

**FACTORS ASSOCIATED WITH MEDICINES WASTAGE AT  
MUHIMBILI NATIONAL HOSPITAL**

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**FACTORS ASSOCIATED WITH MEDICINES WASTAGE AT  
MUHIMBILI NATIONAL HOSPITAL**

**By**

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**Dissertation Submitted in Partial Fulfillment of the Requirements for the  
Degree of Master of Science in Pharmaceutical Management of  
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November 2013**

**CERTIFICATION**

The undersigned certify that she has read and hereby recommends for acceptance of dissertation entitled '**Factors associated with medicines wastage at Muhimbili National Hospital**' in partial fulfilment of the requirement for the degree of the Masters of Science in Pharmaceutical Management of the Muhimbili University of Health and Allied Sciences.

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**Dr G. Kagashe**  
(Supervisor)

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**Date**

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I **MAKENYA, Florah Boniface**, declare that this dissertation is my own original work and it has not been presented and will not be presented to any other University for similar or any other degree award.

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**DEDICATION**

*This thesis is dedicated to my family, I love you so much !*

## ABSTRACT

**BACKGROUND:** Medicines wastage is a common problem in many health care delivery systems. It refers to medicines remaining without being administered to any patient. Improper management of medicines leads to medicine wastage. In many health care settings, the extent of medicine wastage is less known.

**STUDY OBJECTIVES:** General objective of this study was to assess medicines wastage and its associated factors at Muhimbili National Hospital. The specific objectives were to determine major types of medicines that were wasted, to identify factors contributing towards the wastage and finally to estimate the financial implication of medicines which were wasted.

**METHODOLOGY:** The study was a cross sectional carried out in medical wards of internal medicine department and one OPD dispensing unit. The study population involved patient medical files, tracer medicines, nurses and pharmacists. Four hundred fifty nine patient files were analyzed for last inpatient treatment information for the year 2012. Furthermore 49 health care workers (nurses and pharmacists) who consented to participate were self-administered with a questionnaire to find out their medicine wastage awareness. Medicines remained in medical wards stated to be leftovers were observed, whereas physical inventories and ledger balance of twenty tracer medicines was carried out in outpatient dispensing unit. Finally the data were analyzed using SPSS version 20 to identify major types of medicines wasted, contributing factors and financial implications.

**RESULTS:** About 56.3% of medicines prescribed were dispensed to patients. Out of the dispensed medicines, 730 medicines were wasted. Anti-infective medicines wastage was 18.9%, cardiovascular medicines (8.9%) and the other categories was 23.7% of the total medicines dispensed ( $p=0.0001$ ). The factors identified for the medicines wastage were excess amount provided to patients (44%), pilferage (26.5%), patient death (24%) and change/stop of medicines due to various factors was 5.5%. The value of medicines sold to

patients was 7,828,370.20 Tsh. out of which a sum of 1,804,686.40 Tsh. corresponding to 23.1% of the value of dispensed medicines was wasted.

**CONCLUSION:** Wastage of medicine was observed in medical wards. The major underlying factors were excess amount of medicines provided to patients, patient death, change/stop order from prescribers and pilferage. There is a need to contain medicine wastage in medical wards in order to improve medicines management.



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**LIST OF ABBREVIATIONS**

APhA	Alberta Pharmaceutical Association
CMS	Central Medical Store
GOT	Government of Tanzania
ICB	International Competitive Bidding
ILS	Integrated Logistic System
IPD	In-Patient Department
IV	Intravenous infusion
LCB	Local Competitive Bidding
LMIS	Logistic Management Information System
MMC	Muhimbili Medical Centre
MNH	Muhimbili National Hospital
MoHSW	Ministry of Health and Social Welfare
MSD	Medical Stores Department
MSH	Management Science for Health
MUCHS	Muhimbili University College of Health Sciences
MUHAS	Muhimbili University of Health and Allied Sciences
NDP	National Drug Policy
NEMLIT	National Essential Medicine List for Tanzania
NHIF	National Health Insurance Fund
NHS	National Health Service
NGOs	Non- Government Organizations
NTC	National Therapeutic Committee
NSAID	Non-steroidal anti-inflammatory drug
OPD	Out Patient Department
RUM	Rational Use of Medicines
SOPs	Standard Operating Procedures
STG	Standard Treatment Guideline
TFDA	Tanzania Food and Drugs Authority
THE	Total Health Expenditure
TNF	Tanzania National Formulary
WHO	World Health Organization

## **DEFINITIONS OF KEY TERMS**

**ADHERENCE TO TREATMENT:** The degree to which patients adhere to medical advice and take medicines as directed.

**ANTI-INFECTIVE MEDICINES:** These are medicines which are used to cure or fight an infection.

**CARDIOVASCULAR MEDICINES:** Medicines which are used to control heart diseases.

**FORMULARY:** A list of pharmaceuticals approved for use in a specific health care setting.

**IRRATIONAL PRESCRIBING:** Prescribing that does not conform to good standards as extravagant prescribing, overprescribing, incorrect prescribing etc

**MEDICINES:** Is a substance or preparation used in treating disease or illness, it also affects wellbeing.

**NATIONAL ESSENTIAL MEDICINE LIST:** A list of the minimum medicines needed for a basic health care system in a country; it lists the most efficacious, safe, and cost-effective medicines for priority conditions. Priority conditions are based on current/future public health relevance and the potential for safe and cost-effective treatment.

**‘OTHER’ MEDICINES;** Are all medicines which are not used to control heart diseases or cure/fight an infection.

**STANDARD TREATMENT GUIDELINES (STGS):** A list of the preferred medicine and non-medicine treatment regimens for common health problems experienced by people in a specific health system. For each health problem, the medicine treatment often includes

the name of the medicine, dosage form, strength, average dose, number of doses per day, and the number of days of treatment.

**VERTICAL PROGRAM MEDICINES:** Medicines which are acquired from MSD freely.

**WASTAGE:** The quantity of stock removed from inventory for any reason other than consumption by clients (for example, losses, expiry, and damage)

**USER FEE:** An out of pocket payment made by the patient at the time a health service is provided.

## **CHAPTER ONE**

### **1. INTRODUCTION**

#### **1.1 BACKGROUND**

##### **1.1.1 GENERAL INTRODUCTION**

Medicines are important integral part of health care delivery system. They do prevent, cure diseases and thereafter promote human wellbeing. According to World Health Organization (WHO), essential medicines are those drugs that satisfy the health care needs of the majority of the population; they should therefore be available at all times in adequate amounts and in appropriate dosage forms, at a price the community can afford (Management Sciences for Health, 2010, 2012).

Worldwide availability of essential medicines has been improved significantly but their management is still a challenging issue. It is apparent that effective pharmaceutical management in medicine supply system has a role to ensure timely availability and appropriate use of these medicines in order to save lives and improve health status of people in a direction geared towards cost containment as well as minimizing medicine wastage (Cameron et al, 2011; Musau et al, 2011).

Medicine wastage has been defined as those medicines that remain without being administered to any patients. This also includes medicines remaining as a result of change in medicine or medicine strength within the same therapeutic class that occurs before expected refill date (Taitel et al, 2012). Literature illustrates medicine wastage as an outcome of poor patient adherence, irrational prescribing, expiration, improper storage, theft, poor quality and high prices of medicines (Cameron, 1996; Braund et al, 2008; Taitel et al, 2012). About 36% of the wastage has been found to be a consequence of poor patient adherence and irrational prescribing (Management Sciences for Health, 2010).

Apart from hampering therapeutic benefit, medicine waste also has financial implications. On average medicines spends about 25 % of total health expenditure (THE), it is estimated that about 70% of funds invested in essential medicines are wasted in a normal



supply system (Management Sciences for Health, 2010). It is obvious that wasted medicine is a money loss. In UK the value of dispensed medicines which are discarded each year is about £3 billion (White, 2010). This amount if saved could have been utilized for provision of other medical services (Trueman et al, 2010).

It is evident a certain amount of medication wastage is inevitable, it is estimated about 50% of medicine waste is likely to be cost effectively preventable, for that reason types and basis for medication wastage need to be fully investigated to determine where this wastage can be minimized since wastage have both therapeutic and financial implications on health delivery system (Nava-Ocampo et al, 2004; Braund et al, 2008; White, 2010). Therefore it is the purpose of this study to investigate medicines wastage in a hospital setting in order to understand the current burden which the health delivery system face as a result of medicines waste and thereafter to find possible solutions for the problems identified.

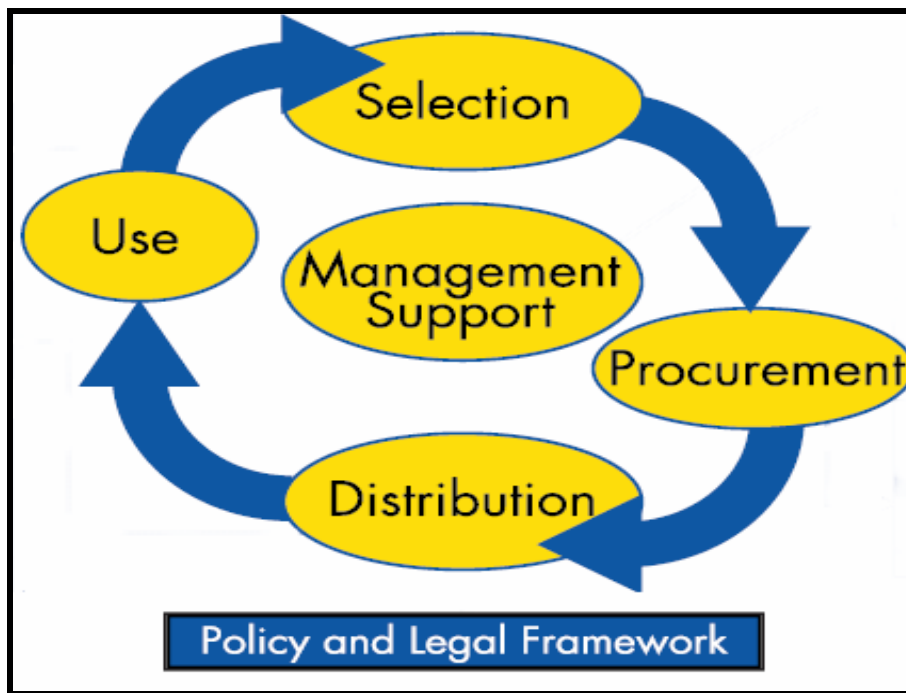
### **1.1.2 HEALTH AND PHARMACEUTICAL DELIVERY SYSTEMS IN TANZANIA**

The health delivery system in Tanzania encompasses different levels. It is organized in a referral pyramid starting from the village level to referral consultant hospitals. It includes both private facilities by 44% and public facilities by 56%. The provision of medicines and medical supplies is through both private and public outlets with large share taken by public outlets (56%) (Ministry of Health and Social Welfare, 2008).

Pharmaceutical services in Tanzania are governed by the Tanzania National Medicine Policy (NMP) (Ministry of Health, 1991) with the overall objective of ensuring provision of quality and equitably accessible pharmaceutical services at all levels. In managing medicines, the NMP stresses utilization of Standard Treatments Guideline (STG), and National Essential Medicine List (NEMLIT) the selection, procurement, distribution and use of essential pharmaceuticals in order to ensure availability and appropriate use of safe, effective quality medicines and thereafter to reduce medicine wastage.

It is evident good pharmaceutical management system can improve performance and bring dramatically improvement in the availability of medicines and medical supplies.

The pharmaceutical management system comprises four basic functions which are selection, procurement, distribution, and use. These functions are schematically illustrated in a cycle commonly known as pharmaceutical management cycle fig 1.



**Fig 1: Components of Pharmaceutical Management Cycle**

*Source: Management Sciences for Health 1997*

The pharmaceutical management cycle is a systematic approach that can be used to make sure medicines at all levels of health care delivery system are consistently available and appropriately used and thus minimize wastage.

Selection of medicines as a function of pharmaceutical management is a process of identifying medicines that satisfy the health care needs of the majority of the population. The selection process is influenced by many factors such as disease pattern, safety, efficacy and quality of medicines, price as well as therapeutic advantages (World Health Organization, 2002; Islam, 2007) . The selection of essential medicines to be used in Tanzania is decided by National Medicine and Therapeutic Committee (NTC). The responsibility to select medicines to be used by individual health facilities has been handed

to facility's medicines and therapeutic committee (Ministry of Health, 1991). The main challenge encountered to achieve the task is the weak functioning or nonfunctioning of these committees to deliver this role which has resulted into failure for majority of hospitals to develop their own list of essential medicines and formularies (Ministry of Health and Social Welfare, 2008).

After establishing the list of essential drugs, the next step is the procurement procedure which is defined as a process of obtaining supplies directly from suppliers (private or public), from manufacturer, distributors, or agencies such as the United Nations Children's Fund (UNICEF), WHO, or bilateral aid programs. It also includes quantifying medicine requirements, selecting procurement methods, managing tenders, establishing contract terms, and ensuring pharmaceutical quality adherence to contract terms (Management Sciences for Health, 2012).

In Tanzania, Medical Stores Department (MSD) which is an autonomous agency of the MoHSW was enacted by the Government of Tanzania (GOT) with the responsibility of procuring, distribution and storage of essential medicines and medical supplies (Ministry of Health and Social Welfare, 2008). MSD has the responsibility to procure and distribute pharmaceuticals and medical devices to all public health facilities and non-Government (NGO) facilities approved by the Government. In order to facilitate the provision of these services in timely basis, MSD has distributed itself in nine zonal medical stores as follows (Medical Stores Department, 2013);

- Tabora zone store; serves Kigoma and Tabora regions.
- Mwanza zone store; serves Kagera, Mwanza, Shinyanga and Mara regions.
- Mbeya zone store; serves Mbeya and Rukwa regions.
- Iringa zone store; serves Iringa and Ruvuma regions.
- Mtwara zone store: serves Mtwara and Lindi regions.
- Tanga zone store; serves Tanga region.
- Moshi zone store; serves Moshi, Arusha and Manyara regions.
- Dodoma zone store; covers Singida and Dodoma regions.
- Dar es salaam zone store; serves Dar es Salaam, Morogoro and Coast regions

- Dar es salaam medical central store; serves as a supplier to all nine zones

At MSD, medicines are procured centrally by MSD Tender Board mostly by International Competitive Bidding (ICB) and to some extent with Local Competitive Bidding (LCB) in accordance with NEMLIT, list of drugs registered or approved by TFDA and adhering to Public Procurement Act and its regulations (PPA 2004).

After stocking medicines in central warehouse, from then on MSD zonal managers do procure medicines and medical supplies from the Central Medical store, while facilities procure medicines and medical supplies from zonal medical stores using funds deposited by MoHSW to MSD account.

Literature reveals that availability of medicines and supplies at the facility level is largely influenced by either the budget allocation of that facility or availability of the products at the medical stores or the way the facility adheres to the rational use of medicines (Ministry of Health and Social welfare, 2008 ; Musau et al, 2011). It has been shown that MSD fulfillment rate is about 65% (Euro Health Group, 2007 ; Baumgatem, 2011).

Once procurement is accomplished, distribution process is followed. Distribution is defined as the movement of medicines and medical supplies to customers. It incorporates steps such as storage, inventory control, delivery and report of consumption data. MSD is responsible for distribution of medicines to public health facilities using demand supply system. The challenge encountered is the weak inventory management encountered by many lower level facilities which in turn provide inaccurate consumption data in their report and request forms (Euro Health Group, 2007 ; Ministry of Health and Social welfare, 2008). MSD directly delivers both vertical and non-vertical medicines and medical supplies to primary health facilities. In general hospitals are responsible to collect their own essential medicines from zonal medical stores.

The last function of the management cycle is the use. The rational use of medicines (RUM) requires patients to receive medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community (Nairobi experts report, 1985). To accomplish this

prescriber need to follow the standard process of prescribing, then medicines need to be dispensed to the right patient in a safe and hygienic manner and lastly the patient takes and adheres to the medicines dispensed.

WHO identified about 50% of all medicines globally are prescribed, dispensed or sold inappropriately, while 50% of the patient fail to take them correctly (WHO Policy Perspectives on Medicines, 2002) which leads to medication wastage. Evidence suggests that there is correlation between inappropriate prescriptions and patient adherence to medicines (Britten et al, 2003 ; Mansur et al, 2009).

The MoHSW has established various mechanisms to promote RUM like incorporation of essential medicines concept in curricula, formation of medicines and drug therapeutic committees in different levels of health care delivery systems, utilization of clinical guideline such as STGs, National Essential Medicines List, National Formulary and Good Dispensing Practice manual. The challenge experienced is the unavailability and poor utilization of these guidelines in many health facilities (Ministry of Health and Social Welfare, 2008).

### **1.1.3 PHARMACEUTICAL DELIVERY SYSTEM AT MUHIMBILI NATIONAL HOSPITAL**

Muhimbili National Hospital was established in November 2004 by separation of the then Muhimbili Medical Centre (MMC) into Muhimbili National Hospital (MNH) and Muhimbili University College of Health Sciences (MUCHS) currently known as Muhimbili University of Health and Allied Sciences (MUHAS). Muhimbili National Hospital (MNH) is a National referral and a university teaching hospital.

As a national referral hospital, MNH provide services to patients which are very diverse from clinical problems point of view to social economic statuses, therefore patients from all regions are being represented.

Muhimbili National Hospital has eight directorates in which directorate of medical services and directorate of surgical services embraces clinical departments. Pharmacy department is under the directorate of clinical support services.

The departments under medical services directorate are internal medicines, pediatric and child health, psychiatry, emergency, outpatient and rehabilitation whereas surgery, dental, ophthalmology, ENT, anesthesia, Obstetrics and gynecology departments are under surgical services directorate. MNH has 1500 bed capacities, attending about 1000 to 1200 patients per day and admitting about 1000 to 1200 patients per day (Muhimbili National Hospital, 2013).

Internal medicine department has 12 subunits which are respiratory, cardiology, diabetic, neurology, dermatology, gastroenterology, nephrology, rheumatology, geriatrics, hematology, oncology and infectious clinics.

Burden of disease in developing countries including Tanzania consists of both infectious and non-infectious diseases, in which infectious diseases are at the lead. This makes the likelihood of internal medicines department to receive more referral cases across the country.

Pharmacy department at MNH is responsible to ensure that most essential medicines are available, through proper procurement, storage and distribution to enhance proper service provisions. The department has five units which are central drug store, outpatient dispensing unit, inpatient dispensing unit, local production unit and drug information unit.

Selection of medicines and medical supplies to be used at MNH is done by the Hospital medicines and therapeutic committee. Central drug store is responsible for identifying the needs and quantification of medicines and medical supplies needed in MNH. Medicines and medical supplies which are not stocked by MSD are procured by the procurement unit of the hospital after obtaining the requirements from the central drug store. Medicines which are available in MSD are purchased directly from MSD by the central drug store unit using funds deposited in MSD account.

Whether ordered by procurement unit or by the central drug store, all medicines and medical supplies procured are received in receiving area, inventories are entered and updated in computer system database (Jeeva) and then the medicines are distributed to sub stores according to their requirements.

The pharmaceutical supply system at MNH is computerized. The system monitors inventories, forecasts the demand, and quantifies the requirements needed. All the sub stores are also connected to the software (Jeeva). The system has enabled the inventory system to be accurate (Kagashe & Massawe, 2012).

The dispensing process at MNH is through computerized system. Prescriptions are received, verified and then dispensed to patients. Before issuing drugs to patients, the information is entered in the computer system and the dispenser mark dispensing statuses of the medicines both in manual prescriptions and in inpatient medical files where the order was derived.

In order to minimize medication wastage, pharmacy department has standard operating procedures (SOPs) which requires all oral antibiotics prescribed for more than five days have to be dispensed for five days only, in addition analgesics/anti-pain and injections including IV fluids prescribed for more than three days are initially dispensed for three days only.

Management of medicines wastage especially those medicines remaining from patients (left overs) is governed by hospital departmental standard operating procedures (SOPs). The written SOPs have not yet been approved by administration to be functional, thus verbal instructions are in use. Healthcare providers are supposed to return all leftover medicines to pharmacy department. Simultaneously pharmacy personnel are required at least weekly to visit medicine cabinets in wards to collect all remained medicines.

If the returned medicines are oral solids (tablets, capsules), are dealt as expired medicines. In case where the returned medicines are Injections and oral liquids which are still in their original immediate containers, these can be reused to other patients. Before reissuing, the returned medicines are reconciled in the database (Jeeva).

Once the responsible patients who generated leftovers due to various reasons have not yet been discharged out of the system, adjustment of the returned medicines is achieved directly and the balance is automatically adjusted within the system. However if the patient have been discharged out of the system and the medicines need positive adjustment, pharmacist in-charge is required to seek approval in writings in order to make necessary adjustment for the medicines to be reused again. It is obvious that return of the leftover medicines to pharmacy department by providers is purely on a voluntary basis.



## **1.2 STATEMENT OF THE PROBLEM**

Medicines are an important component of health care delivery system and have been shown to improve customer satisfaction and patient attendance.

Provision of health services in Tanzania before Health Sector Reforms (HSR) was free to population. The HSR had an ultimate purpose to have improved functional health sector which in turn will lead to better achievement of health statuses of the population.

Health financing was one of the issues addressed by the HSR. In order to increase revenue, patients started to contribute for services which they have received in form of cost sharing (user fees), insurance or waiver. Drug revolving funds (DRF) was then initiated for the purpose of increasing overall availability and management of essential medicines in public health facilities.

In general medicines spend about 40% of total health budget. Despite the fact that budget for medicines has been increased over recent years, yet availability of essential medicines in public sectors has remained to be less than 60% in many health facilities.

Literatures had pointed out major leading causes of the unavailability of essential medicines in health facilities are the insufficient of funds, incomplete supply of medicines by MSD and poor management of medicines.

It is evident that, poor management of these medicines results in medicines wastage which leads to unnecessary burden to health care system and community. Wastage is described as the quantity of stock removed from inventory for any reason other than clients' consumption.

To date, reports in the literature addressing medicine wastage in hospitals are very limited. The extent to which medicines wastage has an influence with availability of essential medicines is not well known. Therefore it is the purpose of this study to assess and quantify the amount of medicines wasted in Muhimbili National Hospital and thereafter to find out factors underlying medicines wastage and possible solutions to overcome them.

### **1.3 STUDY RATIONALE**

Currently in Tanzania no study has been done to assess medicine wastage. Thus the study will assess the problem and impact of medicine waste both in terms of monetary and types of waste in order to understand the magnitude of the problem.

The obtained primary result in medicine waste will provide a basis on medicine budget adjustment during planning. Moreover the information obtained from this study may be utilized to design interventions and education programs and may form the foundation data with regard to common types of medicines that are wasted in medical wards of MNH, underlying causes and their financial implications. Lastly the information will be used to strengthen pharmaceutical management system in the pharmacy department.

### **1.4 RESEARCH QUESTIONS**

1. Is there medicine wastage in public hospitals?
2. What are the major groups of medicines which are commonly wasted in hospital settings?
3. What are the factors contributing towards medicine wastage in hospitals
4. What is the overall financial loss incurred to hospitals as a result of medicine wastage?
5. What is the percentage of medicines used without being documented?

## **1.5 STUDY OBJECTIVES**

### **1.5.1 Broad objective**

To assess medicines wastage and its associated factors in Muhimbili National Hospital (MNH).

### **1.5.2 Specific Objectives**

1. To find out if there is medicines wastage in medical wards of MNH
2. To determine major types of medicines that is wasted in MNH.
3. To identify the factors contributing towards medicines wastage in the hospital.
4. To estimate the percentage of medicines used without being documented at OPD dispensing unit in MNH.
5. To estimate the financial impact of medicines wasted.

## CHAPTER TWO

### 2. LITERATURE REVIEW

Medicines waste is a burden to many health facilities. It increases cost to the system and provision of pharmaceutical benefits. It jeopardize human life and health which results to sub optimal utilization of resources.

Globally the incidence of medicine wastage is enormous. Literature explored medicine wastage in different kinds but to a large extent investigated medicines wastage in community settings either as home storage or returns to pharmacies (Temu et al, 2006 ; Ali & Ibrahim, 2009 ; Al-azzam et al, 2012 ; Saleem et al, 2012). The few studies that investigated medicines waste in hospital settings basically they focused on a specific subject, for instance examined specific drugs or category of drugs used in certain health problems (Birdwell et al, 1993 ; Uchida et al, 1994). Essentially there are few studies examining generally issues of medicine wastage in hospital settings.

Provision of health services in high income countries differs significantly from that in low income countries. In these countries almost all citizens are covered by an insurance scheme, thus the health care system obligate patients to fill up their prescriptions from their nearby community pharmacies. This is different from many developing countries including Tanzania where most of the population purchases health services by paying user fee (cost sharing scheme) and hence patients are expected to fill up their prescriptions preferably from hospital's pharmacy where the service was obtained (Aboagye-Nyame et al, 2003 ; Euro Health Group, 2007). Thus this has demonstrated different patterns of medicine wastage experienced in these regions.

A number of studies done in developed countries to investigate the extent of medicine wastage have verified medicine wastage is a big problem to healthcare delivery systems. In Germany and New-Zealand, 10,603 and 1399 unused packages of medicine returns were collected respectively (Bronder & Klimpel, 2001; Braund et al., 2008). Furthermore about 204 tons of discarded medicines and other medical products were collected by Alberta

Pharmaceutical Association (APhA) in Canada and indicated it as a “mammoth” problem (Cameron, 1996).

Medication wastage investigated in developed countries is mainly those medicines which were returned to pharmacies. The literature shows that the volume and cost of the medications that are returned to pharmacies represent only a small proportion of overall medicine waste; for example only 23% in USA and 22% in New-Zealand of unused medicines were returned to pharmacies (Braund et al, 2009). A comprehensive report to evaluate the scale, causes and cost of waste medicines in National Health Services in England (NHS) found 20% of people possessed unused medicines with half of them having the intention to reuse them in future (Trueman et al, 2010).

Contrary to many developing countries where the magnitude of medicine wastage is less known, in these countries medicines which remained unused due to various reasons such as patient death, side effects, change in prescriptions etc are normally retained in community for future use. This was observed by Jassim (2010) who found an average of 15 medicines being stored per household out of which 45% was declared as leftovers and 23% were kept for future use. Eventually these drugs stored for future use, when consumed irrationally may increase health care utilization due to poor therapeutic outcome and in return may trigger antibiotic resistance.

Variation among countries in respect to quantity of drugs possessed by families, the categories of drugs wasted as well as their contributing factors towards medicine wastage prevails. The study done in Jordan to assess the extent of medication wastage among families, found that all families investigated had medicines in their possession, with an average of  $6.5 \pm 2.5$  drugs per household (Al-azzam et al, 2012).

In Tanzania, the scale of medicine wastage both in community as well as in health care settings is less known. It is obvious medicines remain from patients, but how much remains and where such medicines go is still uncertain. A number of studies done in Tanzania explored availability of medicines at household level observed a similar pattern of home storage as it was found in other developing countries. It was found that 22.3% to

73.4% of the households in Tanzania stored medicines (Temu-Justin et al, 2005; Temu et al, 2006).

The pattern of pharmaceutical categories of medication wastage also differs among countries. In Alexandria 657 drugs were returned to pharmacies, and majority of the drugs returned were cardiovascular and anti –infective drugs (Ibrahim et al, 2012) with a similar trend as found by Al-azzam et al ( 2012). Literature reveals that most of these drugs were obtained from authorized facilities.

It is clear that a small portion of unused medicines are collected or reported, most of the unused medicines end up being disposed either in domestic water supply through flushing in toilets and sinks especially for the liquid preparations (Braund et al, 2009), or crushed, buried or openly burned in waste disposal site (Matiko, 2011).

Evidence suggests these leftovers are normally intended for future use, and as it has been observed previously with other studies, antibiotics constitute a large proportion of these medicines. A study done in Kinondoni, Tanzania revealed 45% of the stored antibiotics were intended for future use (Temu-Justin et al, 2005). This initiates self-medication and irrational use of prescription drugs which in return may cause antibiotic resistance and therapeutic failure in the community.

Apart from promoting self-medication, the quality of these medications is debatable; to a large extent these drugs are stored in poor conditions and also lack important information on their label. A study done to assess drug wastage and utilization in a Malaysian community found that about 69% of medicine possessed did not have names while 91% of them did not have expiry dates (Saleem et al, 2012). The same was observed in Tanzania where 73.1% of malaria medicines did not have expiry dates and 19.2% of them did not have dose/dosage information (Temu et al., 2006) whilst their storage conditions were questionable.

We know that wasted drugs means wasted money; if saved the money could be utilized to improve health provision to the community. Several studies explored medicines wastage in hospital settings as a whole looked at drug wastage in different perspectives, (Uchida et al., 1994) investigated costs of intravenous solution wastage in UCI medical center-USA had found 14,000 IV preparations were destroyed with a cost of \$90,000. A similar trend of wastage from Intravenous admixture in US Hospitals was also observed by (Birdwell et al, 1993).

A study done in Mexico to investigate medicines wastage in pediatric anesthesia care observed the median cost of undocumented drugs used was \$92.4 per 100 requested units, while the cost of medicine wasted was \$141.8 per 100 requested drugs (Nava-Ocampo et al, 2004). The financial burden resulting from medicine waste is very huge. About 47.41% of cost of supplied medicines to female medical students in Universiti Sains Malaysia were wasted (Ali & Ibrahim, 2009). A survey done by Alberta pharmacists revealed the value of returned medicines to be \$60,350 and about 72.4% were prescription drugs out of which 60% were in their original package (Cameron, 1996), while the National Health Service in UK (NHS) lost about £3 billion each year (Trueman et al, 2010).

Factors contributing towards medicine wastage are diverse. They depend upon the form of the medicine wastage investigated and feature of the healthcare delivery system. Household surveys or returns to pharmacies pointed out patient death, medicine expiration, stop or change of prescription, patient felt better, side effects and patient adherence as the major contributing factors towards medicine wastage ( Cameron, 1996 ; Cromarty & Downie, 2001; Braund et al, 2008; Trueman et al, 2010 ).

The health delivery system in developing countries is faced with many challenges, poor availability of essential medicines with frequent stock outs, irrational prescription, high cost of medicines and weak inventory control systems. It is a fact that effective inventory control system provides timely and accurate information which helps to reduce incidence of stock outs as well as controlling wastage. Lack of appropriate systems for recording and maintaining information on receipts, issues and ensuring that stock balances are accurate and are up to date, not only weakens inventory control, but also leaves considerable room

for malpractice and losses (Aboagye-Nyame et al, 2003), thus the extent of medicine wastage and its underlying causes need to be contained in order to improve provision of health services to our community.



## CHAPTER THREE

### 3. MATERIALS AND METHODS

This chapter gives details of methodology which was carried out to achieve the objectives of the study which were to find out if there is medicine wastage, to determine types of medicines that are being wasted and factors contributing towards medicine wastage, to estimate the percentage of medicine used without being documented at the outpatient dispensing pharmacy and lastly is to estimate the financial impact of wasted medicine.

This section elaborates the study design, area of the study, population under the study, data collection process and data management procedures.

#### 3.1 STUDY DESIGN

The study was a cross sectional hospital based study. It involved review of patient medical files data for year 2012, a self-administered questionnaire to health care workers and observation of medicine leftovers.

#### 3.2 STUDY AREA

The study was carried out at Muhimbili National Hospital (MNH) which is a tertiary referral and teaching hospital, situated in Dar es Salaam city. In particular the study was carried out at internal medicine department wards and an OPD dispensing unit.

The Internal Medicine department wards have a bed capacity of 210 with an average of 40 admissions per day. There are eight (8) wards within the department which are number 1, 3, 4, 5, 6, 7, 8 and TB ward. The wards 1, 3, 4, 5, 6, 7, and 8 are located in Mwaisela Block. Ward one encompass patients who need intensive care services, while wards 7 and 8 are private wards. Specifically the study was conducted in male (5, 6) and female (3, 4) wards.

#### 3.3 STUDY POPULATION AND SAMPLE SIZE

**3.3.1 Study population:** The study population comprises medical records of patients admitted in medical wards, tracer medicines, nurses and pharmacists.

**3.3.2 Sample size:** Ten percent of patient medical records of the total annual admissions from January to December 2012 were used as sample size. The 10% sample size for records was utilized similar to the study done by Nova-Ocampo (2004). With respect to healthcare providers, all nurses working in these wards and pharmacists working in the in-patient dispensing unit of the medical wards and outpatient dispensing unit were requested to participate in the study, whereas twenty medicines obtained from the EMLIT were used as tracers.

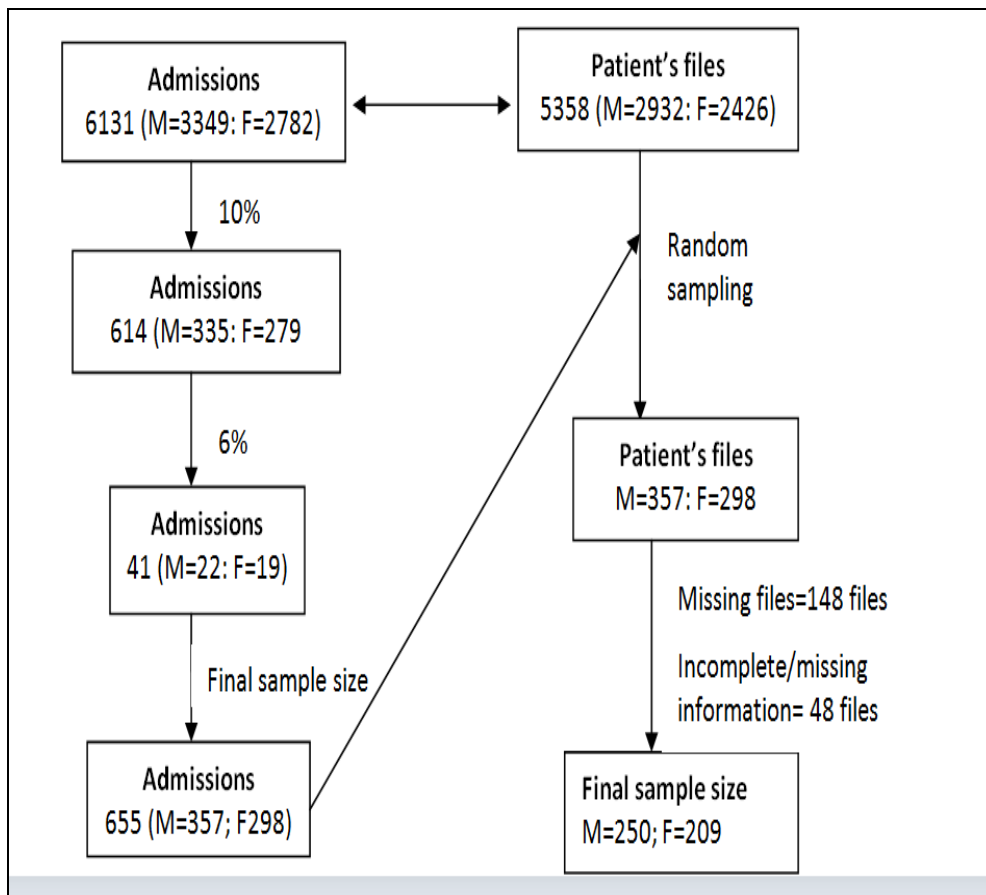
### 3.3.3 Sampling criteria

- i. **Patients Records:** List of patient's registration number admitted to medical wards in 2012 was obtained from MNH data base in which there were 6131 admissions. The list was then categorized into female (wards 3 and 4) and males groups (wards 5 and 6) in order to achieve equal representative. Female admissions were 2782 whereas males were 3349 admissions. After categorization the list was filtered to remove readmission numbers thus total patients admitted in these wards were 5358 in which females were 2426 (fig 2).

Ten percent of annual admissions were calculated to obtain the sample size of 614 out of which female admissions were 279. Together with this, 41 admissions equivalent to 6% from the sample was added to compensate the missing files and the readmissions. The final sample size achieved for the study was 655 out of which 357 were males.

Furthermore the registration numbers for patients were assigned dummy numbers in Microsoft (Ms) Excel data sheet. These dummy numbers were set separately for males and females (M=2932 and F=2426), afterwards these dummy numbers were randomly selected using sampling tool available in data analysis tool pack of Ms Excel spreadsheet to obtain a sample of 655 numbers. Finally the randomly selected dummy numbers were reallocated with their original registration numbers in order to facilitate easy accessibility of patient medical files in medical records department.

Out of 655 patient medical files selected, 148 files were not found and 48 files had incomplete 2012 treatment information. Thus 196 medical files were disregarded and henceforth final sample size of 459 medical files was used in the study. Figure 2 schematically describes the sampling process of the patient's files.



**Fig 2: Patients' medical files sampling procedure**

- ii. **Nurses and Pharmacists:** All nurses who were working in the medical wards at the time of the study were requested to participate. Those who give their consent were enrolled whereas all pharmaceutical personnel working in medical ward dispensing unit and one out patient dispensing unit at the time of study were asked to participate, and only those who agreed to participate were included in the study.

- iii. **Tracer medicines:** Twenty tracer medicines were used in the study. The list was obtained from the National Essential Medicines List of Tanzania (Ministry of Health and Social Welfare, 2007). The selection criteria was based on the priority of the burden of diseases in the country (Ministry of Health and Social Welfare, 2008).

### 3.4 DATA COLLECTION

#### 3.4.1 Data collection Instruments

The data collection tools which were used in this study were developed by a researcher. Three check lists and one questionnaire were used to collect different information.

- i. **Tracer medicines check list (Annex 1):** The tool collected information on the tracer medicines in OPD dispensing unit. The information collected includes availability of the tracer medicine in the dispensing site, physical inventories of the tracers in the dispensing unit and the ledger quantity of the tracers at the time of the study.
- ii. **Patient medical records check list (Annex 2):** This collected patient's demographic and treatment information encountered by the patient during hospital stay. Information collected were age, sex, pattern of medicines prescribed, discharge outcome and course of treatments undergone.
- iii. **Medicine wastage awareness questionnaire (Annex 3):** The questionnaire collected information to nurses and pharmacist's awareness on medicine wastage. Apart from demographics information, other information collected were about their awareness if medicines do remain from patients in medical wards, procedures available for handling left overs and the possible factors which contribute for medicines to remain.
- iv. **Medicine leftovers check list (Annex 5):** This collected information of medicines remaining in wards claimed to be leftovers.

### 3.4.2 Data collection procedure

- i. **Tracer medicines:** Physical inventory of the tracer medicines was carried out on the day of the study and entered in the data collecting tool (annex 1). The amount of inventories as shown in the inventory control tool (Jeeva software) was then recorded in the same tool.
- ii. **Patient medical records:** The Information was extracted from the patients' medical files and recorded in data collecting tool (annex 2). The extracted information was on demographic information and treatment history of the patient in which medicine prescribed during the hospital stay, their outcome together with their dispensing status was recorded. Treatment chart was used to ascertain treatment plan of the patient during the hospital stay.

The list of medicine prescribed were obtained from the medical records and compared with the treatment charts. Dispensing status of medicines were also recorded from medical files and later supplemented with dispensing status of Mweisela pharmacy database. The database was used to provide information on the list of all the medicine dispensed, to whom it was dispensed, quantity dispensed and unit price of the medicine dispensed. Any discrepancy rise was noted.

- iii. **Nurses and pharmacists awareness in medicine waste:** Nurses and pharmacists were asked for their consent to participate in the study. Only those who agreed were given a questionnaire (annex 3) which was a self-administered under the supervision of the researcher.
- iv. **Medicines remaining as leftovers:** Medicines found in wards claimed to be leftovers were to be recorded. Unfortunately during the pre-test phase, it was very difficult to achieve this objective due to social desirability. The tool (annex 5) was then modified to be a self-report of medicine leftovers, and principal investigator observed their presence.

**3.5.2 Inclusion criteria:**

- All nurses and pharmacists worked in the study area at the time of data collection.
- All medicines prescribed and dispensed from hospital pharmacy in the year 2012.

**3.4.3 Exclusion criteria:**

- Medicine dispensed in emergency medicine department and on the discharge day.

**3.4.4 Medicines wastage calculation:**

Waste medicines are medicines which have been dispensed but are unused or partly used by patients.

Thus:

- Medicines wastage  $[W] = \sum [D] - \sum [C]$
- Proportion of medicines wasted  $[P\%] = \frac{\sum [W]}{\sum [D]} \times 100$
- Value of medicines wasted =  $[Q] \times \text{unit price}$

Where by:

D = Medicines dispensed to patients

C = Medicines dispensed to patients which were fully consumed

W = Medicines dispensed to patients which were unused or partly used

Q = Quantity of medicines

**3.5 DATA MANAGEMENT/ANALYSIS**

The collected raw data was entered in Microsoft Access 2012 database developed by a researcher and then exported to Statistical Package for Social Science (SPSS) version 20 for cleanup and analysis. Quality of data was done by checking the completeness of data collection sheets and questionnaire. Then frequency tables were run to check if there were any abnormal data and missing information.

A frequency of change/shift of the prescribed regimen as well as percentage of medicines used without being documented was used to find out if there is medicines wastage at

MNH. Other descriptive parameters such as mean, standard deviation, minimum, maximum, and range were calculated for different variables.

For undocumented medicines variable in the outpatient department pharmacy, record error percentage was calculated and medicines which had record error greater than 10% were used to quantify the undocumented medicines at the OPD pharmacy.

Statistical analysis to find out an association of different variables under investigation was done using chi square ( $\chi^2$ ) test or Fisher Exact test when appropriately required. Confidence interval of 95% was applied and a p value of less than 0.05 was considered as statistically significant.

### **3.6 COST ANALYSIS**

Cost represents a monetary value of each drug sold by the hospital. It is expressed in Tanzanian shillings (Tsh.). The cost of each drug was obtained from the MNH pharmacy database. From this cost, the value of medicines wasted was quantified.

### **3.7 ETHICS**

The ethical clearance was sought from MUHAS Ethical Review Committee. A permission to conduct the study at MNH was obtained from the Executive Director for MNH. Furthermore participants to the study were asked for their consent before participating in the study.

## CHAPTER FOUR

### 4. RESULTS

#### 4.1 Medicines Wastage in Medical wards

##### 4.1.1 Patient information

Four hundred and fifty nine medical records of patients admitted in medical wards in 2012 were analyzed for their treatment information. Records for male patients were 250 (54%). The mean age for the study population was 44 years (SD 18.5), with minimum age of 11 years and maximum of 88years.

The mean age for male patient was 45.4 years (SD 18.5) with a range of 11years and 88years, while for the female patient mean age was 42.5 years (SD 18.3) with minimum of 12 years and maximum age of 85 years. Though female patients seemed to be younger compared to male patients, statistically there was no difference in age between male and female patients ( $p=0.0905$ ).

Hospital stay for these patients ranged from 0 to 104 days with median of 4 days. The median hospital stay days for male and female patients were 5 and 4 days respectively. There was no difference in hospital stay among female and male patients ( $p=0.6008$ ), though female patients had the longest hospital stay, in general female patients stayed briefly compared to male patients.

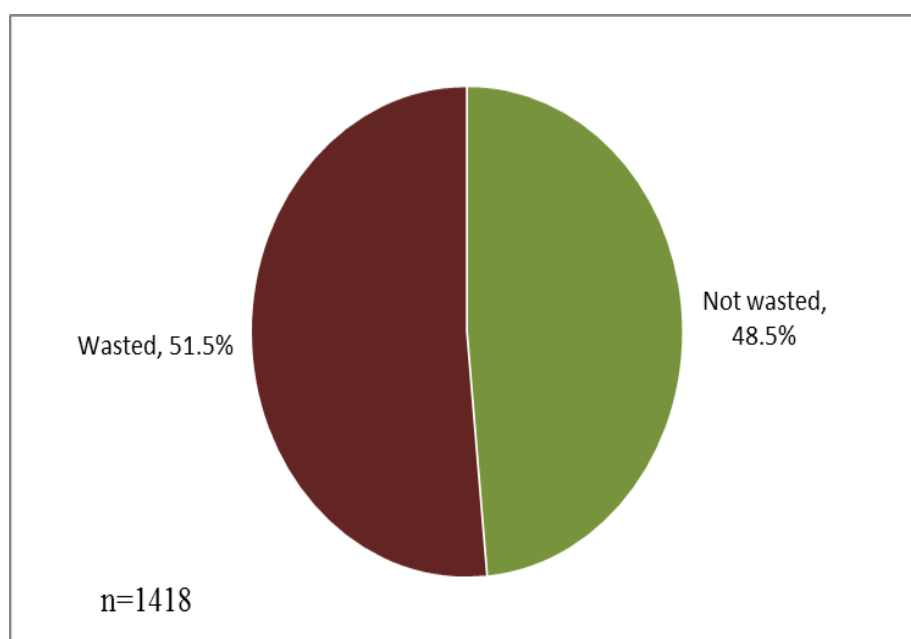
One hundred and thirty nine patients (30.3%) died while the rest were discharged. Out of 139 deaths, 57.6% were male patients. There was no difference in death pattern with respect to sex ( $p=0.381$ ). Patients who died more were those who stayed briefly in hospital ( $n=116$ ), statistically there was no difference in death outcome with respect to hospital stay duration ( $p=0.507$ ).

Pattern of discharge outcome across different age groups shows that, young clients (<24yrs) (67/78) were more discharged home compared to adults (253/383). About 37.4% of death was more to clients aged between 45yrs to 64yrs. The difference of discharge outcome among different age categories was statistically significant ( $p=0.001$ )



#### 4.1.2 Medicines wastage

Overall 2519 frequencies of medicines were prescribed to patients; the median number of drugs was 5 with minimum of 1 medicine to maximum of 31 medicines per patient. One thousand four hundred and eighteen medicines (1418) were dispensed, out of which 730 (51.5%) medicines were not used (fig 3).

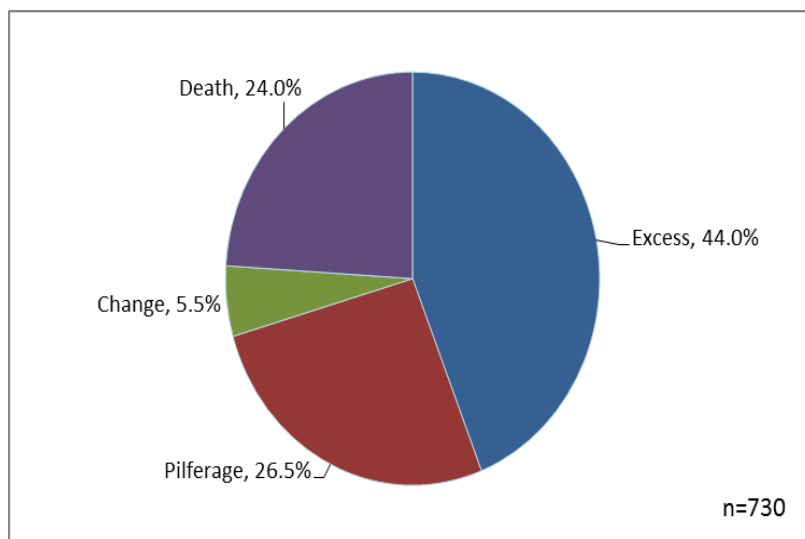


**Fig 3: Proportion of medicines wasted and not wasted**

In general two kinds of medicine wastage were identified which were leftovers and non leftovers medicines. Leftovers were those medicines dispensed to patients and remained unused while non-leftovers were those dispensed out but they were not used by patients as they were not in treatment regimen. Overall percentage of non leftover medicines was 13.8%.

It was found that four different factors contributed to medicines wastage. The factors were excess amount given to patients, pilferage, change and death. The leading causes of wastage for all medicines were excess (refers to the quantity of medicine dispensed to patients which exceeded the course of treatment/duration prescribed) was 44%, pilferage

(26.5%) and death (24.5%). Change/Stop order was observed for 5.5% of the medicines wasted (fig 4).



**Fig 4: Factors contributing to medicines wastage**

#### 4.1.2.1 Medicines wastage with demographic information:

- i. **Sex:** In general medicines were more dispensed to female patients (51.1%) compared to male patients. In general female patients had more wastage than male patients and the proportion difference was statistically significant ( $p=0.001$ ) (Table 1).
- ii. **Discharge outcome:** Overall medicine wastage was more to the discharge home patients (53%) than those who died. The difference was not statistically significant ( $p=0.061$ ) (Table 1).
- iii. **Age:** Patients aged 25 – 44 years were dispensed more with medicines, although the wastage was more to retired age group (65+ years). The difference was statistically significant ( $p = 0.023$ ) (Table 1).
- iv. **Hospital stay:** Medicines were less dispensed to patients who stayed briefly in medical wards compared to those who had longer duration. Medicine wastage for

the patients who stayed briefly in medical wards was greater (64.8%) than those who stayed longer. It was also noted that, medicines wastage decreases as the length of hospital stay increases ( $p=0.0001$ ) (Table 1).

**Table 1: Medicine wastage with respect to sex, discharge outcome, age and hospital stay**

			<b>Wastage</b>	<b>No wastage</b>	<b>Total</b>	<b>P value</b>
Sex	Male	n(%)	326 (47.1)	367 (52.9)	693 (100)	0.001
	Female	n(%)	404 (55.7)	321 (44.3)	725 (100)	
Outcome	Discharged	n(%)	535 (53 )	493 (47 )	1048 (100)	0.061
	Dead	n(%)	175 (47.3)	195 (52.7)	370 (100)	
Age group	1 - 14 yrs	n(%)	13 (37.1)	22 (62.9)	35 (100)	0.023
	15-24 yrs	n(%)	114 (50.9)	110 (49.1)	224 (100)	
	25-44 yrs	n(%)	251 (49.3)	258 (50.7)	509 (100)	
	45-64 yrs	n(%)	201 (50.5)	197 (49.5)	398 (100)	
	65+ yrs	n(%)	151 (59.9)	101 (40.1)	252 (100)	
Hospital stay	<7 days	n(%)	385 (64.8)	209 (35.2)	594 (100)	0.0001
	7+ days	n(%)	345 (41.9)	479 (58.1)	824 (100)	

*n = frequencies of medicines*

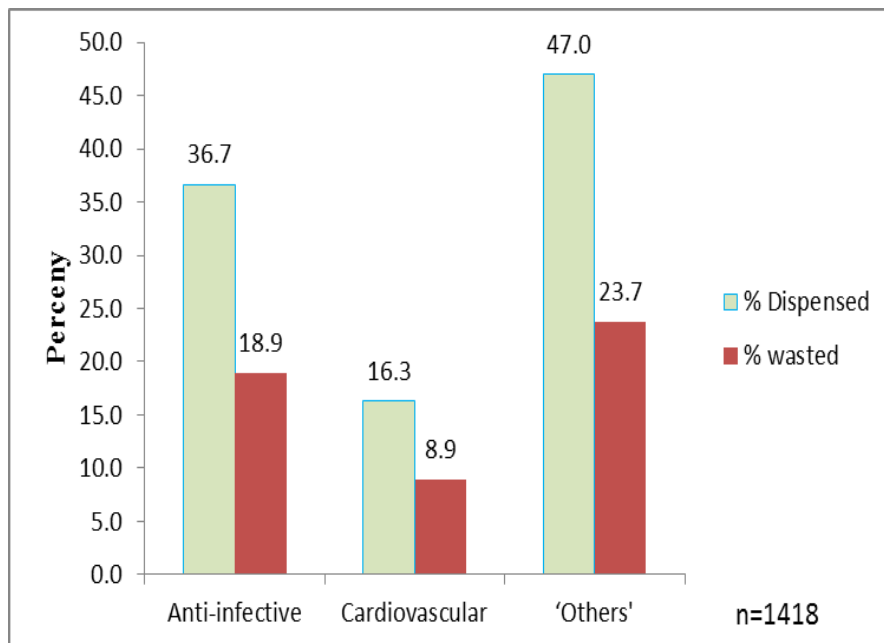
#### 4.1.3 Major types of medicines wasted

In general medicines dispensed to patients were categorized into three major groups with accordance to their frequency of use. The groups were anti-infective medicines, cardiovascular medications and ‘others’ medicines.

Anti-infective medicines included antibiotics, ameobicides, anti-malarial, antifungal, anti-helminthes and antiviral. Cardiovascular medicines consists of anti-angina, antihypertensive, statins, diuretics, anticoagulants, and antiplatelet agents while the ‘others’ category included all medicines not grouped in the previous two classes which are the (Non-Steroidal Anti-inflammatory Drugs (NSAIDs), multivitamin & minerals, anti-diabetics, Central Nervous system (CNS) medicines, hormones, acid inhibitors, steroidal

anti-inflammatory agents, anti-spasmodic agents, bronchodilators, laxatives, fluids & electrolytes.

More than half of the medicines dispensed (n=751) and wasted (n=394) were the anti-infective and cardiovascular medicines. Anti-infective medicines were wasted by 18.9% of the total medicines dispensed followed by cardiovascular medicines and lastly by the 'other' categories. The dispensed to wasted ratio of these groups were 1.9:1, 1.8:1 and 2:1 respectively (fig 5).



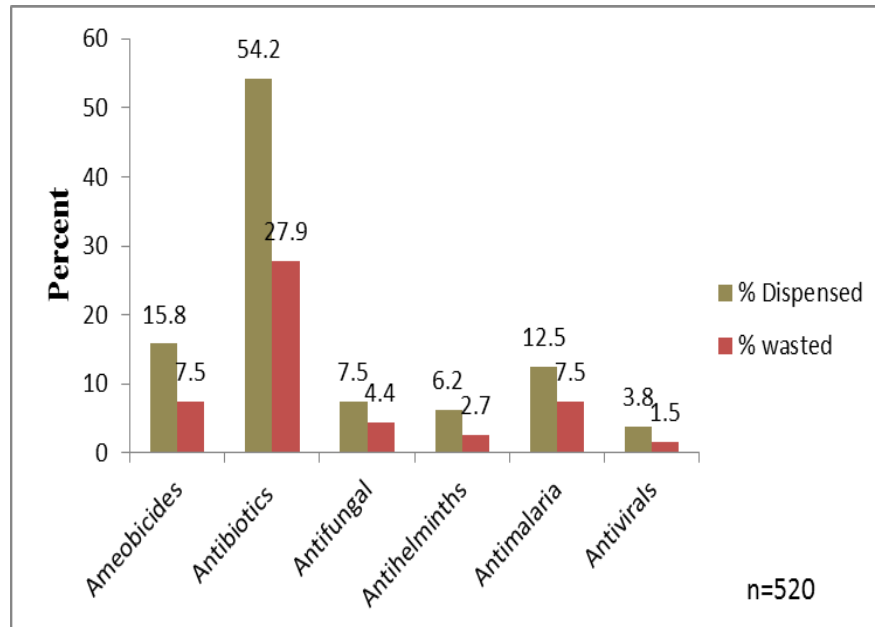
**Fig 5: Overall proportion of medicines categories dispensed and wasted**

#### **4.1.3.1 Anti-infective category:**

The anti-infective category had six classes which were ameobicides, antibiotics, antifungal, anthihelminths, antimalaria and antiviral medicines.

The classes which were frequently dispensed are the antibiotics (54.2%) followed by ameobicides and antimalaria medicines. Anti-infective class which had high overall percentage of wastage was the antibiotics. Antimalarial medicines and ameobicides

contributed to 15% whereas antifungal medicines, antihelminths and antivirals had 8.6% of the total wastage (fig 6).



**Fig 6: Classes of anti-infective medicines dispensed and wasted**

- i) **Antibiotics:** Antibiotic class consists of 23 different medicines in which penicillin had 11 medicines. Over 80% of the dispensed and wasted medicines were penicillin, cephalosporin, fluoroquinolone and sulfonamides (Table 2).
- ii) **Amebicides:** About 96.3% of ameobicides dispensed were metronidazole tabs (63.4%) and metronidazole injections (32.9%). Metronidazole tabs had high frequency of wastage compared to other ameobicides medicines (Table 2).
- iii) **Antimalarial:** Eighty percent of dispensed antimalarial medicines were Artemesinin based combination, while 15.4% of the dispensed antimalarial medicines were quinine. Artemether-Lumefantrine (ALu) tablets had high frequency of wastage compared to other antimalarial medicines (Table 2).

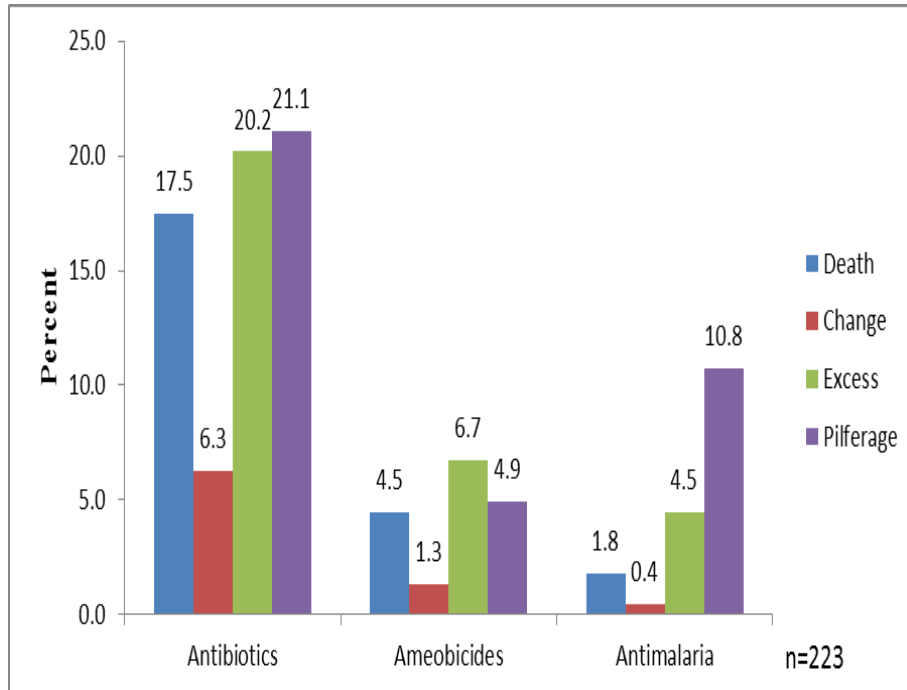
**Table 2: Common anti-infective medicines dispensed and wasted**

Category	Class	Medicine	Frequency Wasted n (%)	Frequency Dispensed n (%)	
Antibiotics	Penicillin	Benzyl penicillin inj	6 (2.1)	24 (8.5)	
		Amoxicillin caps	11 (3.9)	26 (9.2)	
		Cloxacillin caps	10 (3.5)	24 (8.5)	
		Other penicillin	19 (6.7)	24 (8.5)	
	Cephalosporin	Ceftriaxone inj.	38 (13.5)	76 (27.0)	
	Fluoroquinolone	Ciprofloxacin tabs	18 (6.4)	31 (11.0)	
	Sulfonamide	Cotrimoxazole tabs	24 (8.5)	36 (12.8)	
		Other antibiotics	19 (6.7)	41 (14.5)	
	<b>Total</b>			<b>145 (51.4)</b>	<b>282 (100)</b>
	Ameobicides	Azoles	Metronidazole tabs	25 (30.5)	52 (63.4)
Metronidazole inj			11 (13.4)	27 (32.9)	
Other ameobicides			3 (3.7)	3 (3.7)	
<b>Total</b>			<b>39 (47.6)</b>	<b>82 (100)</b>	
Antimalarial	Artemesinin	ALu tabs	23 (35.4)	41 (63.1)	
		Other Artemesinin	8 (12.3)	11 (16.9)	
	Quinine	Quinine injection	4 (6.2)	8 (12.3)	
		Quinine tabs	2 (3.1)	2 (3.1)	
	Others	Other antimalarial	2 (3.1)	3 (4.6)	
	<b>Total</b>			<b>39 (60.0)</b>	<b>65 (100)</b>

Major sources of wastage for the antibiotics were death, excess amount of medicines given to patients, pilferage and to a lesser extent change/stop of medications. Excess and pilferage contributed to 57% of antibiotic wastage.

Patient death and excess each contributes 34.8% of ameobicides wastage, while pilferage and change/stop of medicines contributes 23.9% and 6.5% respectively. Half of

antimalarial medicines wastage were due to pilferage, followed by death, excess and change/stop order was only 2.4% (fig 7) .



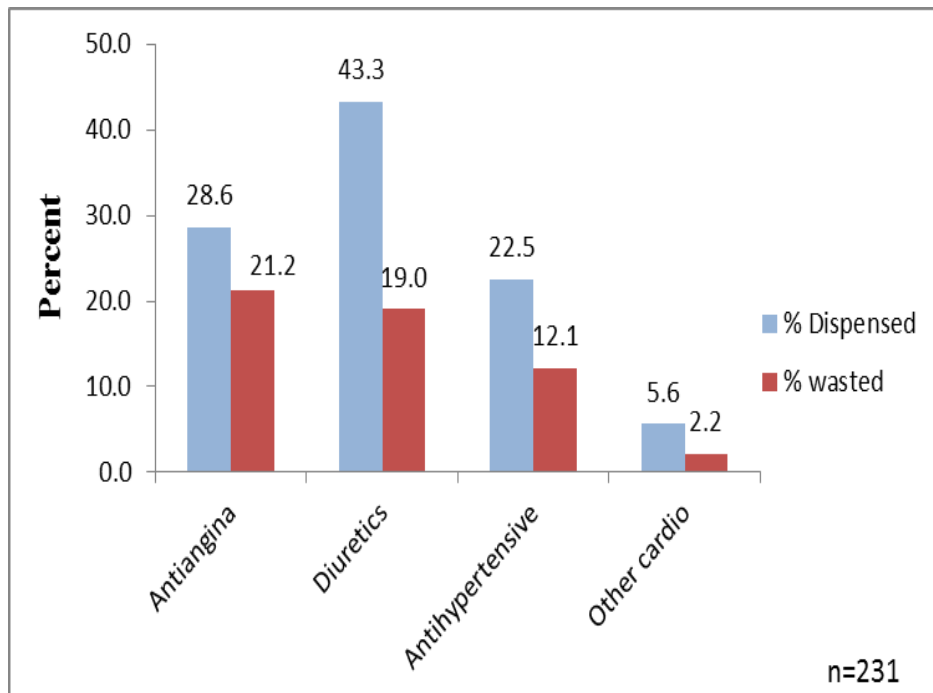
**Fig 7 : Sources of wastage for anti-infective medicines**

*'Excess' means the quantity of medicine dispensed to patients exceed the treatment course of duration used.*

#### **4.1.3.2 Cardiovascular medicines:**

About 16.3% (n=231) of medicines dispensed were the cardiovascular medicines, in which 54.5% of the cardiovascular medicines were wasted.

Most of the wasted medicines were antianginas, diuretics and anti-hypertensives. These three classes contributed to 94.4 % of the total cardiovascular medicines dispensed and 52.3% of the category wastage (fig 8 ). Dispensed to wasted ratio for these three classes were 1.35:1, 2.28:1 and 1.86:1 respectively.



**Fig 8: Classes of cardiovascular medicines with their wastage percent**

Table 3 describes commonly wasted cardiovascular classes. Amount of wastage for anti-angina medicines was 74.2% of the class wastage in which the frequently wasted anti-angina were nifedipine and atenolol tabs.

Large proportion of wastage of diuretics was contributed by furosemide injection, whereas 34.6% of anti-hypertensive wastage was a result of digoxin and captopril (table 3).

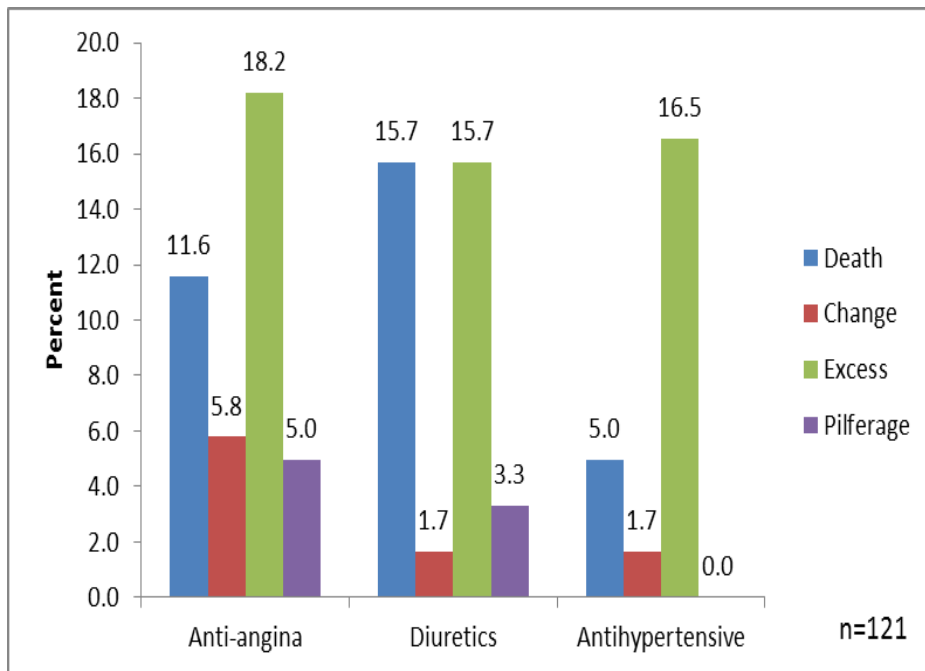


**Table 3: Common dispensed and wasted cardiovascular medicines**

<b>Category</b>	<b>Medicine</b>	<b>Frequency wastage n (%)</b>	<b>Frequency dispensed n (%)</b>
Anti-angina	Atenolol tabs	21 (31.8)	31 (47.0)
	Nifedipine tabs	20 (30.3)	23 (34.8)
	Other anti-angina	8 (12.1)	12 (18.2)
	<b>Total</b>	<b>49 (74.2)</b>	<b>66 (100)</b>
Diuretics	Furosemide injection	19 (19)	63 (63)
	Furosemide tabs	3 ( 3)	6 ( 6)
	Spironolactone	11 (11)	15 (15)
	Bendrofluazide tabs	11 (11)	16 (16)
	<b>Total</b>	<b>44 (44)</b>	<b>100 (100)</b>
Antihypertensive	Captopril	9 (17.3)	16 (30.8)
	Digoxin	9 (17.3)	16 (30.8)
	Other Antihypertensive	10 (19.2)	20 (38.5)
	<b>Total</b>	<b>28 (53.8)</b>	<b>52 (100)</b>

Major causes of wastage to all cardiovascular medications were by excess quantities, followed by death and to a lesser extent change/stop of medications and pilferage (fig 9).

Change/stop order was observed more to antiangina medicines. Overall pilferage accounted for 7% of the total wastage.

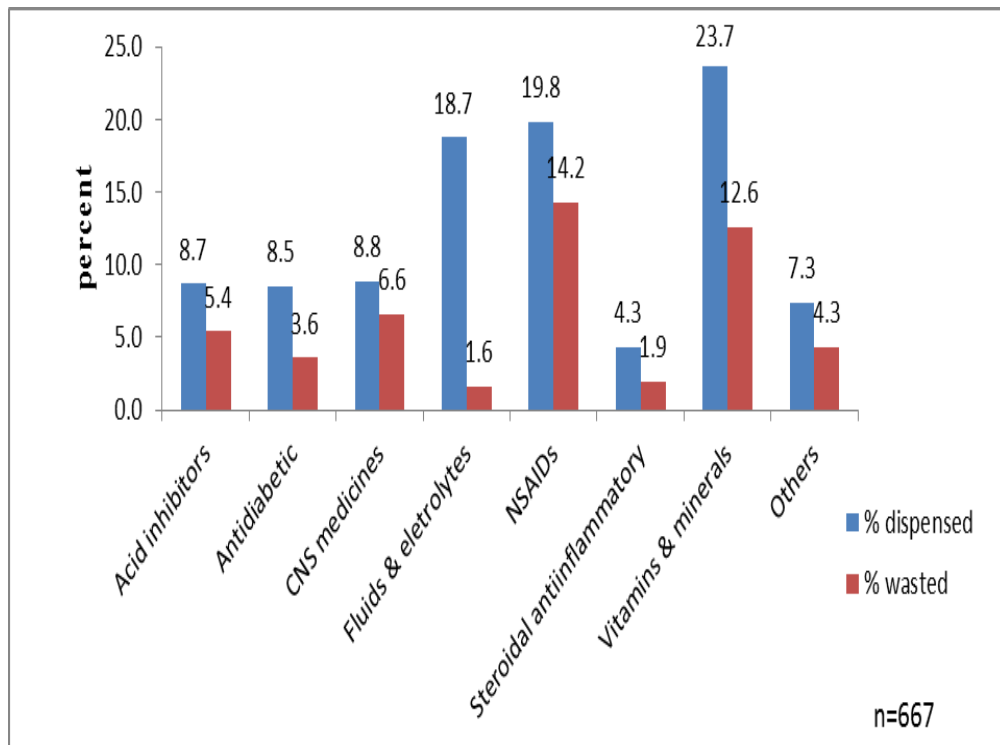


**Fig 9: Sources of wastage for cardiovascular medicines**

*'Excess' means the quantity of medicine dispensed to patients exceed the course of treatment used.*

#### 4.1.3.3 'Others' category of medicines:

'Others' category consists of 11 pharmacological classes in which 667 medicines were dispensed to patients, out of it 336 medicines remaining unused. Percentage of wastage in each class of the 'other' category is described in the figure below. Vitamins & minerals, NSAIDs and Fluids & electrolytes were frequently dispensed compared to other classes. The classes which had more wastage were the NSAIDs and Vitamins & minerals medicines whereby other classes had less than 5% of the total category wastage (fig 10).



**Fig 10: Classes of ‘other’ category of medicines dispensed and wasted**

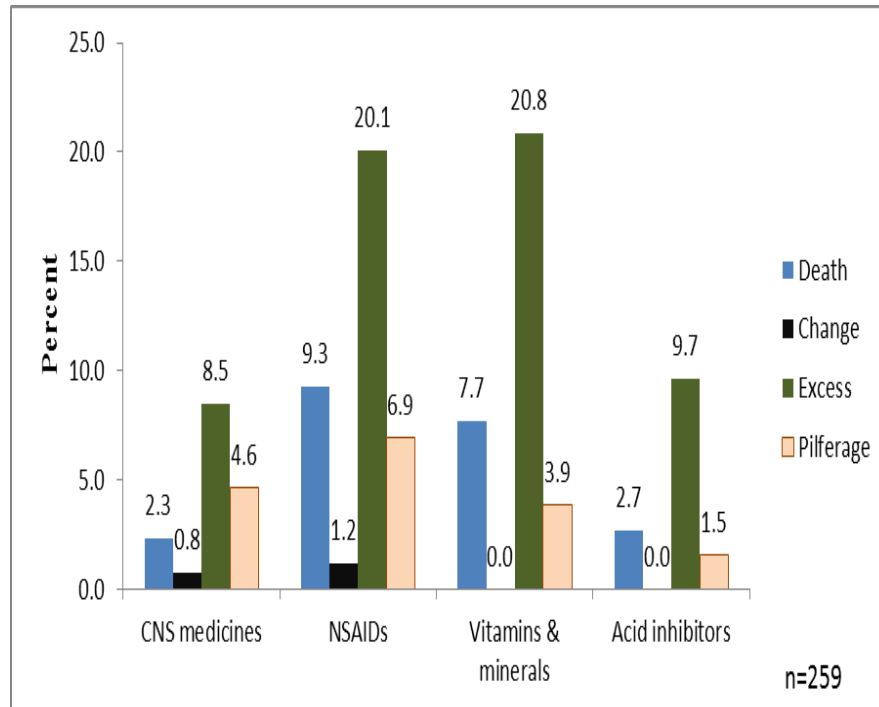
*(Others in this category are hormones, laxatives, bronchodilators and antispasmodics)*

Table 4 describes the frequency of common dispensed and wasted medicines in the ‘others’ category.

**Table 4: Common dispensed and wasted ‘other’ medicines**

<b>Category</b>	<b>Medicine</b>	<b>Frequency wastage n (%)</b>	<b>Frequency dispensed n (%)</b>
NSAIDs	Paracetamol tabs	74 (55.2)	84 (62.7)
	Diclofenac tabs	21 (15.7)	22 (16.4)
	Diclofenac injection	2 ( 1.5)	28 (20.9)
	<b>Total</b>	<b>97 (72.4)</b>	<b>134 (100)</b>
Vitamins & minerals	Ferrous/Folic Acid	61 (48)	121 (95.3)
	Other vitamins	23 (18.1)	6 ( 4.7)
	<b>Total</b>	<b>84 (66.1)</b>	<b>127 (100)</b>
CNS medicines	Amitriptyline tabs	3 (5.5)	4 (7.3)
	Diazepam tabs	4 (7.3)	5 (9.1)
	Diazepam injection	5 (9.1)	11 (20)
	Carbamazepine tabs	14 (25.5)	16 (29.1)
	Phenobarbitone tabs	10 (18.2)	12 (21.8)
	Other	6 (10.9)	7 (12.7)
	<b>Total</b>	<b>42 (76.4)</b>	<b>55 (100)</b>
Acid inhibitors	Omeprazole caps	33 (56.9)	54 (93.1)
	Other anti-acids	<b>3 (5.2)</b>	<b>4 (6.9)</b>
	<b>Total</b>	<b>36 (62.1)</b>	<b>58 (100)</b>

The major contributors of wastage for this category were excess medicines, patient death and pilferage (fig 11).



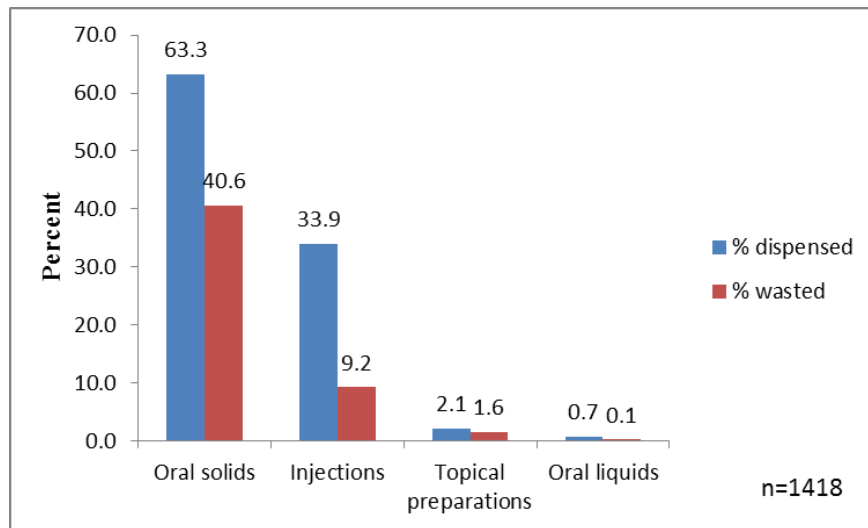
**Fig 11: Sources of wastage for ‘other’ medicines**

*‘Excess’ means the quantity of medicine dispensed to patients exceed the course of treatment given.*

#### 4.1.4 Medicines wastage by dosage forms

Four types of dosage forms were dispensed to patients, which are oral solids, injections, topical preparations and oral liquids. Oral solid dosage forms were dispensed by 63.3% followed by injections and other dosage forms was 2.8%.

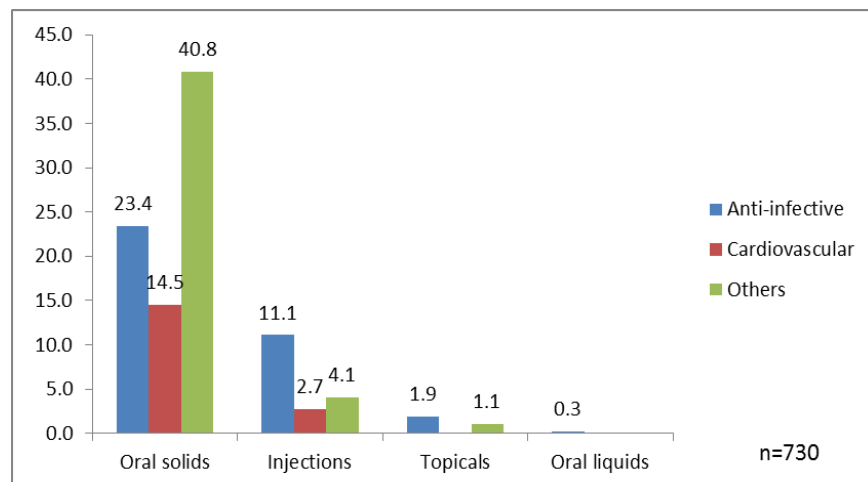
In general oral solids medicines had high percentage of wastage (40.6%) followed by injections (9.2%). Dispensed to wasted ratio for these two dosage forms were 1.56:1 and 3.68:1 respectively (fig 12).



**Fig 12: Proportion of dosage forms dispensed and wasted**

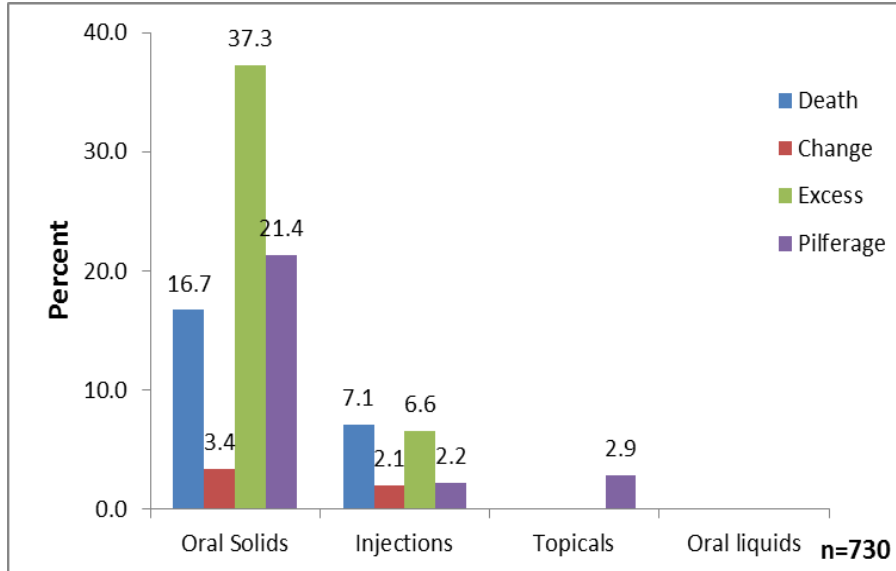
Further analysis for the dosage forms of medicine categories wasted (n=730), it was observed that large percent of anti-infective medicines were oral solids (23.4%), followed by injections (11.1%) and to a few amount were the topical preparations and oral liquids (fig 13).

Large percent of dosage forms for cardiovascular medicines wasted were oral solids (14.5%) and injections. While for the 'others' medicine categories; oral solids accounted 40.8%, injections was 4.1% and oral liquids was 1.1% (Fig 13).



**Fig 13: Medicine categories' dosage forms wasted**

Figure fourteen describes bases of wastage for different dosage forms



**Fig 14: Sources of wastage for different dosage forms**

#### 4.1.5 Quantity of medicines wasted

Quantity of medicines dispensed and wasted is described in the table below. Across the table anti-infective medicines were more dispensed and wasted than other categories.

**Table 5: Quantity of medicines dispensed and wasted**

Dosage form	Medicine category	Quantity wasted		Quantity dispensed	
		units	(%)	units	(%)
Oral solids	Anti-infective	4860	(24.3)	8,702	(43.6)
	Cardiovascular	1447	( 7.2)	2,787	(14.0)
	Others	3400	(17.0)	8,477	(42.5)
	<b>Total</b>	<b>9,707</b>	<b>(48.6)</b>	<b>19,966</b>	<b>(100.0)</b>
Injections	Anti-infective	501	(10.7)	1,919	(41.1)
	Cardiovascular	237	(5.1)	1,754	(37.5)
	Others	115	(2.5)	999	(21.4)
	<b>Total</b>	<b>853</b>	<b>(18.3)</b>	<b>4,672</b>	<b>(100.0)</b>
Topical Preparations	Antifungal	37	(59.7)	48	(77.4)
	Others	11	(17.7)	14	(22.6)
	<b>Total</b>	<b>48</b>	<b>(77.4)</b>	<b>62</b>	<b>(100.0)</b>
Oral liquids	Antifungal	2	(10)	20	(100)

#### 4.1.6 Factors contributing to medicines wastage

Four factors were identified to contribute medicine wastage in medical wards. These are patient death, excess, pilferage and change/stopping of medicines.

1. **Patient death:** Overall frequency of medicine dispensed to patients whose outcome was death were 26.1%, out of these 175 medicines remained. Whereas medicines remained from discharged patients were 53% out of 1048 medicines dispensed. There was no statistical difference in medicine wastage among the two groups ( $p=0.061$ ).
2. **Pilferage tendencies:** About 14% of the total medicines dispensed were not valid for the respective patients. This was equivalent to 27% of the whole medicine wasted ( $p = 0.0001$ ). Oral solids were more likely to be pilfered (80.4%), followed by topical preparations (10.8%) ( $p=0.0001$ ). Categorically anti-infective medicines



were more pilfered (56.7%) compared to other medicines (37.6%). The difference was statistically significant ( $p=0.0001$ ).

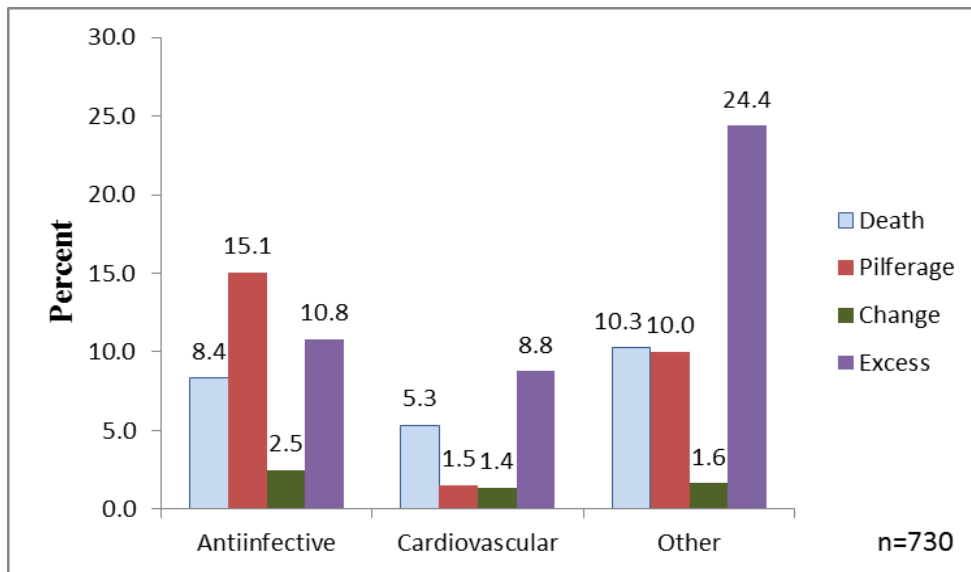
3. **Excess medicines:** Frequency of medicine remained whose dispensed duration exceeded course duration was 22.6% and all of them were wasted (table 8).
4. **Change/stop of medicines:** Stop/change order was observed to 57 of the medicines dispensed. Medicines waste resulted from stop/change order was 5.5% of the total wastage. The difference was statistically significant ( $p=0.003$ ).

**Table 6: Factors contributing to medicines wastage**

Category			Wastage	No wastage	Total	P value
Outcome	Discharged	n(%)	535 (53.0)	493 (47)	1048 (100)	0.061
	Dead	n(%)	175 (47.3)	195 (52.7)	370 (100)	
Pilferage	Yes	n(%)	194 (100)	0 (0.0)	194 (100)	0.0001
	No	n(%)	536 (48.8)	688 (56.2)	1224 (100)	
Excess	Not in excess	n(%)	409 (68.9)	688 (37.3)	1097 (100)	0.0001
	Excess	n(%)	321 (100)	0 (0)	321 (100)	
Medicine change/stop	Not changed	n(%)	690 (50.7)	671 (49.3)	1361 (100)	0.003
	Changed	n(%)	40 (70.2)	17 (29.8)	57 (100)	

*n = frequencies of medicines*

The figure below describes the different factors that contributed to medicines wastage. Overall anti-infective medicines were pilfered more than cardiovascular category. While cardiovascular and the 'other' categories had medicines in excess (fig 15).



**Fig 15: Sources of wastage for different medicine categories wasted**

#### **4.2 Medicine wastage at outpatient dispensing pharmacy**

Twenty medicines were used as tracers at the outpatient dispensing unit. Items reported to be stocked were 14 while others were non-stock items. The non-stock items were all the tracer injections (n=6). Most of the stocked items were the anti-infective medicines 71.4%. Oral solid dosage forms were 78.6 %.

Stock quantity of seven items (50%) did not match with inventory control tool used (a computer data base), out of which five items had physical inventories more than the data base system and the two items (one oral liquid and one oral solid dosage forms) were less than the system. The mean proportional of the difference between the observed and the expected stock quantities (record error) was 3.6 % (S D4.35) for the study medicines. Only 14.3% of the items had more than 10% of the record error (Table 7).

**Table 7: Physical Inventories (PI) of the tracer medicines compared with the database system**

Category			PI match the system	PI do not match with the system	Total	P value
Dosage form	Oral liquids	n(%)	1 (33.3)	2 (66.7)	3 (100)	0.72
	Oral solids	n(%)	6 (54.5)	5 (45.5)	11 (100)	
Medicine category	Anti- infective	n(%)	5 (50)	5 (50)	10 (100)	0.5
	Non anti- infective	n(%)	2 (50)	2 (50)	4 (100)	
Error rate	< 10%	n(%)	7 (58.3)	5 (41.7)	12 (100)	0.23
	10% +	n(%)	0 (0)	2 (100)	2 (100)	

*n = frequencies of medicines*

In general quality of data in OPD dispensing unit was good as an average error rate was less than 10%. The discrepancy amount observed was not related to the system error rather than other factors. Items which their system error more than 10% their physical inventories were more than the inventory control tool used, therefore medicine used without being documented was insignificant.

### 4.3 Financial implication of medicine wastage

Financial aspect of medicine wasted was evaluated by determining the value of the studied dispensed and wasted medicines. The price utilized was the unit selling price as it was found in the Mwisela database. The unit price was in Tanzanian Shillings (Tsh). The

exchange rate for Tanzanian shilling against 1\$ (US Dollar) was equivalent to Tsh. 1569.81 (June 30 2012).

The median price for all dispensed medicines was 40, with variation from 0 to 126,360 shillings. The total value of the dispensed medicines (n = 1418) was 7,828,370.20 shillings, whereas the value of the wasted medicine was 1,804,686.40 shillings corresponding to 23% of the total value.

Overall value of injections wastage was 59.5% and money wasted with anti-infective medicines was 58.2 % (Table 8).

**Table 8: Financial assessment of the medicine wasted**

Category			Value of medicine wasted		Value of medicine dispensed	
Dosage form	Oral solids	n (%)	620,651.40	(7.9)	1,119,115.20	( 14.3)
	Injections	n (%)	1,074,139	(13.7)	6,559,957.00	( 83.8)
	Topical		104,796.00	( 1.3)	122,858.00	( 1.6)
	Oral liquids	n (%)	5,100.00	( 0.1)	26,440.00	( 0.3)
	<b>Total</b>	<b>n (%)</b>	<b>1,804,686.4</b>	<b>(23.1)</b>	<b>7,828,370.20</b>	<b>(100.0)</b>
Pharmaceutica l Category	Anti-infective	n (%)	1,050,277.4	(13.4)	3238856.2	( 41.4)
			0			
	Cardiovascular	n (%)	257,384.00	( 3.3)	1071185.00	( 13.7)
	Other	n (%)	497,025.00	( 6.3)	3,518,329.00	( 44.9)
<b>Total</b>	<b>n(%)</b>	<b>1,804,686.4</b>	<b>(23.1)</b>	<b>7,828,370.20</b>	<b>(100.0)</b>	
		<b>0</b>			<b>)</b>	

*n = value of medicines in Tanzanian Shillings*

#### 4.4 Medicines wastage awareness

##### 4.4.1 Demographic information

A total of 49 health workers participated in the study, out of which 26.5% were male with mean age of 35 (SD 9.8). Majority of the participants were nurses (n=44) and had diploma education (n=33). More than half (57%) of the participants had worked for over three years in their current section.

##### 4.4.2 Management of Patient's medicine leftovers

Respondent who agreed that medicines do remain as leftovers from patients in medical wards were 77.5%. Most of these were female, aged more than 36 years and worked for more than three years. There was no statistical difference in response among sex, age and working experience (Table 9).

**Table 9: Responses regarding medicines leftovers by sex, age and working experience**

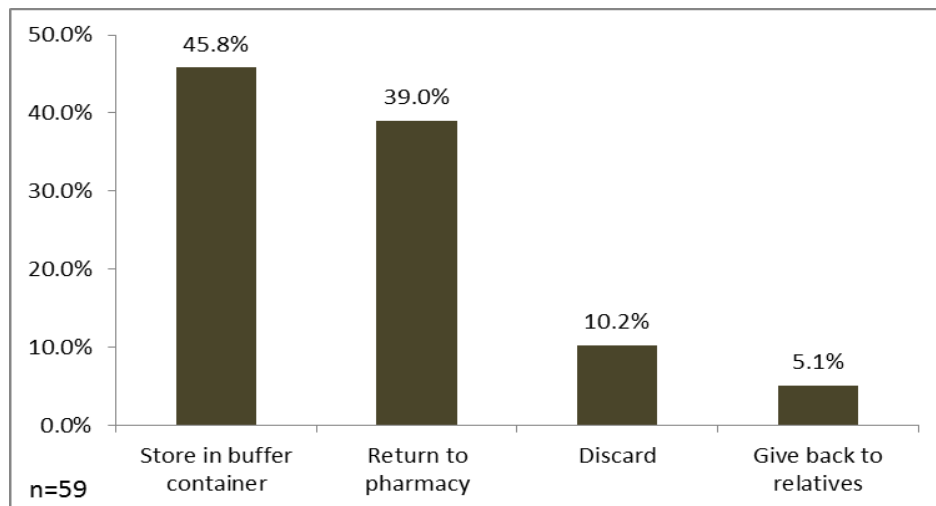
Category			Medicine do remain	Medicine do not remain	Total	P value
Sex	Male	n(%)	9 (69.3)	4 (30.7)	13 (100)	0.451
	Female	n(%)	29 (80.5)	7 (19.4)	36 (100)	
Age	< 35yrs	n(%)	24 (72.7)	9 (27.3)	33 (100)	0.300
	36+	n(%)	14 (87.5)	2 (12.5)	16 (100)	
Working experience	< 3 year	n(%)	14 (66.7)	7 (33.3)	21 (100)	0.169
	3+ years	n(%)	24 (85.7)	4 (14.3)	28 (100)	

*n = frequencies of responses*

#### 4.4.3 Procedure available for handling leftovers:

About 61% of the participants agreed that a procedure was available for handling leftovers. The positive response was more to those who had worked for more than three years (60%). There was no statistical difference in the response among those who had worked for more than three years and those who worked briefly ( $p=0.612$ ).

Analysis of the responses of different practices utilized by healthcare in handling medicine leftovers identified four different ways; which are returning medicines to pharmacy, storing in a buffer container, discarding or dumping, returning back to patients or relatives when discharged or in case a death occurred. Store in buffer container response was 45.8%, followed by return to pharmacy (fig 16).



**Fig 16: Methods reported by health workers for handling medicine leftovers**

Furthermore it was revealed that large percent of the health workers who store leftover medicines in buffer container are those aged above 35 years old (66.7%) and had more than 3 working experience (66.7%). The difference was not statistically significant ( $p=0.910$ ).

#### **4.4.4 Reasons for medicines to remain**

Major reasons identified by healthcare workers for medicines to remain are patient deaths (36/49) as leading cause and change of medicine by clinicians (37/49) was a second reason for medicines to remain.

#### **4.4.5 Medicines purchased outside hospital pharmacy for admitted patients**

Overall 94% of the respondents acknowledged patients do purchase medicines outside hospital pharmacy. Overall 124 frequencies of medicines were reported by providers, as are being brought in by patients. Proportional of categories of these medicines were anti-infective (12.9%), cardiovascular medicines were (46.8%) and the remained medicines were the 'other' medicine categories.

Most of the reported anti-infective medicine was cotrimoxazole injection where for cardiovascular medicines were nimodipine tabs and isosorbide mononitrate tabs (7/58). Additionally the frequently reported 'other' category medicines were pantoprazole injection (12/50), metochlopropamide injection (10/50) and omeprazole caps (8/50). Other reported medicines are shown in table 10.

**Table 10: Reported medicines brought in by patients**

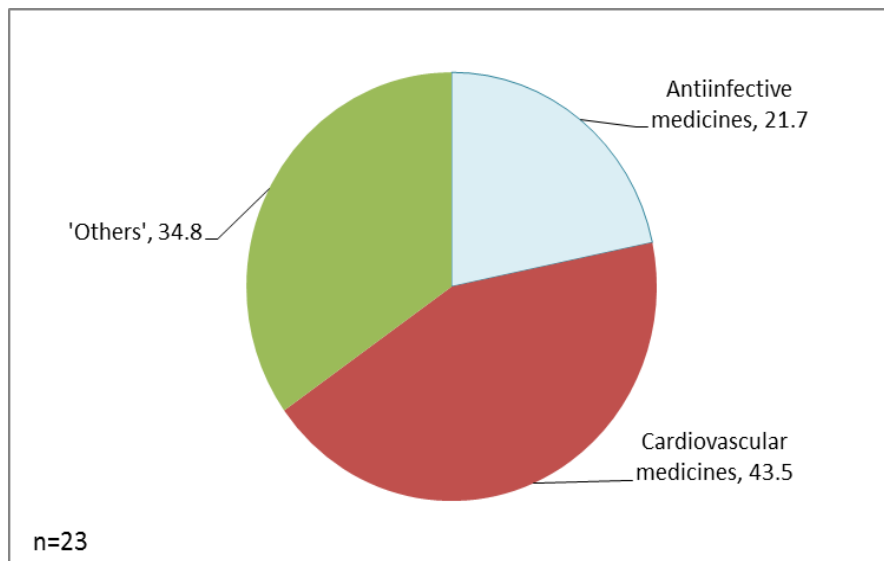
<b>Category</b>	<b>Medicine Name</b>	<b>Frequency(n)</b>	<b>Percent (%)</b>
Anti- infective Medicines	Cotrimoxazole injection	6	37.5
	Amoxiclav tabs	1	6.3
	Augmentin injection	1	6.3
	Metronidazole injection	1	6.3
	Meropenum injection	2	12.5
	Artemether injection	2	12.5
	Fluconazole injection	1	6.3
	Gynazole cream	2	12.5
	<b>Total</b>	<b>16</b>	<b>100.0</b>
Cardiovascular Medicines	Nimodipine tabs	12	20.7
	Isosorbide mononitrate tabs	7	12.1
	Spinolactone tabs	6	10.3
	Enalapril tabs	5	8.6
	Furosemide tabs	5	8.6
	Furosemide inj	5	8.6
	Carvedilol tabs	4	6.9
	Losartan tabs	3	5.2
	Amlodipine tabs	3	5.2
	Atorvastatin tabs	3	5.2
	Nifedipine tabs	2	3.4
	Aspirin junior tabs	2	3.4
Hydralazine injection	1	1.7	
	<b>Total</b>	<b>58</b>	<b>100.0</b>
'Others' Medicines	Pantoprazole injection	12	24.0
	Metochlopropamide injection	10	20.0
	Omeprazole caps	8	16.0
	Pantoprazole tabs	4	8.0
	Calcium sandoz tabs	3	6.0
	Lactulose syrup	2	4.0
	Phenorbabitone injection	2	4.0
	Vit B12 injection	2	4.0
	Calcium carbonate injection	1	2.0
	Gabapentin tabs	1	2.0
	Livolin tabs	1	2.0
	Meloxicam tabs	1	2.0
	Metformin tabs	1	2.0
	Methylprednisolone injection	1	2.0
Metochlopropamide tabs	1	2.0	
	<b>Total</b>	<b>50</b>	<b>100.0</b>



#### 4.4.6 Left over medicines found in wards

Eight medicines were self-reported to be stocked in buffer containers as leftovers. According to self-report; half of the medicines were purchased outside pharmacy. All of them had instructions on how to use, while two anti-infective medicines were expired, the categories which were stored are anti-infective medicines 37.5%, cardiovascular medicines 50% while 'other' medicines were 12.5%.

With observation findings, all investigated wards had medicine leftovers in their medicines cabinet. All medicines stated to be leftovers were the oral solids. Those leftover medicines purchased from outside pharmacy were kept separately in one container. Two third of the medicines observed were the anti-infective and cardiovascular medicines (fig 17).



**Fig 17: Proportional of observed leftover medicines**

## CHAPTER FIVE

### 5. DISCUSSION

The study aimed to investigate medicines wastage and its associated factors at MNH. The study assessed types of medicines wasted and its underlying factors in addition; it explored financial implication that occurred as a result of the wastage.

In this study a total of four hundred and fifty nine patients file with male to female ratio of 1.2:1 were reviewed for their treatment history. The mean age of the patients was 44 years. In general female patients appeared to be younger than male patients. The median days for hospitalization of these patients were 4; female patients were hospitalized for few days compared to male patients. Median number of medicines prescribed per patient was 5, whereas anti-infective medicines were prescribed more frequently compare to other categories.

Frequency of medication wastage in medical wards observed in this study was 51.5% of the total medicines dispensed which is equivalent to medicine dispensed to wasted ratio of 1.9:1.

The problem of medicines wastage has been also encountered both in community and in healthcare settings. Findings from Trueman et al (2010) in evaluation of scale, causes and cost of waste medicines which assessed wastage indicated that 20% of the community in UK possessed medicines, and at least one of the kept medicines was not used. This is a little less compared to Tanzanian community in which home storage of medicines ranges from 22.3% (Temu-Justin et al, 2005) to 73.4% (Temu et al, 2006).

In this study more than half of the total medicines dispensed were wasted. Percentage of wastage seen by this study is much higher than the study done by Al-azzam, (2012) which found about 34.7% of the medicines found in homes were not in use. These differences encountered are likely to be influenced by the difference in study sites, as this study investigated medicines wastage in hospital wards whereas the other study assessed

medicine wastage in community. It is a fact that medicines wastage is noticeable in community as well as in healthcare delivery settings.

Pattern of medicine wastage in healthcare delivery systems do vary depending upon services which are rendered. The medicines wastage experienced in medical wards differ from dental sections, operating theatres, obstetrics & gynecology sections etc. This study investigated medicines wastage in medical wards and one OPD dispensing pharmacy.

In medical wards, two kinds of medicines wastage detected were leftovers and non-leftovers. The leftovers were those medicines remaining unused, in which they accounted up to two third of the total wastage, whereas the non-leftovers which were pilfered medicines contributed to one third of the wastage. Most of the medicines assessed by other studies were leftovers (Al-azzam et al, 2012; Cameron, 1996; Saleem et al., 2012) and to a lesser extent medicines used to patients without being documented (Nava-Ocampo et al 2004).

Variations of the kinds of wastage seen previously are likely to be influenced by study areas investigated. The former studies assessed medicines wastage in community settings in which most of the medicines found were either leftovers or those kept for future use while the later study surveyed medicines wastage in operating theatres where both the leftovers and the medicines used without being documented were observed.

This study has also noted similar pattern of wastage as was seen by studies done by Cameron, 1996; Nava-Ocampo et al 2004; Al-azzam et al, 2012 and Saleem et al., 2012 . The major differentiating factor between these studies is the source of medicines investigated, with this study medicines assessed were those obtained from the hospital pharmacy, while the other studies investigated medicines found in community and medicines returned to pharmacy by patients.

With this study, overall medicine wastage was more to female patients and for those patients who stayed few days in medical wards. This may be influenced by a fact that,

female patients and those who stayed briefly in medical wards were dispensed more frequently with medicines compared to others.

More than half of categories of medicines wasted in this study were anti-infective and cardiovascular medications. Large proportion of anti-infective medicines wasted were the antibiotics, followed by amebocides and antimalarial, whereas anti-angina, antihypertensive and diuretics accounted for 96% of the total cardiovascular medicines wasted.

Categories of medicines wasted in developed countries differ significantly with that of developing countries. Trueman et al (2010) reported the leading wasted medicines categories in UK were gastro intestinal medicines (12.4%), medicines for skin (11.2%), pain medications (10.5%) and cardiovascular medicines (10.3%) while in Jordan the most wasted categories were anti-infective (17.7%), muscle-skeletal agents (13.4%), respiratory agents (12%), gastro intestinal medicines (10%) and cardiovascular medicines which was 7.6% (Al-azzam, 2012).

Similar trends was also noted by Ibrahim et al (2012) who observed the return of anti-infective and cardiovascular medicines to community pharmacy by 19 % and 19.4% respectively.

It is evident that, leading causes of morbidity and mortality in medical wards of developing countries are characterized by both infectious and non-infectious diseases. HIV/AIDs, TB, Pneumonia, malaria are the most foremost infectious diseases, whereas cardiovascular disorders and diabetes mellitus are the major non-infectious diseases in medical wards (Mengistu, 2005). The most wasted medicines observed in this study are those medicines for managing communicable and non-communicable diseases. This portrays that, ailments managed by medical wards of MNH represent the burden of diseases which the country is facing.

With this study, anti-infective medicines wastage was 18.9% followed by cardiovascular medicines (8.9%), NSAIDs (6.8%) and vitamins & minerals (5.9%). In comparison with

studies done by Trueman, (2010); Al-azzam, (2012); and Ibrahim et al, (2012)., anti-infective medicines have shown to be similar in wastage while cardiovascular, NSAIDs and vitamins & minerals had low percentage of wastage.

Furthermore it was also found that about 9707 pills and 853 injections were wasted, which made an average of 21 pills and two injections wasted per patient per admission. This seems to be relatively small amount wasted compared to the study done by Saleem et al (2012) who collected 20,799 excess pills, which was an average of 202 pills per patients per attendance of hypertensive clinic. However the study settings were different for making a comparison since the later collected medicines for visiting patients who attended the clinic at the hospital while this study assessed pills remaining from medicines supplied by hospital pharmacy to admitted patients in the medical wards.

Four factors were identified in this study as the major contributors of medicines wastage. These were patient death (24%), excess amount of medicines provided to patients (44%), change/stop of medicines (5.5%) and pilferage (26.5%) out of the total medicines wasted.

Excess amount of medicines was more to oral solids as these were the most dispensed dosage form. Reasons underlying this are likely to be poor tracking and documentation of medicines dispensed to patients, this resulted to patients' prescriptions being refilled before their due date. Shortage of human resource also could play a role in patients receiving excess medicines due to increased patient work load and hence decreases check and balance of the medicines during dispensing process.

Fourteen percent of the medicines dispensed were pilfered and were categorized as non-leftovers. These non-leftover medicines were not administered to patients as they were not part of patient's treatment regimen. Most of these medicines were oral antibiotics, and topical preparations, cardiovascular medications were less pilfered compared to others. In literature pilfering tendencies has been encountered in systems where inventory management is weak. It contributes between 4 to 9% of overall waste in supply systems (Management Sciences for Health, 2010). Findings from this study suggests that pilferage

is high in medical wards, even though the findings cannot be compared with the MSH (2010) as this study did not investigate overall medicines wastage in MNH.

As it have been observed by Temu-Justin et al., (2005); Temu et al. (2006) most of the medicines stored at home were obtained from authorized health facilities hence there is a possibility that the pilfered medicines ends up as home storage for future use when need arise.

Kagashe & Massawe, (2012) found that the inventory control tool used by MNH in managing medicines and medical supplies was accurate, thus the possible underling cause of the pilferage may be due to weakness of the distribution system which failed to detect unusual pattern of medicine use.

Patient death was the third cause for medicines wastage, and also was noted by other studies (Cameron, 1996; Al-azzam et al, 2012; Saleem et al., 2012) as the major contributor of medicines wastage. It is a fact that death is certain in hospital settings, yet the amount of medicines wasted as a result of patients' death can be minimized. In this study, injections that remained unused as a result of death were 52% of the total wastage. It was further noted that, about 45% of the injections wasted, their duration of issue was more than the prescribed course of treatment.

Pharmacy department at MNH had in house dispensing strategy for initial dispensing of five days for oral solids with the exception of analgesics and three days for all injections in order to combat medicine wastage, to some extent this has contributed to the extra amount of medicines provided to patients especially during the refilling phase of the prescriptions.

Medicines wasted as a result of stop/change order were only six percent, out of which anti-infective and cardiovascular medicines were most wasted. Mzale (2012) observed 80.2% of prescription errors and 16% of dispensing errors in management of chronic cardiac failure in medical wards at MNH. This possibly could have an influence in changing or stopping of cardiovascular medicines. Furthermore empirical treatment in most cases may have fueled the problem (Mzale, 2012).

Other possible causes of medicines wastage as revealed by other studies were adverse effects of medicines (Cameron, 1996; Al-azzam et al, 2012) and inconvenience/difficult following instructions (Braund et al., 2008).

Most of the studies (Cameron, 1996; Braund et al, 2008; Al-azzam et al, 2012; Saleem et al., 2012) identified patient death, change/stop of medication and medicines kept for future use as the major contributing factors of medicines wastage while in this study excess amount of medicines given to patients, pilferage and patient deaths contributed to about 94.5% of the overall medicines wastage.

In addition, assessment done to health care providers to find out their perception in major factors contributing to medicine leftovers in wards pointed patient death and change of medicine by clinicians as the leading factors of the medicine leftovers. This is in contrary to findings obtained from patients' record which identified excess of medicines to patients and pilferage as major contributors of medicine wastage in medical wards of MNH.

The concern of medicine leftovers is known to wards staffs. Three quarter of the healthcare participated in the study acknowledged existence of medicine leftovers in wards. Medicine leftovers have shown to be a burden to many healthcare deliveries. The cost of handling them is high both in terms of time and monetary. Availability of hands-on standard protocols in managing medicines including leftovers and those brought in by patients and adhering into, has shown to improve management of medicines in health facilities (Management Sciences for Health, 2010).

Procedure for managing medicines leftovers was stated to be available. In this study, nevertheless one third of the healthcare workers were not aware of its existence and somehow have caused large proportion of the leftover medicines as reported by healthcare workers not to be returned to pharmacy department as it is required by the protocol. The reason underlying as perceived by health workers is unavailability of written standard protocol for managing medicines in the hospital.

Additional information into why medicines were not returned to pharmacy according to protocol requirements, responses alleged the inefficiency of the database system especially when power is off which delays dispensing process, frequent stock outs of the essential medicines which distress poor people and hence the leftover medicines are given to these patients. On the other outlook it was also perceived that, there was a challenge from pharmacy to accept the leftovers especially when the patient is already discharged from the system, as the procedure for recycling is a bit complex.

Remington, (1995) addressed the issue of medicines brought in by patients in hospitals. In UK medicines brought in by patients were 20% (Remington, 1995). It is well known that fate of these brought in medicines is mainly governed by hospital policy. It has been noticed that up to 41% of medicines brought in by patients are not required or are in poor conditions, moreover it was further pointed out that the cost associated with the re-use of these medicines were net full year increase of £6700 for the hospital costs (Remington, 1995). It is evident that recycling of remained medicines is a bit expensive in terms of resources required, thus it is necessary to contain it beforehand.

At outpatient dispensing unit the aspect of medicine wastage was assessed in terms of record errors of the data system. The previous study done by Kagashe & Masawe (2012) pointed the accuracy of inventories was a result of computerization of the inventory system. This is further confirmed by the mean record error obtained in this study which was less than 4%, this make the observed discrepancy to be of insignificant amount to be considered as wastage.

An overall value of medicine wastage was 23% of total worth of dispensed medicines as was observed by this study. This is an approximate of 4000 Tsh per patient per admission or equivalent to 100 units of the median priced items that remained per patient per admission.

The financial burden of the wasted medicines may not be obviously realized by healthcare workers or probably with the hospital system too as these lost medicines have already been billed to patients. In other viewpoint these losses are facility burdens since most of the



patients admitted to these wards are either by policy are exempted from cost sharing or utilize public tariffs which are at a very minimal when purchasing different health services including medicines.

It is important to contain medicines wastage in healthcare delivery system in turn to optimize the intended therapeutic benefits needed by patients and to increase overall medicine availability in hospitals.

## CHAPTER SIX

### 6.1 CONCLUSION

Medicines wastage is a problem to health facilities. The study was set to assess medicines wastage and its associated factors at Muhimbili national hospital. The study also sought to understand the existence of medicines wastage, to determine major types of medicines that are wasted, their contributing factors and financial impact.

The study was a cross sectional, utilized twenty tracer medicines, medical files for patients admitted in medical wards for the year 2012 to find out pattern of medicines use, nurses and pharmacist as healthcare providers to assess their awareness of medicines wastage.

The study identified the existence of medicine wastage in medical wards which was about a half of the total medicine dispensed with dosage form variation, whereas tablets were wasted more than injections as they were frequently used dosage form. As a National referral hospital, MNH is more likely to handle patients who are in critical conditions as well as those who have multiple diseases. These patients do need different kinds of medications in order to alleviate and/or cure their illnesses.

Medicine categories wasted were those commonly utilized by patients. These are the anti-infective and cardiovascular medications. Specifically the anti-infective medicines were the penicillin's, ceftriaxone, metronidazole and antimalarial medicines, whereas for cardiovascular medications were the furosemide injection, atenolol and nifedipine tabs. It is clear that minimizing medicines wastage may increase overall availability of medicines and in return the amount saved could be utilized to purchase other health service needs.

Major factors contributed towards wastage of medicines in medical wards identified were excess medicines being provided to patients, patient death, pilferage of medicines, and change/stop order of medicines due to various reasons. Death and change/ stop of medicines are inevitable in hospital settings especially the tertiary ones; nevertheless these factors do contribute to a less than one third of the total wastage observed. Managing excess and minimizing pilferage can reduce wastage by two folds.

Most of healthcare providers were aware that medicines do remain from patients. Methods stipulated on how to manage medicine leftovers in wards though available are not adhered

to, as most of the leftovers were retained in buffer containers. This brings suspicion with their quality with respect to storage conditions and monitoring of shelf life. It was noted that these leftover medicines especially those brought in by patients are mixed together in one container and thus chances of giving a patient either a wrong medication or an expired medicine is very high.

Assessment of medicines wastage at the OPD pharmacy did not observe undocumented medicines as the average medical error was less than 10%.

Medicines wastage is money loss. The value of the medicine wastage sold to patients is a quarter of the total value of the dispensed medicines. The overall financial loss incurred to hospital is not obvious as these medicines have already been billed to patients. It is apparent that most of the patients admitted in medical wards are either exempted by policy and hence do not cost share when utilizing health services, or are in public categories in which tariff rates utilized when purchasing health services are very minimal, thus the losses occurred are indirectly burden to the facility itself.

Finally medicines wastage has shown to have an impact on healthcare delivery system. Measures should be addressed to seize the sources of wastage identified in order to enhance overall pharmaceutical management.

**Study limitations:**

The study has presented an assessment of medicine wastage at MNH; however this study has encountered number of limitations due to its methodology;

- The study did not contain all parameters of medicine wastage. The aspects of medicine wastage investigated are those medicines remaining unused in wards and undocumented medicine at the outpatient dispensing unit.
- The study did not include all areas where medicines use process is involved.
- The study did not include other healthcare workers who are also involved in the process of drug administration.

## **6.2 RECOMMENDATIONS**

### **6.2.1 Dissemination and adherence of standard operating procedures (SOPs)**

The pharmacy department should make sure that the written SOPs are authorized for its utilization in the hospital. Meanwhile sensitization of proper management of medicines (handling, distribution and use of medicines including medicines brought in by patients) to all healthcare should be done.

### **6.2.2 To review the unit of issue:**

The unit of issue of medicines especially for injections and non-antimicrobial agents should be reviewed and only the evidence based one should be exercised. This may be achieved by doing operational researches in order to identify the unit of issue which will minimize wastage at the same time improve efficiency of pharmaceutical services.

### **6.2.3 Automation of prescriptions in the database system:**

The database system should be effective to minimize wastage, reduce opportunity of medicines diversion and be able to identify unusual medicine usage pattern thus automation of the prescriptions could help to reduce fraud of hand written prescriptions and in turn minimize pilferage.

### **6.2.4 Conduct of regular operational researches:**

Pharmacy department in collaboration with the hospital medicines and therapeutic committee (HTC), need to be conducting operational researches and medicine audit studies in regular basis in order to assess the pattern of medicine utilization in the hospital.

The scale of the wastage observed is still at the base. In order to have improvement and to have achievable strategies for containing medicine wastage there is a need for further studies in other aspects of medicines use. The following studies can be done in order to have in-depth understanding of the magnitude of medicine wastage in MNH:

- Medicine utilization studies and
- Prescription audit

**6.2.6 Increasing number of human resource at Mwisela pharmacy:**

Currently number of permanent pharmaceutical staff at Mwisela block is very minimal. Increasing their numbers will reduce workload as it is currently experienced and in return will improve pharmaceutical benefits to patients.

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## ANNEXES

## ANNEX 1: LIST OF TRACER MEDICINES

S/No	Description	Strength	Unit	Physical Inventory	Balance in the registers
1	Albendazole/ Mebendazole	100mg/200mg	Tabs		
2	Artemether – Lumefantrine Tablets	Green Pack	Strip		
		Red Pack	Strip		
		Blue Pack	Strip		
		Yellow Pack	Strip		
3	Amoxicillin Capsules	500mg	Caps		
4	Amoxicillin suspension	125mg/5ml	Bottle		
5	Co-trimoxazole Tablets	480mg	Tabs		
6	Co-trimoxazole suspension	120mg/5ml	Bottle		
7	Metronidazole Tablets	200mg	Tabs		
8	Fluconazole Tablets	150mg/200mg	Tabs		
9	Paracetamol Tablets	500mg	Tabs		
10	Ferrous + Folic Acid Tab		Tabs		
11	Ergometrine /Oxytocin Inj	0.05% w/v; 5IU/10IU	Ampoule		
12	Ciprofloxacin 500mg tabs	250mg/500mg	Tabs		
13	Oral Rehydration Salts	Sachets	Sachets		
14	Zinc sulphate Tablets		Tabs		
15	Quinine injection	300mg/ml	Ampoules		
16	Benzyl Penicillin Injection	5MU	Vial		
17	Magnesium Sulphate Inj.	50% w/v	Vial		
18	Dextrose 5% / DNS	500ml/100ml	Bottle		
19	Ceftriaxone Injection	250mg/1gm	Vial		
20	Quinine tabs	300mg	Tabs		

**ANNEX 2: PATIENT MEDICAL RECORDS DATA COLLECTING TOOL****Demographic information**

Patient Reg No: \_\_\_\_\_ Sex \_\_\_\_\_ Date of birth \_\_\_\_/\_\_\_\_/\_\_\_\_ (Age: \_\_\_\_\_ years )

Date admitted: \_\_\_\_/\_\_\_\_/\_\_\_\_ Diagnosis during admission: \_\_\_\_\_

Date discharged: : \_\_\_\_/\_\_\_\_/\_\_\_\_ Diagnosis during discharge: \_\_\_\_\_

Hospital services Payment method: \_\_\_\_\_

**Treatment History**

Medicine prescribed during hospital stay

Date	Name of the medicine prescribed and dosage	Status	Days drugs Prescribed	No. Of days & Qty of drugs Dispensed		Days & Qty of drugs Consumed	Qty of drugs wasted
			Days	Days	Qty	Days	
		Completed					
		Stop/change					
		Completed					
		Stop/change					
		Completed					
		Stop/change					
		Completed					
		Stop/change					

**ANNEX 3: MEDICINES WASTAGE AWARENESS**

**Demographic Information**

- 1) Age..... 2) Sex ..... 3) Ward/Unit.....
- 4) Title..... 5) Education level.....
- 6) For how long have you been working in this section Years.....Months.....

**Management of patient’s medicine leftovers**

- 7) Do medicines remain as leftovers from patients in wards? **Yes/No.....**
- 8) Is there any procedure to handle medicine remaining as leftovers **Yes/No.....**
- 9) What do you do with medicine leftovers?

- 10) What are the possible reasons for medicine to remain? (Rank according to superiority)
  - i) Patient death (.....)
  - ii) Poor patient adherence (.....)
  - iii) Change/Stop of medicine by clinician (.....)
  - iv) Over supply from the pharmacy (.....)

- 11) Is there any time when patients buy medicines outside the hospital pharmacy?  
**Yes/No.....**

- 12) If yes which medicines are frequently bought by patients?  
.....  
.....  
.....

**THANKS FOR PARTICIPATING**

**ANNEX 4: UFAHAMU KUHUSU UPOTEVU WA DAWA****Taarifa binafsi**

- 1) Umri..... 2) Jinsia..... 3) Wodi..... 4) Cheo cha kazi.....  
5) Kiwango cha elimu.....

6) Ni muda gani umefanyia kazi katika wodi hii? Miaka..... Miezi .....

**Utunzaji wa dawa wanazobakiza wagonjwa**

7) Je katika wodi unayo fanya kazi, hutokea mgonjwa/wagonjwa wakabakiza dawa?

**Ndio/Hapana.....**

9) Je kuna utaratibu wowote uliowekwa wa namna ya kuzishughulikia dawa zilizobakizwa na mgonjwa? **Ndio/Hapana .....**

10) Je, dawa wanazobakiza wagonjwa wewe huwa unazifanyaje?

11) Kwa mawazo yako ni nini husababisha mgonjwa/wagonjwa kubakiza dawa? (Panga kwa mfuatano wa umuhimu wake)

- i. Mgonjwa kufariki (.....)
- ii. Mgonjwa kushindwa kuzingatia matumizi sahihi ya dawa (.....)
- iii. Daktari kubadilisha/kusimamisha matibabu (.....)
- iv. Famasi kutoa dawa nyingi kuliko zilivyokuwa zinahitajika (.....)

11) Je kuna wakati ambapo wagonjwa hulazimika kujinunulia dawa nje ya hospitali?

**Ndio/Hapana**

12) Kama ni ndio ni aina zipi za dawa ambazo wagonjwa hujinunulia mara kwa mara?

.....  
.....

**AHSANTE KWA KUSHIRIKI**



**ANNEX 6: INFORMED CONSENT FORM (ENGLISH VERSION)**

This is an informed consent form for the study titled ‘Medicine Wastage and associated factors: A case study at Muhimbili National Hospital’. This study is sponsored by the Ministry of Health and Social Welfare together with Muhimbili University of Health and Allied Sciences. The purpose of this study is to assess medicine wastage and its associated factors at Muhimbili National Hospital. The Principal Investigator is Florah B Makenya, supervised by Dr. G Kagashe.

**RISKS AND DISCOMFORT:** We do not foresee any risks and discomfort from your participation in this study.

**VOLUNTARY PARTICIPATION:** Your participation is completely voluntary and you may choose not to participate at any time. Your decision not to volunteer will not influence the treatment you may be receiving either now or in future.

**WITHDRAWAL FROM THE STUDY:** You can stop participating in the study at any time for any reason. If you so decide, your decision to stop participating or to refuse to answer particular questions will not affect your relationship with the researcher or any other associated with this project.

**CONFIDENTIALITY:** All information you supply during the research will be held in confidence and unless you specifically indicate your consent, your name will not appear in any report or publication of the research. Your data will be safely stored in locked facility and only research staff will have access to this information. Confidentiality will be provided to the fullest possible law.

**QUESTIONS ABOUT THE RESEARCH:** If you have questions about the research in general or about your role in the study please feel free to contact Ms. Florah B. Makenya Mobile number +255 713 788423, email; [kasana224@yahoo.co.uk](mailto:kasana224@yahoo.co.uk) or Dr. G. Kagashe mobile number +255 713310511

**LEGAL RIGHTS AND SIGNATURES:**

I.....(*fill in your name here*) consent to participate in .....(*Insert study name*) conducted by .....(*insert investigator name*). I have understood the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form. My signature below indicates my consent.

**Signature.....Date.....**  
Participant

**Signature.....Date.....**  
Principal investigator



**ANNEX 7: FOMU YA MAOMBI YA RIDHAA**

Hii ni fomu ya maombi ya ridhaa kwa utafiti wa ‘Upotevu wa Dawa na visababishi vyake katika Hospitali ya Taifa ya Muhimbili’. Utafiti huu unafadhiliwa na Wizara ya afya na Ustawi wa jamii pamoja na Chuo Kikuu cha Afya na Sayansi Shirikishi Muhimbili. Lengo kuu la utafiti huu ni kutathimini upotevu wa dawa na visababishi vyake katika Hospitali ya Taifa ya Muhimbili. Mtafiti mkuu ni Florah B. Makenya akisimamiwa na Dr. G Kagashe.

**MADHARA YA UTAFITI:** Hatutegemei madhara wala hatari yoyote kwa ushiriki wako kwenye utafiti huu.

**USHIRIKISHWAJI KWA HIARI:** Ushiriki wako katika utafiti huu ni wa hiari na unaweza kuamua kutoshiriki muda wowote ule.

**KUJITOA KWENYE UTAFITI:** Unaweza kujitoa kwenye utafiti muda wowote ule na kwa sababu yeyote ile. Maamuzi yako ya kuamua kujitoa/ kutokushiriki hayataathiri mahusiano baina yako na mtafiti au watafiti.

**USIRI WA TAARIFA:** Taarifa zote utakazo toa wakati wa utafiti zitatunzwa kwa siri, hali kadharika jina lako halitaonekana kwenye ripoti ya utafiti. Taarifa zitatunzwa sehemu salama ambapo ni watafiti tu watakaoruhusiwa kuzitumia kwa kufanikisha utafiti tu na si vingenevyo.

**MASWALI JUU YA UTAFITI:** Kama una swali au maswali kuhusu utafiti huu au ushirikishwaji wako kwenye utafiti, tafadhali jisikie huru kuwasiliana an Bi Florah B. Makenya simu ya kiganjani namba +255 713 788423, email; [kasana224@yahoo.co.uk](mailto:kasana224@yahoo.co.uk) au Dr. G. Kagashe (Msimamizi mkuu wa utafiti) simu ya kiganjani namba +255 713 31 05 11

**HAKI ZA KISHERIA NA SAINI;**

Mimi.....(andika jina lako) naridhia kushiriki katika utafiti wa  
 .....(andika jina la utafiti) unaofanywa  
 na.....(andika jina la mtafiti). Nimesoma maelezo ya utafiti huu nimeona  
 umbile la kazi hii, faida zake, madhumuni yake. Ushiriki katika tafiti hii si wa kulazimishwa  
 na nimeona hauna madhara kwa yeyote na yale yatakayotokea ni mambo ambayo  
 hayatarajiwi.

**Saini.....Tarehe.....**  
 Mshiriki

**Saini.....Tarehe.....**  
 Mtafiti