensers, 13 were at the age between 18 and 25 years; while 10 people were at the age above the 45 years, and the rest (9 respondents) were at the age between 36 and 45 years.

Table 4.1: Socio-demographic information drug dispensers

Characteristics	Number	Percentage
Sex		
Male	16	50
Female	16	50
Total	32	100
Age Group (in years)		
18-25	0	0
26-35	13	41
36-45	9	28
Above 45	10	31
Professional Qualification distribution		
Pharmacist	7	21.9
Pharmaceutical Technician	16	50
Pharmaceutical Assistant	1	3.1
Nurses	8	25

4.1.1.2. Gender

Among 32 drug dispensers interviewed, number of males and females were equal i.e there were 16 males and 16 females.

4.1.1.3 Professional Qualification distribution

Among 32 drug dispensers, there were seven (7) pharmacists, sixteen (16) pharmaceutical technicians, one (1) pharmaceutical assistant and eight (8) nurses. Also among them, there were eight (8) drug store managers who perfom dual duties i.e main drug store management and drug dispensing. Pharmacists and Pharmaceutical Technicians were available at both hospitals and health centers. However the nurses and pharmaceutical technicians were mostly available at health centers.

Table 4.2 below shows that 41% of the total numbers of respondents were aged between 26 to 35 years and 31% of all respondents were aged between 36 to 45 years while above 45 years respondents occupied 28%. However table 4.2 below shows the age distribution within the professional qualifications.

Table 4.2: Age distribution Pharmaceutical Health workers in relation to professional qualification

		Pharmacist	Pharmaceutical Technician	Pharmaceutical Assistant	Nurse	Total
Age	26-35 years	3	9	0	1	13(41%)
	36-45 years	0	2	1	7	10(31%)
	Above 45 years	4	5	0	0	9(28%)
Total		7	16	1	8	32(100%)

The study findings revealed that all pharmacists had two (2) to five (5) years of working experience; eight (8) Pharmaceutical technicians had the same period of working experience as pharmacists, however only one (1) had one (1) year in the management of the Main Drug Stores.

Also the number of subordinates (pharmaceutical technicians or pharmaceutical assistants) who were working together with drug store managers in the store room had mean value of one (1) with standard deviation of 0.3 for the mean. The median was one (1) and the number of the subordinates ranged from zero to highest number of three (3) per store room.

4.1.2. Knowledge in practice of pharmaceutical health workers on antimalarial drug management

Quantification and Forecasting

Among all (9) drug store managers, five (5) of them had no general concept of the quantification process of the medicines including antimalarial drugs. Among four (4) of drug store managers (which represent pharmacists), only three (3) had general concept of quantification process; and five (5) of all respondents (which represented by Pharmaceutical Technicians), only one (1) provided the correct information about quantification concept. Also among those who indicated that they have general concept of the Quantification process of medicines, two (2) of them didn't know the advantages of having effective and efficient quantification process of medicines in the health facility system. These results have shown that there is significant association of Quantification knowledge and qualification levels of pharmaceutical professionals ($P<0.05$).

Among all the interviewed drug store managers who are pharmacists, three (3) had satisfactory- and the other had poor knowledge level on ILS. All the drug store managers who are pharmacist indicated that ILS does not help to reach the target of good estimation of drugs to be purchased, and about three quarters of them mentioned that ILS is still confusing to apply it.

For Pharmaceutical technicians, only one (1) was found to have satisfactory knowledge level on ILS, and three (3) revealed that the ILS is still confusing to be effectively utilized.

Chi-square test was done to find out the association between perceptions on the ILS with the professional status. Results obtained (χ^2 =6.975, df = 2 and P-value<0.05) have shown that there is significant variation of ILS application among qualification levels of pharmaceutical professionals.

Procurement and Inventory management

Regarding the procurement component of the pharmaceutical management, the results of the study show that out of the 9 visited health facilities, 7 of them procured antimalarial medicines only from Medical Stores Department (MSD), while the remaining 2 health facilities were procuring antimalarial medicines from both MSD and private sources including wholesale pharmacies and Medicine supplying agents in Tanzania.

Even though most of the visited health facilities responded that they were supplied antimalarial medicines, especially ALU, by the MSD alone, the study findings shows that still they were supplied other antimalarial medicines; such as Artemether injections, duo-cotexcin, quinine injections as donation from medical agencies through MOHSW. Good examples were Mwananyamala Hospital and Amana hospital which had a lot of Artemether injections and other antimalarial medicines.

This study also assessed the existence of the procurement units in which drug store managers are supposed to be members of the unit for pharmaceutical profession assistance. Results obtained from the survey indicate that all the public health facilities surveyed had no such Procurement Management Units.

The results also show that all the interviewed pharmaceutical personnel did not know the concept of procurement period used in their health facilities. Regarding the lead time concept; six (6) of all drug store managers revealed that their lead time period was less than one month while three (3) said that the lead time at their health facilities was between one (1) to two (2) months

Table 4.4: Responses on Lead Time concept among pharmaceutical professionals

Professional Qualification	Lead Time Period in the drug stores		TOTAL
	Less than one week	1-2 months	
Pharmacist	1(25%)	3(75%)	4 (16.7%)
Pharmaceutical Technician	5(100%)	0(0%)	5(83.3%)
TOTAL	6(66.7%)	3(33.3%)	9(100%)

From the survey, it was found that only 2 of the visited main drug stores were using BIN card systems, while 7 facilities were using Stock ledger books as their means of inventory control systems. Mwanayamala Hospital was observed to use both BIN card and Stock ledger systems.

On assessing the use of Electronic Drug Record systems as the accurate means of inventory management systems, all 9 health facilities had no such systems in place.

Each public health facility had different numbers of Dispensing sections; the mean value was 2 (with standard deviation=1). It meant that one Main Drug Store was supplying medicines and medical devices to at least two dispensing rooms or satellite pharmacies within the health facility.

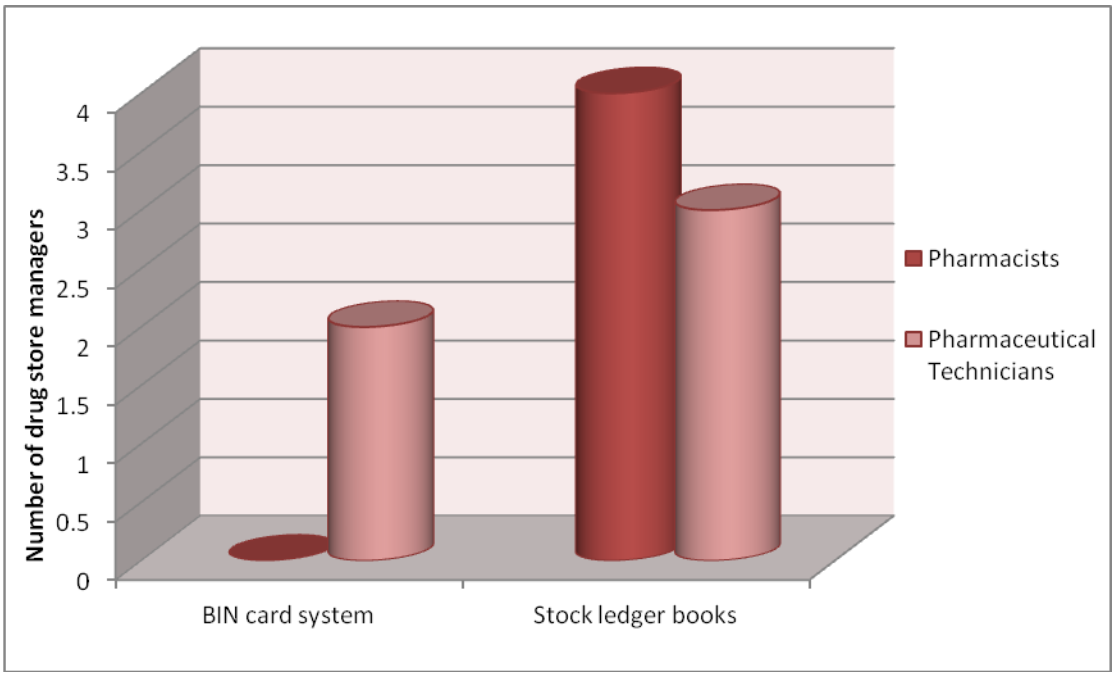


Figure 4.1: Stock Record keeping systems used by pharmaceutical personnel in the Health Facilities

Study findings revealed that for application of stock flow approach among all nine drug store managers, only one (1) manager was using only First- In First-Out (FIFO) system of supplying antimalarial and others medicines, five (5) managers were using First-Expiry First-Out (FEFO) system, and three (3) were using both FIFO and FEFO. Chi-square test was done to find out the association between applications of stock flow approach with the professional qualifications of the drug store managers. Results obtained have shown that there is no significant difference between pharmacist and pharmaceutical technicians (P = 0.151).

Disposal of the expired antimalarials and others medicines

It was pointed out in 7 of the visited public health facilities that expiry of medicines was a very common problem in their main drug stores. Reasons given for expiration of medicines were; donations of drugs with short shelf lives (from donors, private medical companies and other medical agencies), over stocking of medicines due to poor estimations of quantities to be purchased or procured, influence of the patients to choose brand medicines rather than generics, and hence most of the generic medicines were not fast moving. In these facilities, expired drugs had not been disposed for more than six years. The main reason given for not disposing expired drugs was the long, bureaucratic and tedious process for drug disposal.

4.1.3. Average stock-out days for Antimalarial drugs

ALU Green is a pack containing 24 ALU tablets packed to suit the complete dose for adults and children with more than 35 kg of body weights. Among all the visited health facilities, Mwananyamala hospital had no stock-out day for ALU green throughout the study year i.e 2010. Magomeni, Sinza and Mnazi Mmoja health centres showed to have more than three months of ALU green stock out in 2010.

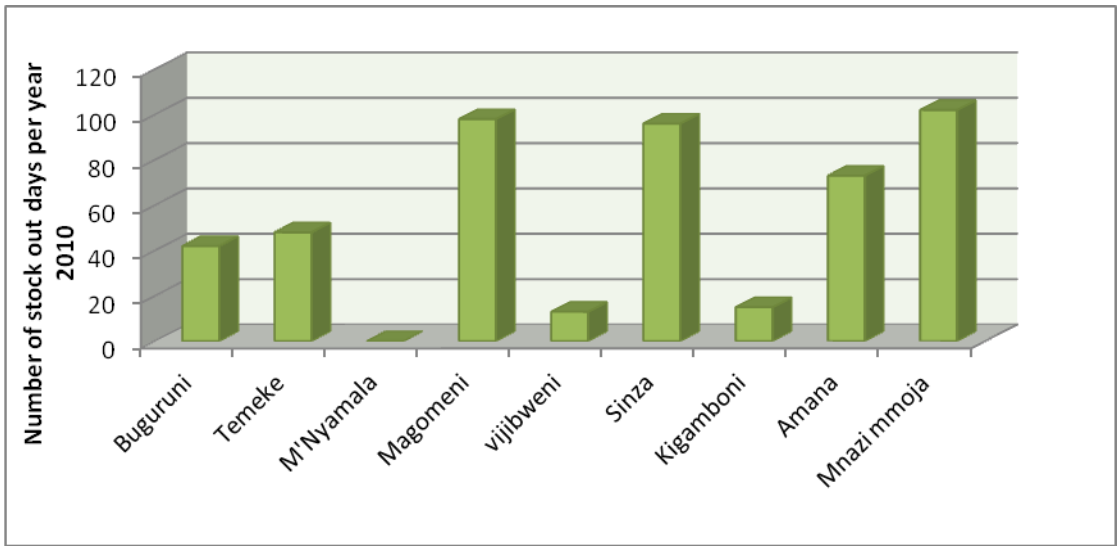


Figure 4.2: Variation in stock out days of ALU Green in the health facilities for the year 2010

ALU Pink is a pack containing 18 tablets of ALU packed to suit the complete dose for children with 26-35 kg of body weight. For ALU Pink it was found that Mwanyamala Hospital had stock of 298 stock out days. Other health facilies had average stock out days of 136, except Vijibweni hospital which had no stock out of ALU Pink in 2010.

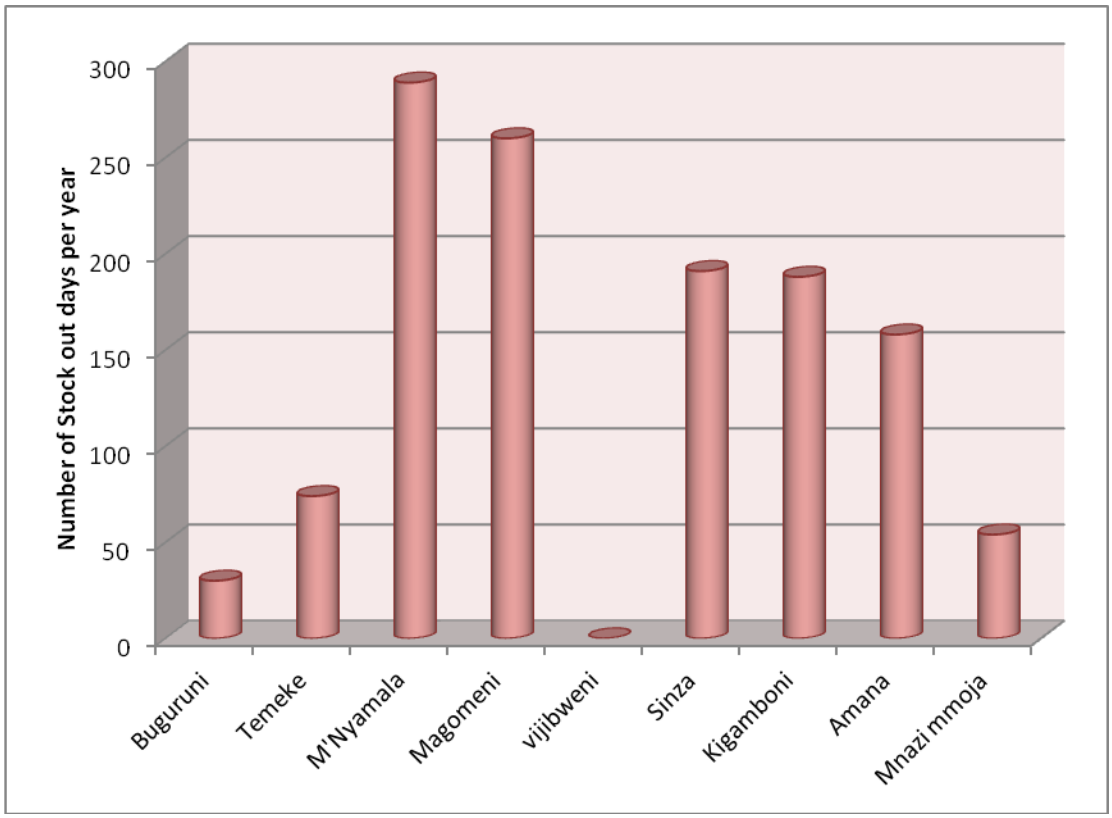


Figure 4.3: Variation in stock out days of ALU Pink in 2010

For ALU Blue, which is a pack of 12 ALU tablets packed to suit the complete dose for children with 16-25 kg of weight; all facilities had numbers of stock out days ranging from 7 to 128, as shown in figure 4.4 below.

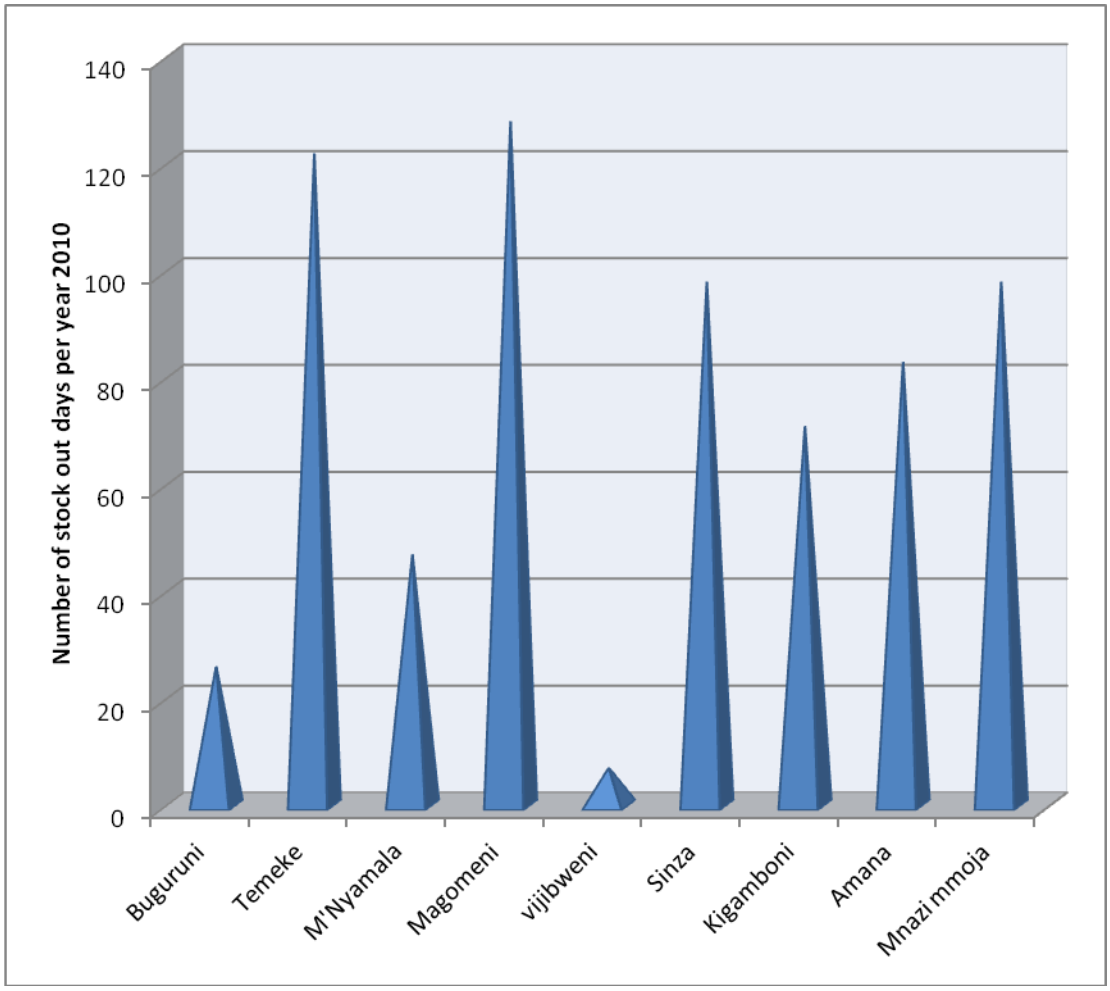


Figure 4.4: Variation in stock out days of ALU Blue in the health facilities for the year 2010

ALU Yellow is a pack of 6 ALU tablets packed to suit the complete dose for children with 5-15 kg of weight. The results show that all facilities had numbers of stock out days ranging from 0 to 120. Magomeni Health Center had high number of stock out days (i.e. more than three months) compared to all visited health facilities in 2010. The reasons that were stated from the drug store manager were that demands of the ALU blue were low and unpredictable and lack of such medicines at MSD. However the reason was found to be unsound since findings from MSD showed that there was no such problem.

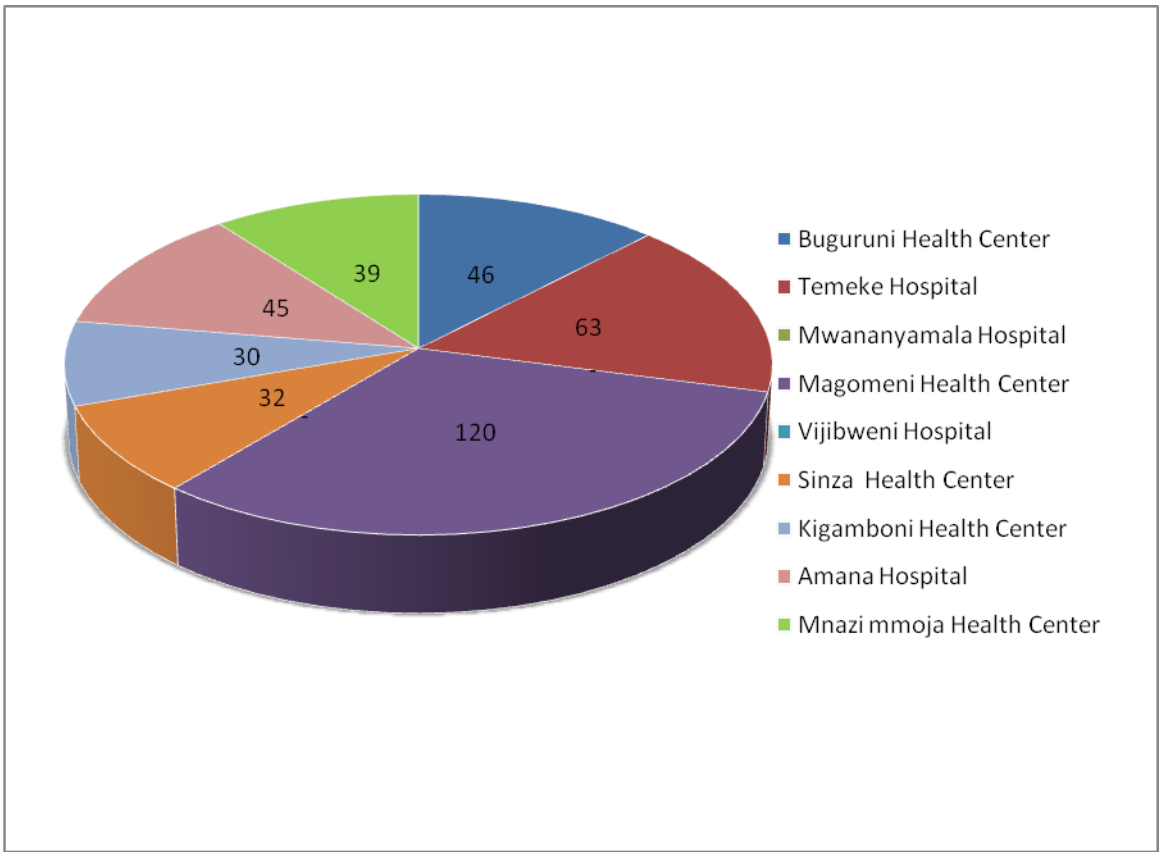


Figure 4.5: Variation in stock out days of ALU Yellow in the Health Facilities per year 2010

Regarding the average percentage of stock out days of antimalarial drugs in whole study year (i.e., the study results showed that among all selected health facilities, Amana Hospital was found to have 46% as maximum while Vijibweni Hospital had 1.3% which was the lowest percentage for ALU stock out days.

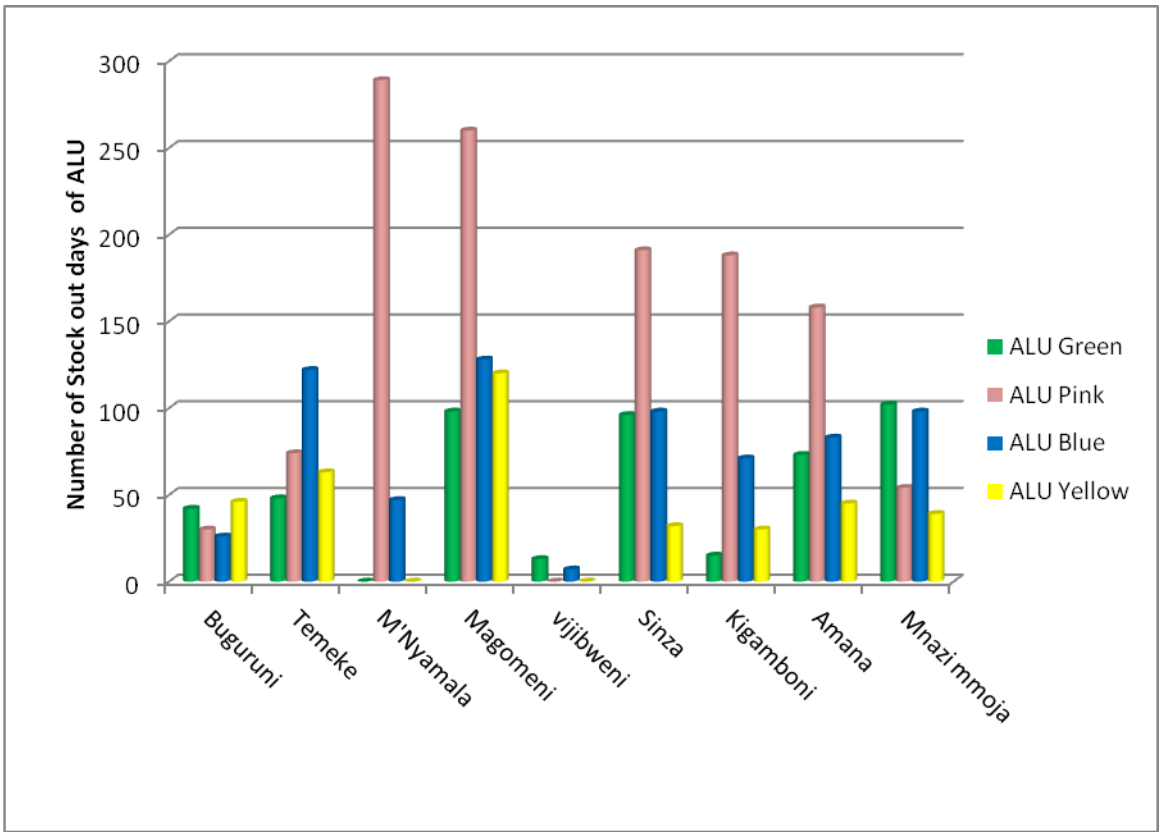


Figure 4.6: Variation in stock out days of ALU of all types in the health facilities for the year in 2010

At the MSD, the stock out days of the antimalarial drugs especially ALU show that the ALU yellow had highest number of stock out period by 122 days, followed by ALU green by 35 days. It was also observed that all stock out periods of the ALU especially ALU Yellow and ALU Green were at the last three months of the year. ALU Pink had 3 days and ALU Blue had no stock out days throughout the year 2010.

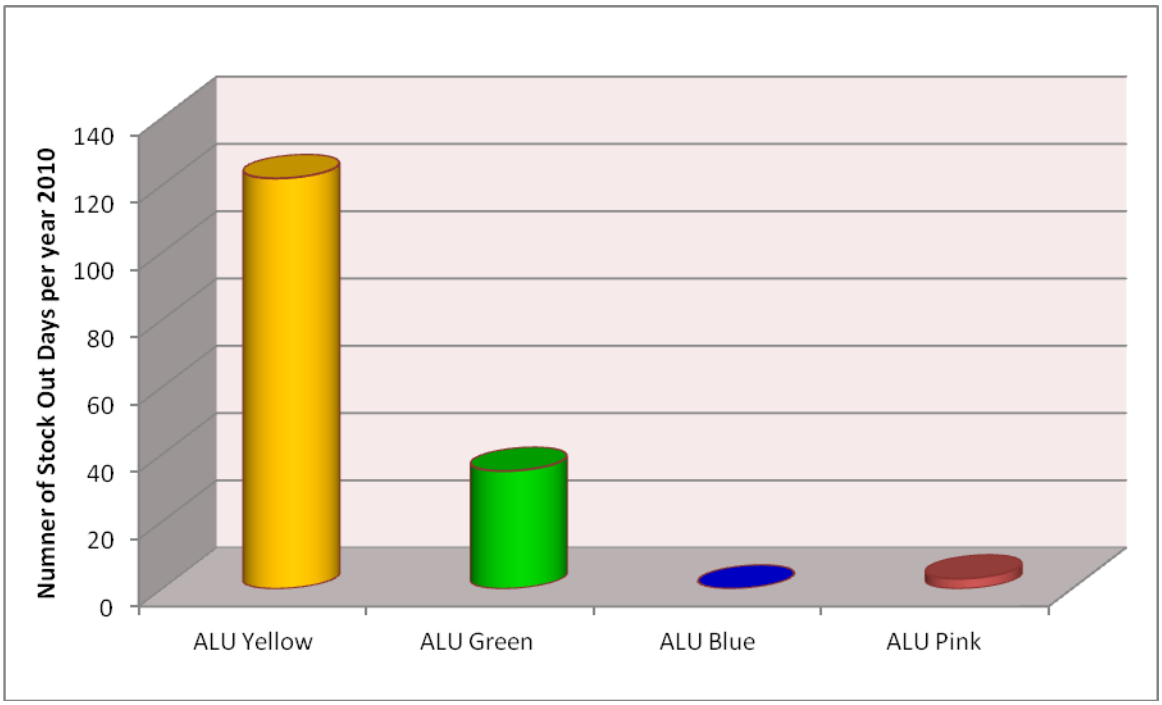


Figure 4.7: Stock out days of ALU drugs at the Medical Store Department in 2010

For quinine tablets, percentage average time out of stock in 2010 was generally high compared to other antimalarial drugs studied. Mwananyamala Hospital had highest value by 53% while Kigamboni Health Center had 2% and it was a minimum percentage average time out of stock. Two health facilities namely Temeke Hospital and Magomeni Health Center had physical stock of quinine tablets but, they were not entered in the stock ledger book, therefore stock out data were not available.

For quinine injections, five (5) out of nine (9) had stock-out days in 2010 ranging from 9 to 68. Buguruni Health Center had percentage average stock out time of 19% which is highest value while four health facilities namely; Vijibweni Hospital, Sinza Health Center, Kigamboni Health Center and Mwananyamala Hospital had no percentage average stock out time.

Table 4.5: Average time stock out of Antimalarial drugs in the Health facilities for the year 2010

Name of Health facility	Percentage Average time Stock-out of ALU and Quinine in 2010		
	ALU	**Quinine tablets**	**Quinine injection**
Magomeni Health Center	42	No Data	9
Vijibweni Hospital	1.3	20	0
Sinza Health Center	28	22	0
Kigamboni Health Center	21	2	0
Amana Hospital	46	28	15
Temeke Hospital	21	No Data	3
Mwananyamala Hospital	23	53	0
Buguruni Health Center	10	40	19
Mnazi Mmoja Health Center	37	15	12
AVERAGE MEAN	**25**	**25.7**	**6.4**

The average percentage time out of stock of ALU (of all types) is 11% at MSD. This value is high according to WHO recommendation, in which the mean stock-out days for essential medicines should be 0%.

4.1.4. Adequacy storage conditions and handling of antimalarial drugs.

During study visits to the selected health facilities, nine (9) Main Drug Stores and fifteen (15) Dispensing rooms were assessed using a checklist (Annex V). Results show that percentage average scores for all Main drug stores in all public hospitals and Health Centers in Dar-es-salaam is 64%. Amana Hospital had maximum average score of about 89%, and Kigamboni Health Center had minimum average score of about 33%. The overall results from each facility are shown in table 4.7 below.

Table 4.6: Adequacy storage conditions and Handling of Medicines in the Main Drug Stores in the Health facilities

Main Drug Stores	% Average scores	Score status
Mwananyamala Hospital	78	Very satisfactory
Amana Hospital	89	Very satisfactory
Temeke Hospital	67	Satisfactory
Sinza Health Center	44	Dissatisfactory
Magomeni Health Center	78	Very satisfactory
Kigamboni Health Center	33	Dissatisfactory
Buguruni Health Center	78	Very satisfactory
Mnazi Mmoja Health Center	56	Dissatisfactory
Vijibweni Hospital	56	Dissatisfactory
AVERAGE SCORE	**64**	**Satisfactory**

Referring to the score chart of Adequacy Storage conditions and Handling of Medicines (Table 3.2), the overall results for the Main Drug Stores is satisfactory. However, all health facilities had no cold storage with temperature chart, and 8 of them were observed to storing medicines on the floor. Also, six (6) main drug stores from all the visited facilities were not keeping expired medicines in a separate place from unexpired medicines, and 3 main drug stores had evidence of pests in the store rooms.

Systematic arrangement of medicines in the main drug stores was also assessed and results showed that only six (6) facilities were found to arrange their medicines in systematic manner especially pharmacological order.

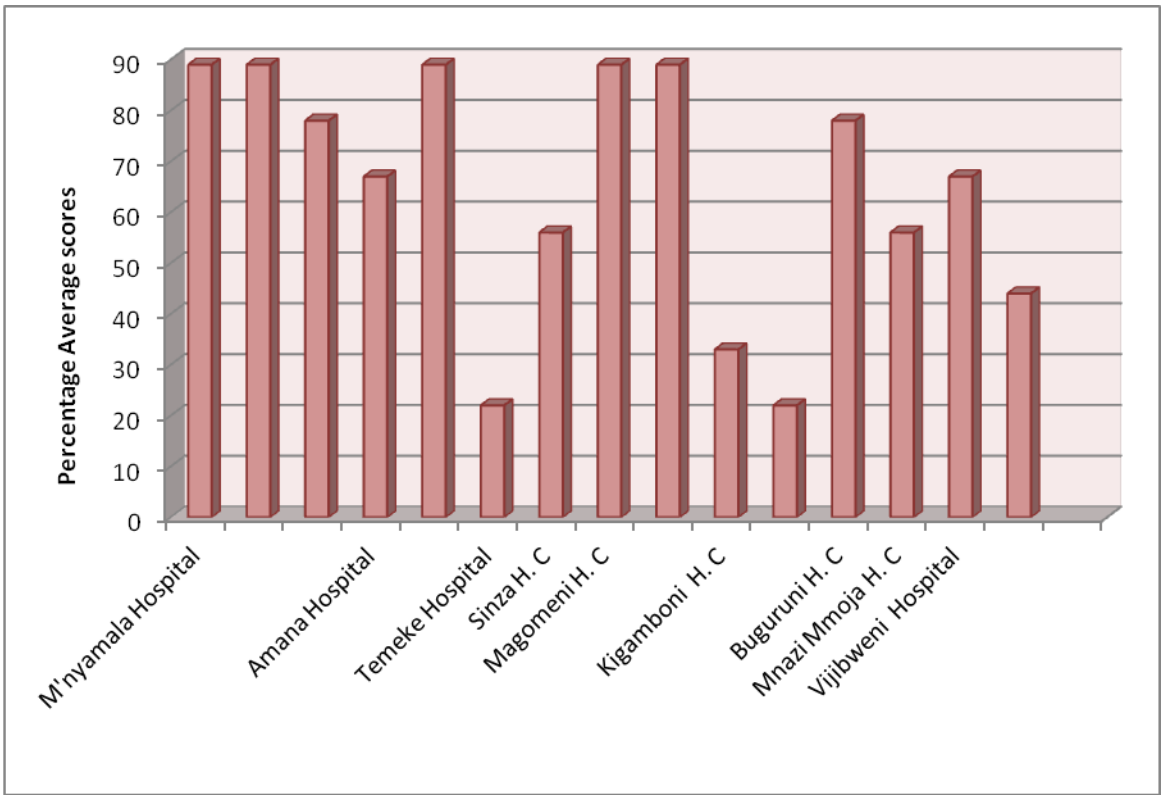
The average score of dispensing rooms in all of the facilities was 65% which is generally satisfactory when referring to Table 3.2 of the Knowledge score chart for Quality Control of medicines.

Table 4.7: Adequacy storage conditions and handling of medicines in the dispensing rooms of the health facilities

Health Facility	Name of Dispensing room	% Average scores	Score status
Mwananyamala Hospital	General dispensing room	89	Very satisfactory
	NHIF* dispensing room	89	Very satisfactory
	Sub-store	78	Very satisfactory
Amana Hospital	General dispensing room	67	Satisfactory
	NHIF dispensing room	89	Very satisfactory
Temeke Hospital	Main Dispensing room	22	Very dissatisfactory
Sinza Health Center	Dispensing room	56	Satisfactory
Magomeni Health Center	Dispensing Room 1	89	Very satisfactory
	NHIF dispensing room	89	Very satisfactory
Kigamboni Health Center	Dispensing room (TB)	33	Dissatisfactory
	General dispensing room	22	Very dissatisfactory
Buguruni Health Center	Dispensing room	78	Very Satisfactory
Mnazi Mmoja Health Center	General dispensing room	56	Satisfactory
Vijibweni Hospital	General Dispensing Room	67	Satisfactory
	Dispensing room	44	Dissatisfactory
Total average		**65**	**Satisfactory**

*National Health Insurance Funds

Despite of the average score, results has shown the satisfactory; Kigamboni's General dispensing room had 22 % which indicate that the quality control of the medicines is very dissatisfactory.



*H.C –Health facilities

Figure 4.8: Average scores for Adequacy storage and Handling of medicines for each dispensing health facility

Results also showed that in about 94% expired medicines were separated from the unexpired medicines. Only one dispensing room was observed to keep expired medicines in the same area with dispensing medicines. Medicines were found to be kept directly on the floor in six dispensing rooms. Only dispensing rooms located at Amana Hospital and Buguruni Health Center were not storing medicines directly on the floor while at least

one of the dispensing rooms from other health facilities were found to keep the medicines directly on the floor.

As it has been observed in main drug stores, all dispensing rooms assessed had no cold storage with temperature chat; therefore control of temperature for cold-conditioned medicines was not done at all. Study results also showed that among all the visited dispensing rooms, 73% had no dispensing tools (such as Pill Counting trays, or Automated Tablet Counting machines). These dispensing tools (only Tablet Counting trays) were seen at Amana Hospital, Buguruni and Mnazi Mmoja Health Centers.

4.1.4. Rational dispensing of ALU in relation to Malaria Treatment Policy

In the questionnaire, a child with 27 kg weight was used to verify whether dispenser can dispense the correct dose to such a patient. Among all the 32 dispensers that were interviewed, 22 provided correct information for the recommended doses of ALU in relation to weight of the patient while the rest of dispensers gave wrong information about the dosage of ALU. There was no statistical significance differences (P = 0.115) among the levels of pharmaceutical health workers regarding knowledge of dispensing ALU in consideration for patient`s weight. Also 20 drug dispensers provided wrong or incomplete dosage information, regarding the correct dosage regimen of ALU,

On assessing the practice of the dispensers towards avoidance of possible adverse reactions of ALU during its administration, 27 (84.6%) drug dispensers had poor knowledge on what basic information is required from the patients before dispensing ALU regardless the patients have got consultation from medical doctors.

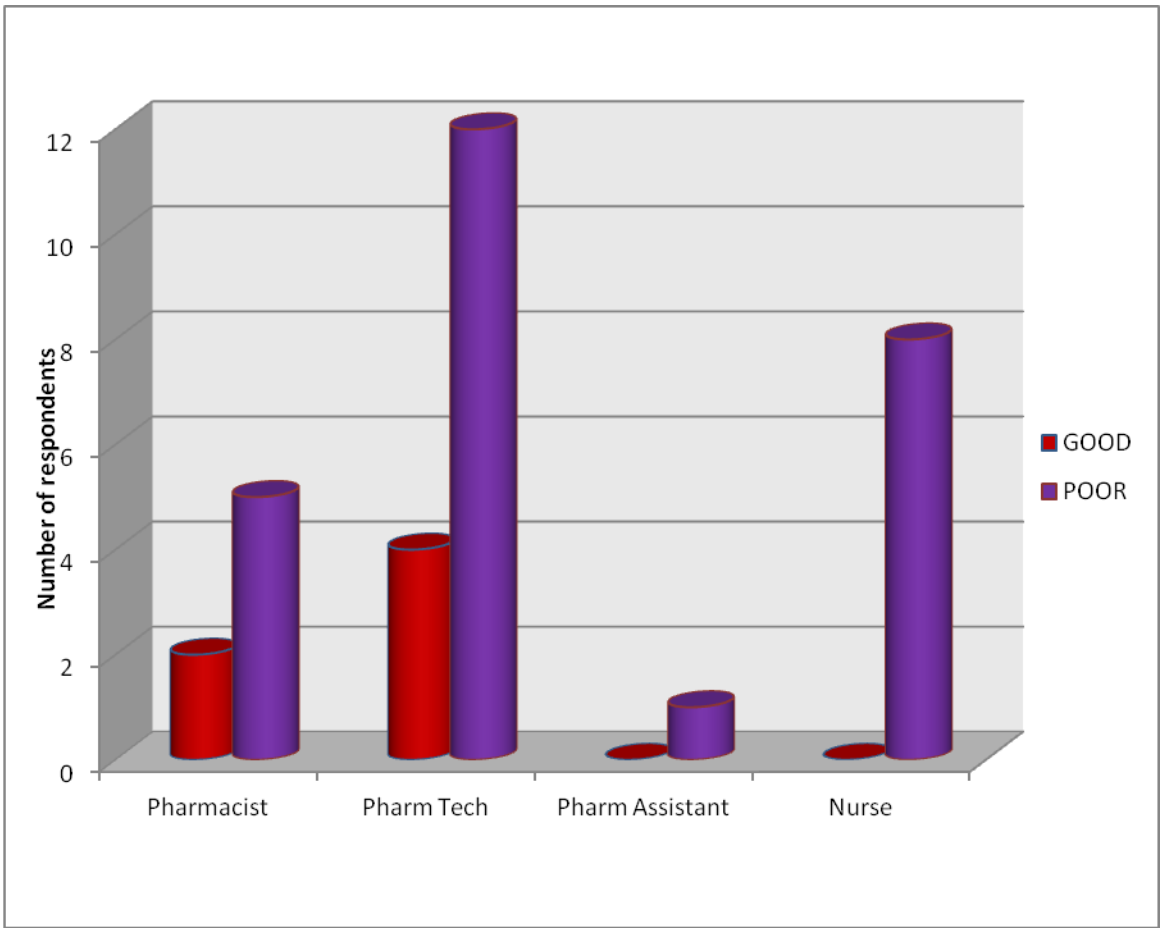


Figure 4.9: Knowledge levels of drug dispensers on Pre-dispensing information needed from Patients before dispensing of ALU

Also study results showed that 17 (53.1%) respondents did not know basic information that patients should be given in order to increase pharmacokinetic properties of ALU medicines. Such information is use of milk and or fatty food before taking the medicines.

Table 4.8: Knowledge levels of drug dispensers regarding information to patients after dispensing ALU.

Professional Qualification	*Knowledge on Post-dispensing information during ALU dispensing*		*Total*
	Good	**Poor**	
Pharmacists	1	6	**7**
Pharmaceutical Technicians	11	5	**16**
Pharmaceutical Assistants	1	0	**1**
Nurses	2	6	**8**
Total	**15(46.9%)**	**17(53.1%)**	**32(100%)**

Among those respondents who indicated that milk or fatty food should be taken before administering ALU, six (20%) dispensers actually did not know the importance of taking milk or fatty food before swallowing ALU medicines, and most of those respondents were not sure if the efficacy of the medicine will be unaffected with the use of milk.

Among all respondents that were interviewed, only 19 of them mentioned that they knew the age of pregnancy during which ALU can be used. Among those who indicated to know the time during which ALU can be used, only seven (7) of them were able to mention the second and third trimesters as the safe period for use of ALU during pregnancy.

Table 4.9: Awareness of Pharmaceutical Health Workers towards use of ALU in Pregnancy

Professional category	Pregnancy period safe to use ALU					
	First Trimester	Second Trimester	Third Trimester	Both 2nd and 3rd Trimesters	Don't Know	Total
Pharmacist	0	0	0	6	1	**7**
Pharm Tech	2	1	3	5	5	**16**
Pharm Assistant	0	1	0	0	0	**1**
Nurse	0	0	1	0	7	**8**
TOTAL	**2(6.3%)**	**2(6.3%)**	**4(12.5%)**	**11(34.4%)**	**13(40.6%)**	**32(100%)**

Chi-square (χ^2) =33.281, df = 12 and P-value <0.001

The results show an association (P < 0.001) between levels of profession and the knowledge for use of ALU during pregnancy. Pharmacists were more aware on the ALU use in pregnancy compared to the all other pharmaceutical professional qualifications

Dispensers indicated that dispensing of ALU presents some challenges including too much information to be given to patients during dispensing and that most patients do not easily understand the provided information. Another challenge was the size of pack and number of tablets of ALU per pack. In particular, the use of ALU pink (18 tablets) for adults in case ALU green (24 tablets) is out of stock is most confusing to most patients.

Majority of drug dispensers indicated to have been receiving complaints from patients who are using ALU. Some patients` complaints included side effects (abnormal heart beat and gastrointestinal disturbances) and long dosage duration of ALU.

4.2. PRESCRIBING PATTERN OF THE ANTIMALARIAL DRUGS.

4.2.1 Socio-demographic data

Among all 4,320 recorded prescriptions from the selected health facilities, it was found that 44% of all prescriptions did not have the gender information and it was therefore difficult to establish the sex of the patients by judging through their names.

Table 4.10: Socio-demographic information of Patients

Characteristics	Number	Percentage
Sex		
Male	1189	27.5
Female	1231	28.5
Not indicated	1900	44
Total	4320	100
Age Group (in years)		
0-5	1294	30
6-18	1104	25.6
Above 18	1877	43.4
Not indicated	45	1
Total	4320	100

Also the patients' ages recorded from the prescription showed that 43.4% of the patients were above 18 years and 1% of the all prescriptions collected had no information concerning the age. About quarter (25.6%) of all patients had age between 6 to 18 years, while 30% of the patients were below 5 years, as shown in Table 4.10 above.

4.2.2: Average number of drugs prescribed per prescription

Statistical analysis of the data results from all study sites have shown that the average number of drugs per prescription is 2.4±0.014, with 95% Confidence interval for the mean value of between 2.34 to 2.40. The range of the number of the drugs per encounter is 6. The maximum number of the drugs prescribed per prescription was 7 which represent about 0.2% of the prescriptions. The median number of drugs per prescription is 2.

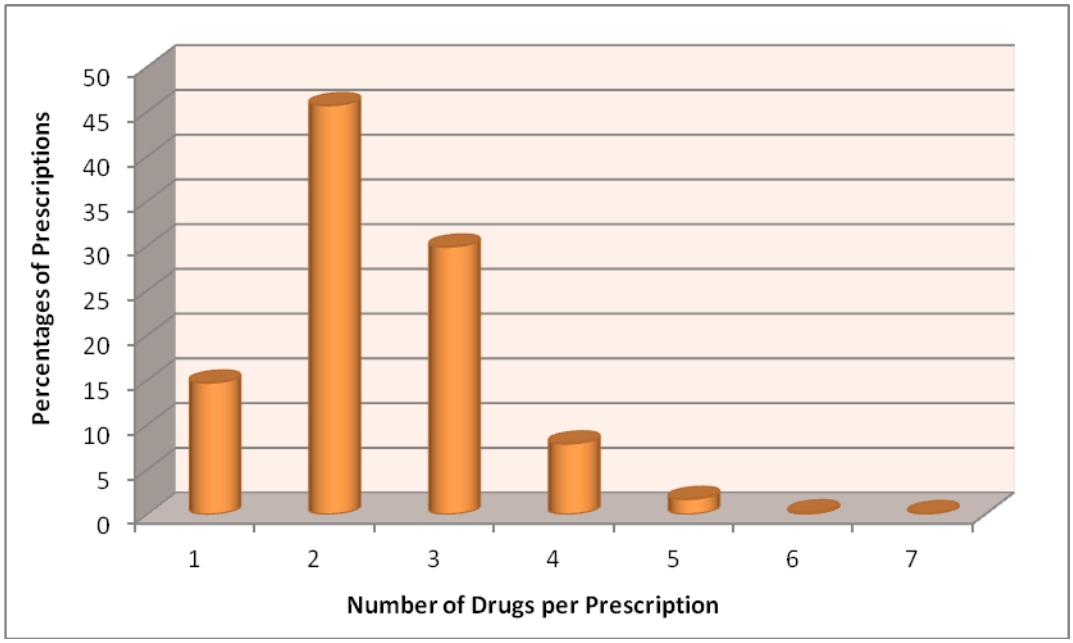


Figure 4.10: Number of drugs per prescription (n = 4320)

Among all the prescriptions assessed, it was found that 77.1% of them contained at least one analgesic drug especially paracetamol and diclofenac. About a quarter (26.9%) of all the prescriptions sampled had at least one antibiotic.

4.2.3. Adherence to the National Malaria Treatment Guidelines.

Among all 4320 from OPDs, it was found that 4235(98%) prescriptions contained only one prescribed antimalarial drug and among them 88.9% of the prescribed drugs was

ALU. About 2% of all prescriptions contained more than one antimalarial drug which is not Fixed Dose Combination (FDC).

Study findings shows that 87.3% of all (4320) prescriptions collected contained ALU as prescribed antimalarial drugs. About 3.6% of the prescriptions showed Quinine injections were prescribed alone in the OPD; 1.9% of prescriptions contained Quinine tablets as only antimalarial drug; and 0.7% of all prescriptions showed the prescribing behavior of both Quinine injections and tablets.

Other antimalarial medicines such as Artemether injections, Amodiaquine and Dihydroartemesinin with Piperaquine (Duo-cotexcin®) were prescribed in 5% of all collected prescriptions.

Table 4.11: Antimalarial drugs prescribed in all prescriptions (n = 4320)

Number of Antimalarial Drugs per prescription	**Antimalarial Drug Prescribed**					
	ALU	SP (Metakelfin* or Fansidar*)	Quinine tablets	Quinine injection	Others	Quinine injection, followed up by tablets
1	3765(99.9%)	59(92.2%)	83(100%)	156(100%)	146(67.9%)	26(81.3%)
2	5(0.1%)	5(7.8%)	0(0%)	0(0%)	69(32.1%)	6(18.8%)
Total	3,770(87.3%)	64(1.5%)	83(1.9%)	156(3.6%)	215(5%)	32(0.7%)

*Metakelfin – Sulphamethoxpyrazine with Pyrimethamine

*Fansidar – Sulfadoxine with Pyrimethamine

Concerning the correctness of good prescribing practice of ALU, the results of the study showed that among all the prescriptions that contained ALU, only 3.1% of them had correct prescribing information that can be understood well by drug dispensers. The assessment was based on the observed written prescribing instructions of the drug, including timing between first and second doses; and between second and third doses of ALU. About 96.9% of the prescriptions showed wrong prescribing practice of ALU.

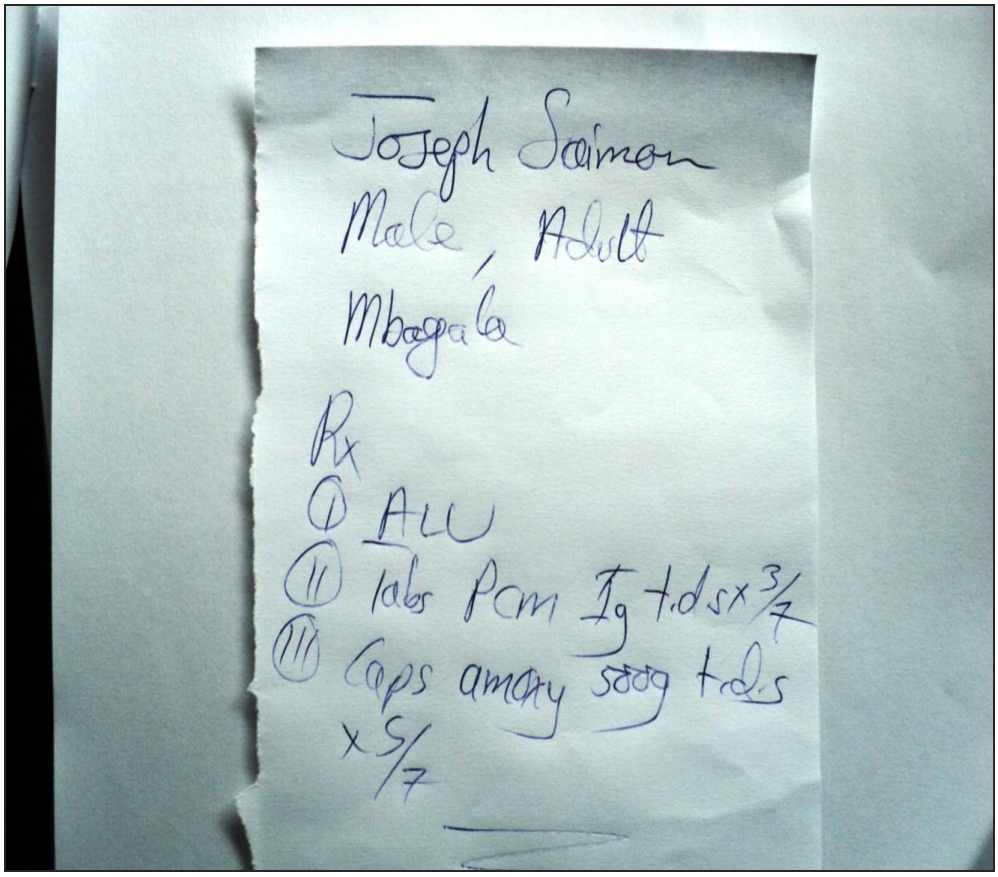


Figure 4.11: A typical example of prescribing of ALU medicine, as it was seen in one of the prescriptions from Temeke Municipal Hospital 2010

CHAPTER FIVE

DISCUSSION

This study aimed at assessing the knowledge in practice of pharmaceutical management of antimalarial medicines especially those medicines which treat uncomplicated malaria, and also to find out the current prescribing pattern of such medicines that may influence pharmaceutical management in the health facilities.

This study involved the interview of 32 pharmaceutical health workers which is equivalent to more than 50% of them. As far as this study is concerned, pharmaceutical health workers meant those health workers who are directly involved in pharmaceutical services in the health facilities. Among all interviewees, 50% were pharmaceutical technicians; 25% were nurses; and 21.9% were pharmacists. These levels of qualifications may influence the drug management in the particular health facilities. Pharmaceutical technicians were found both at hospitals and health centers while pharmacists were found more in hospitals than health centers. Nurses who are not pharmaceutical personnel were mostly found in health centers. Having sufficient number of the pharmacists and pharmaceutical technicians in the health facilities increases the chance of the good antimalarial drug management.

Most of the pharmaceutical health workers (41%) were aged between 26 to 35 years by 41% of all interviewees. This is an indication that providing continuing education and professional development to these personnel is likely to benefit pharmaceutical services for a long time.

Regarding the components of the pharmaceutical management (i.e Selection, Procurement, Distribution and Use) under the Legal framework and Policies, drug store managers play major role in antimalarial and other medicines management in the health facilities (MSH/WHO, 1997). These are pharmaceutical health workers who need to

forecast or estimate quantities of antimalarial and other medicines and medical devices required; to ensure the effective and efficient procurement of medicines in collaboration with health facility management; and to distribute to the satellite pharmacies or dispensing sections within their health facilities.

Effective management of main drug store requires drug store manager and sufficient number of subordinates, who at least have the knowledge of store management that may provide the technical assistance and other store activities to the managers. However the study findings revealed the mean number of subordinates to be one. Actually most of the Health Centers had no any subordinates while Municipal hospitals had one or more in their main drug stores.

5.1 Quantification Knowledge

Drug store managers are required to have sufficient quantification knowledge of the medicines. Advantages of effective and efficient quantification include the assurance of availability of antimalarial and other medicines throughout the year; ensuring effective purchase or procurement and minimizing under- and over-stocking of medicines due to poor forecast; and also avoidance of financial loss due to drug expiry. All of these advantages lead to proper drug management with limited financial resources. Findings from this study show that the majority of the drug store managers (67%) had poor knowledge on quantification concept; the figure is slightly lower than 78% reported by the Ministry of Health and Social Welfare in 2008 (MOHSW Report, 2008). These staff did not have any unified system for determining what to order from MSD.

ILS was introduced in Tanzania in 2007 and all pharmaceutical personnel in the health facilities were trained to apply it for the purpose of improving quantification process and reducing the number of forms required to be filled for purchasing medicines from MSD. However pharmacists were found to have good knowledge of ILS compared to the

pharmaceutical technicians. This scenario can be explained in the sense that most of the training were given to the drug store managers; majority of them being pharmacists. Nowadays due to insufficient number of pharmacists in most of the health facilities, pharmaceutical technicians are taking responsibilities in such health facilities. Therefore when they were interviewed during the study survey, probably they couldn't have such knowledge.

Other reason is massive influx of fresher's pharmaceutical personnel from colleges or universities who were recruited by government. Most of their working experience is less than one to two years and hence they didn't have such ILS knowledge. Therefore there is a need to have regular on-job training that will build capacity to the new staffs and refresh knowledge to the experienced staffs.

5.2 Procurement, Distribution and Inventory Management

Most of the Health facilities (78 %) procured antimalarial medicines from MSD only, specifically those medicines which are recommended in the national malaria treatment guideline. Advantage of procuring antimalarial and other medicines from one reliable source is the guarantee of quality, safety and efficacy of such medicines (MSH/WHO, 1997). Some of the Health facilities were procuring antimalarial drugs from private sectors. Such medicines were Quinine injections and tablets, but not ALU because subsidized ones were not available in private sectors at the time of study survey. Most of those drug store managers were not happy with their so called "special procurement" at MSD, the process which normally takes long time before receiving ordered. As a result, facilities usually decide to procure such items from the private agents.

Lack of Procurement Management Units (PMUs) or departments within the health facilities normally affects the transparency, effective and efficiency procurement of medicines and other non-pharmaceutical products (MSH/WHO, 1997). Within the

procurement unit, technical experts from each department are involved in making decisions in procurement cycle. In this study, all the health facilities assessed did not have PMUs PMU. The risks of misuse of limited resources; special influence on the selection of products; and suppliers are inevitable under this circumstances (WHO Report, 1999).

On assessing the knowledge of procurement, procurement period and Lead time were used as additional parameters. Study findings revealed that all drug store managers were confusing procurement period with lead time. Most of them were quoted to say; "*our procurement period normally takes one week*". This is an indication that the respondents have poor knowledge on Procurement Cycle. Normally efficient procurement cycle takes once or twice in a year. For lower procurement period i.e below six months, there is high chances of poor outcome from the procurement process (Kangwana et al, 2009).

Further findings showed that Lead Time of antimalarial and other medicines was less than one week in the stores that were mostly managed by Pharmaceutical technicians, while lead time of between one to two months were observed to the drug stores that were managed by the pharmacists. Having Lead Time of less than a week can be interpreted as ordering few items in quantities; or supplier delivery time is too short. On the other hand, long Lead Time period can cause drug shortages in the health facilities, as it was reported in a study conducted in Malawi (Lufesi and Andrew, 2007).

Inventory management involves a number of techniques and methods for effectiveness and efficiency. Recording system is very important to the inventory management (Blackburn, 2010). Main indicators that were used in this study were the use of Electronic Drug Recording Systems (EDRS); BIN Cards; and Stock ledger books. Findings revealed that no any visited health facilities were using EDRS, and few of them (22 %) were using BIN card system. EDRS is more reliable system than other systems, however it is highly recommended to apply all three systems for excellent reconciliation of stock data. Poor stock records, resulted from the poor stock recording behaviors

usually provide poor quantification outcomes especially with the use of consumption methods (like ILS). As a result, the availability of antimalarial and other medicines is affected (MSH/WHO, 1997). Therefore emphasis should be made to ensure that the use of EDRS and other systems of stock recordings are well established and applied effectively.

In every hospital or health center, a sufficient number of dispensing sections or satellite pharmacies is required in order to enhance the effective supply of the medicines to the patients and in turn, it minimizes the patient waiting time at the dispensing windows. In this study the mean number of dispensing sections was two (2). As a result in most facilities, especially in the health centers, there was long waiting time for patients to get their medicines. There is therefore a need to establish more dispensing sections and dispensing personnel on these facilities.

First In First Out (FIFO) and First Expiry First Out (FEFO) are among of the known stock flow approaches in the drug stores. Among them, FEFO, which is highly recommended, is knowledge driven- approach and it minimizes the problem of drug expiry. Regarding the supply of antimalarial and other medicines from the stores to the dispensing rooms, it was revealed that some drug store managers (11 %) were using FIFO system. This figure is slightly higher than 5.8 % that was reported in a study that was recently conducted in Uganda (Nakyanzi et al, 2009). Therefore there is a need of promoting awareness to these drug store managers on the application of FEFO stock flow approaches and its advantages.

5.3 Disposal of Expired Antimalarial and other medicines

Findings from this study pointed out that expiry of medicines are a common problem in most of the visited health facilities in Dar-es-salaam. This is equivalent to the findings reported in Ethiopia at which there were 8% of the expired medicines in all

health facilities in 2002 (WHO Report, 2003). Reasons given for the expiration of drugs were donated medicines were of short shelf lives; patients like brand medicines, rather than generics available at the public health facilities; and poor estimation of the drugs to be procured. In this case drug donation as a reason for expired drugs, the results of this study is similar to the study conducted in Uganda, and reported that almost half (55.6%) of the expired drugs was due to donated drugs that were about to expire (Nakyanzi et al, 2009). Regulatory bodies must establish or enforce the guidelines to prevent dumping of donated medicines. For example one of the recommendation of this study is medicines with lower than six months shelf lives should not be received by any health facility if they are not fast moving. With these guidelines, it will help to minimize cost of storing medicines that are likely to expire in a short period of time. About a third of respondents (33%) indicated that poor estimation is one of the source of overstocking and hence expiry of medicines.

Disposal of the expired medicines is very essential activity that must be done at all levels of health facilities. It was observed in this study that there was no any disposal of expired medicines and medical devices conducted in all Municipal hospitals and Health centers in Dar-es-salaam since 2006. As a result, the expired medicines occupied spaces and increase costs of storing them.

Almost all respondents admitted that the process of disposal of expired medicines normally takes long time and involves bureaucratic procedures. Normally District health officers, TFDA and members of police army are the personnel that must be involved for drug disposal. The same situation was reported in Turkey; however after baseline assessment of the study, the existing regulations were reviewed and amended (Alaqoz and Kosacoy, 2008). Later, a modified regulation was published and suited the needs. Therefore for Tanzania, there is a need to review the disposal guidelines so as to make it user-friendly to all stakeholders.

5.4 Average Stock out period of Antimalarial medicines

WHO recommends a zero value of stock out days and hence zero percentage time out of stock of medicines such as antimalarial drugs in any health facilities. In this study, percentage average stock out days of all types ALU ranged from 1.3 to 46 days; and also overall percentage time out of stock of ALU across all visited health facilities was 25. These results are indication that, in every 100 days during the year 2010, all types of ALU were out of stock for 25 days. This implies that as ALU being the first line drugs for the treatment of uncomplicated malaria in Tanzania, patients were missing the recommended drug and therefore the fight against malaria is affected

For Quinine tablets and injection, their mean values of percentage average time out of stock were 25 and 6.4 days respectively, which is higher than recommended value from WHO guidelines. These results are indication that even for the management of complicated malaria was affected due to the stock out days of the first line drugs for the severe malaria

Since most of the antimalarial medicines at the health facilities were purchased from MSD, data showed that there is no significant association between MSD stocks-out days with health facilities. This is an indication that main reasons for stock out of antimalarials at the health facilities are poor forecasting and quantification. Findings from Kangwana et al (2009) revealed the same reasons regarding stock out of ALU in the health facilities in Kenya. Shortage of antimalarial medicines with stock out days of 42 to 138 days was also reported in Malawi (Lufesi and Andrew, 2007); however the main reason was insufficient deliveries from the Regional Medical Stores Taken together, these findings need to build capacity to drug store managers on quantification and forecasting through provision of continuing education and professional development.

5.5 Adequacy Storage Conditions and Handling of Antimalarial medicines

Most of the visited health facilities' main drug stores had satisfactory scores (64% mean score) in storage and handling of medicines. This figure is comparatively lower than 80 % reported by Ministry of Health in Uganda (MOH Report, 2008). Comparing to other lower income countries like Tanzania, WHO Report (2006) revealed most of the public health facilities scored median value of 75%, which is higher than 64% in this study.

Even though the health facilities in this study could be regarded as having satisfactory storage conditions for antimalarials, almost all of the health facilities' drug stores had no cold storage with temperature chat and medicines were stored directly to the floor and expired medicines were kept in the same area with dispensing medicines.

Among all the 15 visited dispensing rooms, the average score was 65%, which corresponds to the score mark "satisfactory" as for the main drug stores. As compared the other public health facilities from other regions (average score of 55%) (WHO Report, 2003), there is slightly difference in favor of Dar-es-salaam public health facilities.

Results of the present study also showed lack of dispensing tools in most (73%) of the health facilities and therefore counting tablets using bare hands is still common practice. There is a need to provide dispensing tools to those health facilities that do not have, and to make sure such tools are used for dispensing of medicines.

5.6 Rational Dispensing of ALU

Following the introduction of ALU in 2006 as the first line medicine for treating uncomplicated malaria in Tanzania, the government through MOHSW conducted training to all stakeholders including drug dispensers (MOHSW Report, 2009). However, more than 67 % of drug dispensers in this study had poor knowledge on the recommended dose and dosage of ALU. This finding indicates that most of the patients receiving malarial

treatment in these facilities are given incorrect or incomplete instructions on dosage regimen. Most of the drug dispensers instructed patients to take three tables twice a day for three days. Due to pharmacokinetic profile of Artemether and Lumefantrine , ALU needs a loading dose in such that the second dose is taken after eight hours from the first dose, third dose is taken 16 hours from the second or 24 hours from the first doses, while the fourth, fifth and sixth doses are taken in twelve (12) hours intervals.

It is known that ALU medicines should be used carefully to the patients with cardiovascular diseases and pregnant women etc (BNF, 2010). However 84.6% of the interviewed dispensers normally were not aware of the contraindication of ALU.

ALU is among the medicines that require special attention of its pharmacokinetic properties upon its administration (i.e correct dosage and taking of milk or fatty food). Taking ALU without consuming of milk or fatty food has significant impact on its bioavailability (Buck, 2010). It was found that more than 56 % of all dispensers had poor knowledge regarding the beneficial effect of ALU-food interaction. Lack of such knowledge among drug dispensers has a negative impact to the patients and population in general. Therefore there is a need of conducting on-job training or short courses to these dispensers to ensure rational dispensing and use of ALU.

As stated earlier, pregnant women can take ALU during the second and third trimesters (Buck, 2010). However 41 % of the dispensers were not aware on the safe use of the drug in pregnant women. Findings from this study support the need to build capacity of drug dispensers regarding antimalarial use in pregnancy (Kamuhabwa and Mnyusiwallla, 2011).

5.7 Dispensers Awareness towards dispensing ALU

The study findings revealed that some of the dispensers (28%) admitted difficulties such as too much information required to give patients and also patients takes time to understand the dosage requirement during dispensing ALU. This is most likely to

appear because dispensers themselves had no sufficient knowledge that can make patient to understand.

Patient perceptions and complaints toward ALU medicines were usually collected through their drug dispensers. Despite the on-going sensitization of ALU medicines, still there were complaints of side effects and resistance towards the malaria diseases. It is possible but several studies have been done to support the safety of the drug (Falade et al, 2005).

Poor knowledge of dispensers on correct basic information (dose and dosage regimen, additional information needed to patient) may exaggerate the negative perception of the patients towards the use of such medicines. However pharmacovigilance system should be more sensitized to the public so that such adverse drug reactions (ADR) are officially documented and sent to TFDA for further investigations.

5.8 Prescribing Pattern of the Antimalarial medicines

Prescribing behavior of prescribers at a particular health facility normally influence availability of particular medicines and expiration of recommended-medicines; and hence it affects the whole pharmaceutical management of the medicines (MSH/WHO, 1997).

On assessing the prescribing pattern of antimalarial medicines, some parameters were evaluated, namely average number of medicines per prescription, percentage average number of analgesic; and percentage average number of antibiotics.

Average number of medicines per prescription (2.4) is turned to be slightly lower than 3.9, 3.0, 2.8 and 2.9 that were reported from studies in Yemen (Abbo-Rabbo, 2003), Uganda (MOH, 2008); in Nigeria (Adebayo and Hussain, 2010) and United Arab

Emirates (UAE) (Bazigha et al, 2010) respectively; and slightly higher than 2.2 that was reported in Dubai (Sharif et al, 2007).

The results of this study showed that percentage of prescriptions without the age of the patients was 1%, which is lower than 47.1% that was reported in Yemen (Abbo-Rabbo, 2003), 64% reported in UAE (Bazigha et al, 2010) and 9.7% reported in Dubai (Sharif et al, 2007). Also the study findings revealed that percentage (44%) of the prescriptions without patient sex information is higher than 3.1% and 31% that were reported in the public hospital and health centers respectively in Yemen (Abbo-Rabbo, 2003). The findings from this study also indicate higher percentage value than. 12% that was reported in a study conducted in Dubai (Sharif et al, 2007); and it is lower than 68% reported in UAE (Bazigha et al, 2010). These results imply the need to promote the formal prescription writing among prescribers in the health facilities, and in turn it will enhance the rational dispensing of ALU and other medicines.

As far as ALU dispensing is concerned, patient age and weight are very important to the dispenser as to justify the correct doses of such medicines prescribed by physicians. However physicians must adhere to the 5 steps of Rational Prescribing, so as to improve the physicians-drug dispenser communication for the better of patient health.

5.9 Adherence to Malaria treatment policy

The findings from this study revealed that in most (89%) of malarial case prescriptions, ALU was prescribed as the first line medicines for uncomplicated malaria disease according to the current national and WHO malaria treatment policies. In Nigeria, it was reported that only 58.1% of the prescribers did not adhere to the national malaria treatment policy (Adebayo and Hussain, 2010).

The findings further revealed that there is still a pattern of prescribing Metakelfin and Fansidar for the treatment of uncomplicated malaria, which is against the malarial

treatment policy of the Tanzania and WHO as well. Other drugs such as Amodiaquine, Duo-cotexcin were also prescribed.

Another prescribing behaviors evaluated from this study was the failure of the prescribers to prescribe ALU correctly in the prescription so that a fresher dispenser can well understand basic dosage instructions. Results from this study show that percentage (96.9%) of prescriptions without basic dosage information of ALU is high. Therefore there is a need to emphasize to the prescribers on importance of the writing the formal complete prescription of ALU in supporting the rational dispensing of the drug. Advantage of the complete prescribing of ALU (i.e showing the loading and maintenance dose with dosage regimen) is that drug dispenser is reminded to dispense drugs according to the literature and clinical findings that support effective pharmacokinetic properties of the medicines, and therefore promote rational dispensing of ALU.

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

Despite the effort of MOHSW to ensure ALU and other antimalarial medicines are constantly available at the MSD, yet there is significant stock out periods of such medicines to the public health facilities. Poor quantification, procurement and inventory management within the store facilities have been found to be among the main reasons for the stock outs observed in this study.

The level of the knowledge of pharmaceutical management of antimalarial medicines among the pharmaceutical health workers in the health facilities was observed to be poor and it was supported by presence of high percentage average time of antimalarials' stock outs and poor inventory management systems.

Adequacy storage conditions and handling of antimalarial drugs, both in main drug stores and dispensing rooms, were found to be satisfactory. However there is a need to address the critical issues such as keeping medicines directly on the floor and lack of cold storage with temperature chart in the stores.

Lack of the commitment of the health facilities' management teams and bureaucratic systems for disposal of expired medicines were among the reasons for indisposing of the expired medicines. Therefore there is a need to provide on-job training for addressing the critical issues of the whole systems of the disposal of expired drugs.

Deficiencies on rational dispensing of ALU have been realized to be critical problems. The drug dispensers did not have sufficient knowledge regarding the dosage of ALU that suit the pharmacokinetic needs of the drug in terms of doses' timing, and uptake of the fatty food or milk.

Prescribing pattern of ALU is satisfactory, however some of the prescribers were not adhering to malaria treatment guidelines, and hence they affect procurement or purchasing according to the guidelines. Also irrational prescribing of ALU in the prescription has been seen to promote dispensing and use of incomplete dose and dosage regimen of ALU from drug dispensers to patients. The encouragement of prescriber-dispenser communication is very important for improving rational use of medicines in the health facilities.

Therefore basing on these results, the knowledge in practice of pharmaceutical management among pharmaceutical health workers is poor and prescribing pattern of antimalarial medicines has little negative influence to the drug management within a particular health facility.

Recommendations

1. **Education approach:**

   MOHSW and other stakeholders should conduct regular on-job training and short courses to the pharmaceutical health workers about the concept and application of pharmaceutical management including re-training the ILS.

   MOHSW and other stakeholders should conduct regular on-job training for drug dispensers at their health facilities that will build their capacities about rational dispensing of ALU and antimalarial medicines.

   Despite of increase of public awareness of ALU, the MOHSW with collaboration of other stakeholders should provide enough copies of STGs and educative materials such as brochures and leaflets to the prescribers with information about Rational Prescribing of ALU and other medicines.

MOHSW through TFDA should sensitize health workers and the public regarding reporting of ADR through using the existing yellow forms. Therefore using mass media or routine workshops, it will help to disseminate the information to stakeholders regarding proper use of antimalarial drugs.

2. Managerial Approach:

MOHSW, in collaboration with Health Management Team (HMT) or Health Center management team and other stakeholders should evaluate and repair the drug stores and dispensing rooms' facilities, to meet the national and international standard requirements.

MOHSW should increase the recruiting rate of pharmaceutical personnel to the public health facilities, to guarantee the provision of best pharmaceutical services.

MOHSW should initiate the establishment of Procurement Management Units that will be led by Chief Supply Officer, and will include technical staff from each department. This will help to perform effective and efficient procurement of pharmaceutical and non-pharmaceutical products.

MOHSW or Health facility management should ensure the availability of dispensing tools at the health facilities and also to make sure effective utilization of such tools.

MOHSW should review the guidelines for Disposal of expired pharmaceutical products so as to make the procedures user friendly to all stakeholders.

MOHSW, through its agency i.e TFDA, should re-strengthen the ADR reporting systems at the health facilities levels by sensitizing health workers including drug

dispensers to internalize the habit of adverse reactions reporting; and in parallel to it, they need to ensure availability of Yellow forms at all health facilities.

3. **Regulatory Approach*:***

MOHSW should enforce the existing laws to the health management teams in each health facilities to enable constant availability of medicines especially antimalarial medicines.

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ANNEXES I:

PHARMACEUTICAL MANAGEMENT AND PRESCRIBING PATTERN OF ANTIMALARIAL DRUGS IN DAR-ES-SALAAM HEALTH FACILITIES

QUESTIONNAIRE

Drug store Managers

Code No ……..

Name of the Health Facility…….

Location……

Name of the Interviewer……...

Date: ……

SECTION I:

1. Age ☐

2. Gender: Male ☐

   Female ☐

3. Professional status: a) Pharmacist

   b) Pharmaceutical Technician

   c) Pharmaceutical Assistant

   d) Nurse

e) Others.
Specify_____

SECTION II:

Please Circle your choice where necessary

4. How many years have you been working in this health facility?

   a) 0-1 year

   b) 2-5 years

   c) 5- 10 years

   d) Above 10 years

5. How many subordinates are you working with in your drug store?

   _____ (*in numbers*)

6. Do you know what does Quantification process of medicine mean?

   a) Yes.(*Allow interviewee to explain briefly)*

   _____
   _____
   _____

   b) No

7. If the answer to Qn. 6 is YES, What are the possible advantages of the efficient and effective Quantification process of the Antimalarial drugs

   a) It ensures effective procurement of antimalarial drugs

   b) It avoids stock outs of antimalarial drugs

   c) It minimizes over-stocking of the antimalarial drugs

   d) It helps to avoid financial loss due to drug expiry

e) I don't know

f) Others. Specify……

8. What method(s) do you regularly use to estimate quantities of antimalarial drugs to meet the demand of a target period?

a) consumption data method

b) Morbidity data method

c) I don't know

d) Others. Please specify…….

9. Do you apply Integrated Logistics System (ILS) in your drug store?

a) Yes

b) No

10. If Qn. 9 is YES, does ILS help you to make a good estimation of quantities of antimalarial drugs to be purchased?

a) Yes, it helps to reach my target

b) Yes, but it is still confusing to be effective utilized

c) No at all

d) No, because I'm not using it.

11. Where do you procure antimalarial medicines?

a) Medical Store department (MSD)

b) Private pharmacies

c) Both MSD and Private Pharmacies

d) Others. Specify……..

12. Are you one of the members of the Procurement Unit in your health facility?
    a. Yes

    b. No

    c. No Procurement Unit in my health facility.

13. If Answer to Qn. 11 is YES, briefly explain what your responsibility is.

    _____

    _____

    -

    _____

14. What is procurement period that is normally used in your drug store

    a) Every month

    b) Quarterly (every three months)

    c) Every six months

    d) Others. Specify……..

15. How much time it normally takes when you prepare a purchasing order until the ordered drugs are received in your store?

    a) Less than One week

    b) 2 - 4 weeks

    c) 1 - 2 months

    d) More than 2 months

16. Which method(s) do you use to keep records of antimalarial drugs?

    a) Electronic drug record system (EDRS)

b) BIN cards

c) Both EDRS and Bin card

d) Others. Specify…….

17. How many dispensing sections do you supply medicines and medical devices in your health facility?

_____ (*in numbers*)

Please mention

_____
_____
_____
_____

18. Which method(s) do you use to supply pharmaceutical products (medicines, medical devices) from Main drug store to Dispensing section(s)?

a) First In-First Out (FIFO)

b) First expiry-First Out (FEFO)

c) Batch-to-Batch System

d) I don't know

e) Others. Please specify……..

19. Is expiring of medicines a common problem in your store?

a) Yes

b) No

20. If Qn 19 is YES, why do medicines expiry in your health facility?

……
….

……
……
……
……
….

21. Do you perform disposal process for expired medicines?

    a) Yes

    b) No

22. If Qn 21. Is YES, how frequently in a year do you perform disposal process for the expired medicines?

    a) Once

    b) Twice

    c) Thrice

    d) Not at all

23. Generally are you satisfied with disposal process for expired medicines in your facility?

    a) Yes

    b) No

24. If Qn 23. is NO, what should be done to make the disposal process of the expired medicines to be efficient and effective?

    _____
    _____
    _____
    _____
    ___

25. In your opinions, what should be done in order to improve Pharmaceutical management of antimalarial and other drugs?

a) Provision of regular workshops, seminars and on-job training

b) Curriculum in the pharmaceutical schools should contain such knowledge.

c) Provision of short courses concerning Pharmaceutical management

d) Others.
Specify_____
_____
_____
_____

********THANK YOU********

ANNEX II:

PHARMACEUTICAL MANAGEMENT AND PRESCRIBING PATTERN OF ANTIMALARIAL DRUGS IN DAR-ES-SALAAM PUBLIC HEALTH FACILITIES

QUESTIONNAIRE

Drug Dispensers

Code No ……..

Name of the Health Facility…….

Location……

Name of the Interviewer……...

Date:……

SECTION I:

1. Age ☐

2. Gender: Male ☐

Female ☐

3. Professional status: a) Pharmacist

b) Pharmaceutical Technician

c) Pharmaceutical Assistant

d) Nurse

e) Others.
Specify_____

SECTION II

Please circle ALL your answers where necessary

3. Which antimalarial drugs are frequently prescribed in your health facility?

   a) Metakelfin

   b) Fansidar

   c) ALU

   d) Quinine

   e) Other. Please mention……..

4. Do you know what antimalarial drug(s) have been recommended in the Standard Treatment Guideline for the treatment uncomplicated malaria?

   a. YES

   b. NO

5. If the answer of Qn. 5 is YES, how did you get that information?

   a. I have seen it in the STG book that we have in the health facility

   b. Through training/seminar

   c. Public adverts, media and other source of public communication

   d. Through my professional education from school

   e. Others. Specify……..

6. Do you know the recommended doses of ALU by the weight of the patient?

   a. Yes

b. No

7. Do you know the dosage regimen of ALU drug correctly? (*if the answer is YES, tell interviewee to give out information on dispensing ALU before circling the answer)*

   a. YES (*tell interviewee to give out information on dispensing ALU to adult patient)*_____

      _____
      _____
      _____
      ___

   b. NO

8. What information are you supposed to request from patient before you dispense ALU drugs?

   a. History of Cardiac diseases eg Prolongation of QT interval

   b. Pregnancy status (for female patients)

   c. If there is suspicion of adverse drug reaction, resistance of ALU due to previous usage of drug.

   d. I don't know

   e. Others. Please Specify……

      …….

9. What other information are needed to give the patients when dispensing ALU?

   a. Patient should take milk before taking ALU tablets

   b. Patient should take fatty meal before taking ALU tablets

   c. I don't know

d. Others. Specify……..

10. What is/are the importance of taking ALU with milk or fatty food?

a. to accelerate rate of absorption of ALU from Gastrointestinal tract

b. I don't know

c. Others. Specify …….

……

11. Do you know at which age of pregnancy ALU drug can be dispensed to patient?

a. YES

b. NO

12. If the answer of Qn. 12 is YES, which period is/are suitable for a pregnant woman to take ALU drug?

a. First Trimester

b. Second Trimester

c. Third Trimester

d. Both 2^{nd} and 3^{rd} Trimesters

e. I don't know

13. Are there any difficulties to dispense ALU to patients?

a. Yes

b. No

14. If answer to Qn. 14 is YES, what is/are difficulty(ies)

a. Too much information is required to give the patients.

b. Patients face difficulty to understand the given information

c. Pack sizes are confusing

d. No difficulties at all

e. Others. Please specify_____

_____
_____
___

15. From your experience, what complaints are normally received from patients who usually use ALU drugs?

a. Drugs have more side effects

b. Long dosage duration compared to other drug dosage regimen

c. Abnormal heart-beat rate

d. ALU has resistance in treating malaria

e. No complaint

f. Others. Specify_____

_____
_____
___

*******Thank You *******

ANNEX III

ANNEX III:
STOCK OUT DATA FORM FOR ANTIMALARIAL DRUG

Facility Name:……..

Location:…….

Data Collector:……

Date:…….

Product name	2010								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept
1. Artemether/ Lumefantrine (GREEN)									
2. Artemether/Lumefantrine (PINK)									
3. Artemether/Lumefantrine (BLUE)									
4. Artemether/Lumefantrine (YELLOW)									
5. Metakelfin tablet									
6. Fansidar tablets									
7. Quinine 300mg tablets									
8. Quinine injection									
Total no. of stock out days for all drugs									
*Average % time-out of stock									

* This can be calculated by: Total number of the stockout days x 100

ANNEX IV*:*

PRESCRIPTION PATTERN DATA COLLECTION TOOL

Name of Health Facility …… Code no….
Location…… (*Municipal*)
Date ……..
Prescription of Period …….

P/code	**Patient Details**		**Total number of drugs prescribed**	**Number of Antimalarials prescribed**	**Antimalarial Drugs prescribed** *(1-ALU,2-SP,3-Qn tab,4. Qn inj, 5-others)*	**Number of analgesics**	**Number of antibiotics**
	Age *(1,2,3)*	**Sex** (*M/F*)					
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							

NB.

Age code: *1* **= *(*0-5yrs*)*,** *2* **= *(*6-18yrs*)*,** *3* **= *(*above 18=adults*)***

ANNEX V*:*

ADEQUATE CONSERVATION CONDITIONS AND HANDLING OF MEDICINES

Name of Health Facility……..
Location…….. *(Municipal*)
Name of the section……
Date of visit…….
Name of the investigator…….

Checklist	**Store room** 1=YES, 0=NO	**Dispensing Room** 1=YES, 0=NO
1. There is a method in place to control temperature (e.g. roof and ceiling with space between them in hot climates).		
2. There are windows that can be opened or there are air vents.		
3. No direct sunlight can enter the area (e.g. windowpanes are painted or there are curtains/blinds to protect against the sun).		
4. Area is free from moisture (e.g. leaking ceiling, roof, drains, taps, etc.).		
5. Medicines are not stored directly on the floor.		
6. In the facility there is a cold storage with temperature chart.		
7. Medicines are stored in a systematic way (e.g. alphabetical, pharmacological or first expiry first out).		
8. There is no evidence of pests in the area.		
9. There is dispensing tools and they are in use.		
10. Expired medicines are well kept in a separate place from dispensing medicines.		
Total marks (t):		
Average score : [(t x 100) ÷ 9]		

ANNEX VI*:*

STUDY PARTICIPANTS INFORMED CONSENT FOR

PHARMACEUTICAL MANAGEMENT AND PRESCRIBING PATTERN OF ANTIMALARIAL DRUGS IN THE PUBLIC HEALTH FACILITIES IN DAR-ES-SALAAM, TANZANIA.

NAME OF INVESTIGATOR: SILUMBE, RICHARD

SPONSOR: MINISTRY OF HEALTH AND SOCIAL WELFARE

ADDRESS: MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

P.O BOX 65001,

DAR-ES SALAAM.

Identification number:_____

Introduction:

Hello! This consent form contains information about the research named above. In order to be sure that you are informed about being in this research, we are asking you to read or have read to you this consent form. You will also be asked to sign it or make a mark in front of the witness. You will be given a copy of this form. This consent form might contain some words that are unfamiliar to you. Please ask us to explain anything you might not understand.

Reason for the research:

You are being asked to take part in this research that aims to assess pharmaceutical management and prescribing pattern of antimalarial drugs in the public health facilities, how effective is Malaria Treatment Policy being implemented by health workers for the treatment of uncomplicated malaria and what are the challenges on the implementation of the policy in Dar-es-salaam, Tanzania.

General information and your part in research:

If you agree to be in this research you will be required to answer a series of questions in the interview guide or questionnaires. The interview will be conducted at the health facility where you will be working. Therefore there will be no additional costs for travelling.

Risks:

We do not expect any harm to happen to you because of joining this study

Benefits:

Like all participants in the study, you will benefit from gaining more knowledge about how to ensure the constant availability of antimalarial and other drugs by improving the rational dispensing of ALU. Also, the information you give will contribute on improving the malaria treatment policy adherence and its effective implementation.

Right to withdraw and alternatives:

Taking part in this study is completely your choice. You can stop participating in this study at any time, even if you have already given your consent. Refusal to participate or withdrawal from the study will not involve penalty.

Confidentiality:

All the information obtained from this study will be used for the research purpose only, and will not be shared to any one without participant consent.

Who to contact:

If you have any questions about your rights as a participant, you may call Mr. Silumbe, Richard (Tel: 0713 481467), or Dr. A. Kamuhabwa, who are the coordinators of this study, MUHAS PO BOX 65001, Dar es Salaam. If you have any questions about your right as the participant you may contact Prof. M. Aboud, Chairman of the College Research and Publications Committee, P.O Box 65001, Dar-es-salaam, Tel: 2150302-6.

Your right as participant:

This research has been reviewed and approved by the IRB of Muhimbili University of Health and Allied Sciences. An IRB is a committee that reviews research studies in order to help and protect participants.

Signature:

Do you agree?
Participant agrees..... Participant does not agree.....

I, _____I have read the contents in this form. My questions have been answered. I agree to participate in this study.

Signature of participant _____

Signature of research assistant _____

Date of signed consent _____