

**ASSESSMENT OF PRESCRIBING AND ADMINISTRATION
ERRORS IN MEDICATION USE PROCESS AT THE UNIVERSITY
TEACHING HOSPITAL IN LUSAKA, ZAMBIA**

By

Martin Kampamba

**A dissertation submitted to the University of Zambia in partial
fulfilment of the requirements of the degree of Master of Clinical
Pharmacy**

THE UNIVERSITY OF ZAMBIA

LUSAKA

2014

DECLARATION

I **Martin Kampamba** declare that this dissertation represents my own work and that all the sources I have quoted have been indicated and acknowledged by means of complete references. I further declare that this dissertation has not previously been submitted for a Master degree, diploma or other qualifications at this or another University.

Signed.....

Date.....

CERTIFICATE OF APPROVAL

The University of Zambia approves this Dissertation of Martin Kampamba in Partial Fulfilment of the requirement for the award of the Degree of Master of Clinical Pharmacy

Signature for examiner one.....Date.....

Signature for examiner two.....Date.....

Signature for examiner three.....Date.....

Signature of principle supervisor.....Date.....

DEDICATION

To God Almighty, for His divine wisdom and guidance throughout my dissertation. To my wife Patricia and children Wandi and Bongani for their unwavering support throughout this project.

To my mother, father, brothers and sisters for their support and prayers too.

ACKNOWLEDGEMENTS

My sincere and utmost gratitude to the following for their contribution and support towards this Dissertation;

My Supervisor Dr L.T.Muungo for all the academic and technical support rendered during and completion of this Dissertation. Dr .B Vwalika my Co-supervisor who guided me through proposal development and for his untiring guidance, corrections and contributions throughout this dissertation.

Dr P. Yassa my Co-supervisor who provided guidance and statistical analysis of the data.

Dr Y. Ahmed who provided technique support, untiring guidance, corrections and contributions

The members of staff at the Pharmacy Department, University of Zambia who guided me during and completion of this dissertation

ABSTRACT

Background: Medication errors can occur at any of the five steps of the medication use process: prescribing, transcription, dispensing, administration and monitoring.

AIM: This study aimed to ascertain the incidence and types of prescribing and administration errors.

METHODS: The study was a prospective cross-sectional study of prescribing and administration errors. Prospective review of treatment charts to detect prescribing errors and prospective observation of nurses preparing and administering drugs to detect administration errors. The study was conducted in the Departments of Internal Medicine, Obstetrics/Gynaecology and Surgery at University Teaching Hospital, Lusaka, Zambia, from December 2013 to March 2014. The study population comprised adult inpatients admitted to the hospital and nurses administering medications to inpatients. The main outcomes of the study were the incidence and types of prescribing and administration errors.

RESULTS: A total of 385 patients were studied over 16 weeks. For these Patients, a total of 438 medication orders were written. There were 159 prescribing errors, resulting in an overall prescribing error rate of 36.3%. The most common type of prescribing errors were improper frequency (7.3%), medication omission (5.0%), improper dose (4.8%) and omitted duration (4.6%). 197 administration errors were identified out of the same 438 written medication orders, giving in an overall administration error rate of 45% . The most common type of administration errors were medication omission (23.1%), wrong time (18.9%) and wrong dose (1.6%)

CONCLUSION: Prescribing and medication administration errors are common in adults at UTH and there was variation in the error rates across the departments studied. The severity and causes of prescribing and administration errors need to be investigated so that improvements strategies can be employed.

TABLE OF CONTENT

Declaration	i
Certificate of approval	ii
Dedication	iii
Acknowledgements	iv
Abstract	v
Table of content	vi
List of tables and graphs	ix
Acronyms	x
Operational definitions	xi

CHAPTER 1

Page(s)

1.0	Background and Introduction	1
1.1	Statement of the problem	3
1.2	Research Question	3
1.3	Study Justification	3
1.4	Literature review	4

CHAPTER 2

2.0	Aim of the study	8
2.1	Specific objectives	8

CHAPTER 3

3.0	Methodology	9
3.1	Study Design	9
3.2	Study Setting	9
3.4	Study Population	9
3.5	Inclusion Criteria	9

3.6	Exclusion Criteria	9
3.7	Sample Size Determination and Sampling	9
3.8	Variables	10
3.9	Data Collection Techniques	11
3.11	Validity	12
3.12	Reliability	12
3.13	Pre-testing	12
3.14	Data Analysis	13
3.15	Ethical Considerations and Approval	13
3.16	Plan for dissemination and utilization of the study finding	13
CHAPTER 4		
4.1	Presentation of results	14
4.11	Incidence and types of prescribing errors	14
4.12	Incidence and types of administration errors	16
CHAPTER 5		
5.0	Discussion	18
5.1	Study limitations	21
5.2	Conclusion	21
5.3	Recommendation	22
6.0	References	23
APPENDICES		
	Appendix i : Budget	28
	Appendix ii: Work plan schedule	29
	Appendix iii: Data collection form for administration errors	30
	Appendix iv: Data collection form for prescribing errors	31
	Appendix v: Criteria for prescribing and administration errors (ASHP 1982)	32

Appendix vi: Information sheet	33
Appendix vii: Informed consent form	35
Appendix viii: Letter for ethical approval	36
Appendix ix : Letter for permission to conduct a research	37

LIST OF TABLES AND FIGURES

Title	Page
Table 1: Number and percentages of various types of prescribing	14
Table 2: Prescribing error rate by category across all departments	15
Table 3: Number and percentages of various types of administration errors	16
Table 4: Administration error rate by category across the departments	17

LIST OF GRAPHS

Title	Page
Figure 1: Comparison of prescribing errors rates across all departments	15
Figure 2: Comparison of administration error rates across all departments	17

ACRONYMS

ASHP American Society of Health-System Pharmacists

FDA Food and Drug Administration

UNZA University of Zambia

UTH University Teaching Hospital

WHO World Health Organization.

USA United States of America

UK United Kingdom

IOM Institute of Medicine

ADRs Adverse Drug Reactions

OPERATIONAL DEFINITIONS

In this research dissertation the terms were interpreted as follows;

Administration

The right medication to the right patient in the right way at the right time.

Dispensing

Dispensed medication is concordant with prescribed drug in nurse medication chart.

Transcription

An identical copy of prescription in medical records.

Medication Error (ASHP 1982)

Any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures, and systems, including prescribing; order communication; product labelling, packaging, and nomenclature; compounding; dispensing; distribution; administration; education; monitoring; and use.

Administration Errors (ASHP 1982)

An error originating during the process directly associated with medication administration at the nursing unit.

Monitoring Errors (ASHP 1982)

Failure to review a prescribed regimen for appropriateness, or failure to use appropriate clinical or laboratory data for adequate assessment of resident response to prescribed therapy.

Missing or Inaccurate Allergy Information

Order received in pharmacy without proper allergy information or allergy information conflicting with existing pharmacy database.

Drug/Allergy Interaction

Patient had a known allergy to, or a possible cross-sensitivity to, prescribed medication; pharmacist intervention required to alter therapy.

Improper Dose/Quantity or Omitted Dose/Quantity

Improper dose strength was prescribed or dose strength was omitted from the medication order.

Nomenclature/Wrong Formulation

This would include failure to specify medication formulation when more than one formulation was available.

Improper or Omitted Route of Administration

Improper route of administration was prescribed or route was omitted from medication order.

Improper or Omitted Frequency

Incorrect medication frequency was prescribed or omitted from the order.

Medication Omission Error

Prescriber inadvertently omitted a medication or treatment from admission, transfer, or postoperative orders. Also includes a patient having an indication for which no treatment or inadequate treatment was prescribed.

Medication Duplication

Two or more medications in the same therapeutic class were prescribed for the patient resulting in unnecessary therapeutic duplication.

Drug-Drug Interaction

A medication was prescribed that had a potential interaction with current drug regimen; pharmacist intervention was required to alter therapy.

Drug-Food Interaction: A medication was prescribed that had a potential interaction with current dietary orders; pharmacist intervention was required to alter therapy.

Incorrect Medication or Unspecified Medication

Medication ordered was not appropriate for patient based on indication, patient-specific variables, or clinical status. Orders for “patient may take own medication(s)” without specifying the exact medication and directions would also fall into this category.

Unauthorized Drug

This category would include restricted medications ordered by a prescriber who was not authorized to do so at our institution (e.g., an antibiotic restricted for use by the infectious diseases service only). A medication was ordered that was not on the formulary at our institution.

Incorrect Treatment Duration

Medication was prescribed without an appropriate stop time when such is indicated (eg, injectable diclofenac and Dexamethasone injection (used Obstetrics/Gynaecology for lungs maturation) without the 2-day limit specified).

Illegible Order

Order received in the pharmacy that could not be processed owing to illegible handwriting, inappropriate abbreviation(s), and/or difficulty in interpreting what was meant by the order. This required further clarification with the prescriber and/or chart review.

Missing or Inaccurate Height/Weight

Patient's height and/or weight were missing or inaccurate where needed for height- and/or weight-based medication doses (eg, chemotherapy).

Improper/Omitted Medication Rate

The medication rate (when required) was omitted or incorrect for the specific medication, patient-specific variables, and/or clinical status.

Omission Error :The failure to give an ordered dose.

Wrong Dose Error

An amount of medication is given that differs from that ordered by more than 17% (10% for injectable).

Unordered Drug Error

A medication is administered that was never ordered for that patient.

Wrong Form Error

A dose is given in a different form than what was ordered.

Wrong Time Error

A administration of a dose more than 60 minutes before or after it is due.

Wrong Route Error

A medication is administered using a different route than was ordered.

Deteriorated Drug Error

The drugs are expired, or the physical or chemical integrity of a medication's dosage form has been compromised.

Wrong Rate of Administration Error

Infusions or intravenous fluids are administered at a rate other than that which was prescribed

Wrong Administration Technique Error

Failing to wipe an injection site with alcohol prior to administering an injection.

Wrong Dose Preparation Error

Administering an oral suspension without shaking the container.

CHAPTER ONE

1.0 BACKGROUND AND INTRODUCTION

Medication errors are serious problems throughout the world and have become a major public health concern (Lisby *et al.*, 2005; Prot *et al.*, 2005). Medication errors as defined by the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) are any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professionals, patients or consumers (Joshi and Roy, 2005).

According to an internal audit of pharmacy records on self-reported pharmaceutical interventions made between February 2011 to July 2011 at University Teaching Hospital (UTH) Internal Medicine Satellite Pharmacy, the prescribing and administration error rates were approximately 37% and 41% respectively. These prescribing and administration errors have not been quantified and no literature was published in Zambia at the time of study

A growing body of evidence shows that medication errors are a well-recognized problem in hospitals (Lisby *et al.*, 2005). Medication errors are one of the major causes of adverse drug reactions (ADR) in hospitals resulting in disability and death in up to 6.5% of admitted patients (Brennan *et al.*, 2004, Bates *et al.*, 1995). In 1999, medication errors in United States of America (USA) were attributable to 8th leading cause of death and it was estimated that up to 98 000 Americans might have died annually as a result of medication errors (Kohn *et al.*, 1999). Thomas *et al.*, (1999) suggest that medication errors have vast economic impact on healthcare and patients. Medication errors occur in all types of patients and at any stage of medication use process (prescribing, transcription, preparation, dispensing, administration and monitoring). Their proximal causes can be associated with physicians, pharmacists, nurses, caregivers or patients (Norton, 2001).

The following factors have been identified as the major causes of medication errors: Over-load of work on health professionals; Lack of expertise and training; Poor communication among professionals in the care process; Lack of appropriate technologies (computer aided diagnosis and prescription); Poor labelling; Prescription errors (ineligibility of physician's hand writing and typographical errors); Non

cohesion in the handing over; Victimized culprits of error leading to non-reporting; Non-involvement of patients and or their relatives in the care process (Kilbridge and Classen, 2001).

The majority of errors in the medication use process occur at the administration stage (median of 53% of all errors) followed by prescribing stage (17%) (Krahenbulh-Melcher et al, 2007) .In a recent study done by Lewis et al (2009), prescribing errors have been found to affect a median of 7% of medication orders, 2% of patient days and 50% of hospital admissions.

Prescribing errors may be defined as the incorrect drug selection for a patient (Williams, 2007). These errors involve: prescribing missing or inaccurate allergy information; improper or omitted dose; omitted route of administration; improper or omitted frequency; medication omission; medication incorrect or unspecified medication; duplication; drug/allergy interaction; wrong formulation; potential drug/drug interaction requiring pharmacist intervention to alter therapy; drug/food interaction; unauthorized drug; incorrect treatment duration; illegible order; missing or inaccurate patient height and/or weight (if required); and improper medication infusion rate (Bobb *et al.*, 2004).

For the purpose of this study, administration errors will be defined as the administration of a dose of medication that deviates from the prescription, as written on the patient medication chart, or from standard hospital policy and procedures (Ghaleb *et al.*, 2010). Administration errors will be classified into 10 categories in accordance with the classification developed by the American Society of Hospital Pharmacy. The categories include: timing errors (greater than 1-hour difference compared with the ordered time), omission, unordered drug, wrong generic drug, wrong dosage, wrong formulation, wrong route, deteriorated drug, technical error in preparation or administration (e.g. wrong infusion flow rate or wrong diluent), and extra dose (Prot *et al.*, 2005).

This study therefore sought to assess the types and incidence of prescribing and administration errors in medication use process in Internal Medicine, Obstetrics/Gynaecology and Surgical departments at UTH.

1.1 STATEMENT OF THE PROBLEM

There is overwhelming evidence published in literature suggesting that medication errors are one of the major causes of mortality and morbidity. Even though no more than 10% of medication errors cause an ADR, these errors have serious implications for patients, families, and health care providers (Barker, 2002). As a consequence, the Pharmacy Department at UTH in Lusaka instituted an internal audit of self-reported pharmaceutical interventions in order to document and address medication errors. The audit was conducted in the Internal Medicine Satellite Pharmacy between February and July 2011 to ascertain the impact of pharmacists' interventions. The raw data calculations showed that prescribing and administration error rates were found to be approximately 37% and 41%, respectively. This demonstrated the need to further investigate medication error rates within other departments.

This study also looked at the types of prescribing and administration errors and indicated whether difference in the error rates in various departments were statistically significant. Literature review revealed that there was no published information of similar research having been undertaken at UTH.

In other healthcare settings, several attempts such as improving manpower, having a robust drug distribution systems and using computerized prescriber order entry in which prescribers write orders online have been made to reduce medication errors but to date, there is little evidence that patient safety has improved (Leape and Berwick, 2005).

1.2 RESEARCH QUESTION

What is the type and incidence of prescribing and administration errors in Internal Medicine, Obstetrics/Gynaecology and Surgery Departments at UTH?

1.3 STUDY JUSTIFICATION

Medication errors are accounted to be the seventh most common cause of death in general (Moyen et al, 2008). Prescribing and administration errors can prolong patient's hospital stay resulting in increased healthcare cost for the patients, families and health professional (Barker, 2002). Since the magnitude of errors at prescribing and administration stages in medication use process at UTH was unknown, it was imperative that the study was conducted to ascertain the incidence and types of prescribing and administration errors. The results of this study would be used by

nurses, physicians, surgeons and pharmacists to: improving patient safety; establish interdisciplinary consensus on medication-use processes; stimulate improvements in medication-use processes; identify areas in the drug distribution system which might require improvement to reduce incidence of medication errors in hospitals; and stimulate standardization in medication-use process.

1.4 LITERATURE REVIEW

Franklin *et al* (2011) reported that medicating errors harm about 1 to 2% of inpatients, the majority of which are related to prescribing and administration errors .Medication errors are a significant cause of patient morbidity and mortality (Hussain and Kao, 2005). The majority of medication errors happen at the administration stage (median of 53% of all errors) followed by prescribing stage (17%) (Krahenbulh-Melcher *et al.*, 2007). The administration stage comes out to be principally very susceptible to errors because of lack of system checks as the majority of medications are administered by a single nurse (Carabrase *et al.*, 2001). The Institute of Medicine (IOM) USA and National Patient Safety Agency (NPSA) of the United kingdom(UK) both do acknowledge that the majority of errors are not as the consequence of irresponsible actions on the part of a health care team, however occur as a consequence of the haste and complexity of the medication-use cycle (Williams, 2007).

According to Williams (2007), the incidence of medication errors differ very widely depending on the definition used, hospital setting and methodology used. A four week prospective study in UK of 36,200 prescriptions revealed that of the 1.5% of prescribing errors identified, 25% of those errors were rated as potentially serious. When only severe errors were scrutinized, 58% of the errors emanated from prescribing decision and 42% in medication order writing. In the UK, 9% of in-patients are affected by medication errors at the prescribing stage making prescribing errors very common (Vincent *et al.*, 2009).

Another study was conducted in the UK on prescribing errors in three different hospitals of which included at least one medical admission ward and at least one surgical ward. The incidence of prescribing errors was found to be 14.7%. The three most common types of prescribing errors were omission, incorrect dose and incomplete prescriptions (Bryony *et al.*, 2011). The frequency of errors identified from the medical admissions wards was considerably higher than the frequency of errors on the surgical admission wards owing to a variation in the prevalence of omission errors. The incidence of erroneous orders identified also varied considerably among the organization (Bryony *et al.*, 2011). Factors

cited to contribute to prescribing errors included: lack of information from primary care about patients; chart design which was demonstrated in one hospital with errors occurring due to the lack of a section detailing the maximum allowable doses or frequencies; a lack of standardisation of how certain drugs were prescribed; and poor documentation of prescribing decisions (Bryony et al, 2011).

It was noteworthy to indicate that prescribing error rates differ among various healthcare settings as evidenced in the study on prescribing errors by Bryony et al (2011). The study done by Bryony et al (2011) was conducted at three different healthcare organisations of which included at least one medical admissions ward and at least one surgical ward. In order to have a good number of opportunities for errors and eliminate some form of bias. This study conducted at UTH on prescribing and administration errors was not restricted to at least one medical admissions ward and at least one surgical ward, but it also included all the wards falling under Internal Medicine, obstetrics/gynaecology and surgical departments.

A study on epidemiology of prescribing errors was conducted at a 700-bed academic medical center in Chicago giving an overall prescribing error rate of 6.2 per 100 medication orders. Most of these errors (64%) occurred at admission stage (Bobb et al, 2004). Pharmacists who participated in this study were asked to set aside all physician orders that contained a prescribing error that required their intervention to correct. These errors involved were those found during clinical monitoring, clinical rounds and telephone calls. The Pharmacists identified potential prescribing errors using : their own professional knowledge; the pharmacy computer system(which has drug-interaction and drug/allergy checking capacities);Computer access to current laboratory value and Clinical guidelines published in staff manual and Reference text (Bobb et al., 2004).

Prescribing error rates have been found to vary according to the prescribing stages (admission stage, hospital stay stage and discharge stage) as evidenced in a study conducted by (Bobb *et al.*, 2004) where 64% of prescribing errors occurred at admission stage. The study that was conducted at UTH on prescribing and administration errors also include admission wards just as the study done by Bobb *et al.*,(2004) on epidemiology of prescribing errors. The prescribing errors were identified using pharmacy professional knowledge, pharmacy computer system installed at pharmacy department UTH and

clinical reference material such as British National Formulary (BNF) 2013 and any relevant material with evidence based information.

Administration errors are reported to arise in one in five medication dosages (Barker et al, 2002). Such events have long been examined; with the major focus being the practice of nurses and their responsibility in medication errors since administration errors contribute directly to patient morbidity and mortality (Tissot et al, 2003; Barker et al, 2002a). In New Zealand a study was conducted to survey recent literature associated with medication administration errors (McBride and Foureur, 2006). Two observational studies established that administration error rates in the acute-care setting were 14.9% and 32.4% (Tissot et al 2003; Schneider et al 1998). The medication error rate for intravenous medications is considerably higher than other types of medications, with researchers observing preparation error rates of 26% and administration error rates of 34% (Wirtz *et al.*, 2003). It is noteworthy to mention that most studies classified preparation errors under administrations errors (Prot et al, 2005; ASHP, 1982) which was not the case with a study done by Wirtz *et al.*, (2003).

In this study, preparation errors were classified under administration errors because administration of drugs to the patient is a process which encompasses preparations of medications such as reconstitution of powdered injectable.

Ghaleb et al (2010) reported that prescribing and administration errors are common in paediatric inpatients in the UK with the incidence of prescribing and administration errors being 13.2% and 19.1% respectively. Evidence suggests that the incidence of medication errors and consequent injury could be higher in children than in adults (Kaushal *et al.*, 2001; Ghaleb *et al*, 2010). This may possibly be due to the fact that majority of drug doses in paediatric medication are calculated individually, based on the patient's age, weight, body surface area and/or their clinical condition. Additionally, most of the drugs administered in children are unlicensed or off-label (Choonara and Conroy, 2002; Ghaleb *et al*, 2009).The incidence of both prescribing and administration errors varies between children and adults. Therefore, this study focused on medications prescribed to adult patients to allow for good comparison with similar studies in adults.

According to Lisby *et al.*, (2005) the medication error rate observed at Aarhus University Hospital in Denmark was 43%. In each phase of medication use process, the frequency of medication errors were 39% at prescribing; 56% at transcription; 4% at dispensing; 41% at

administration; and lastly discharge summaries at 76%. Notably, medication errors occurring at the stage of prescribing and administration were among the most common types of medication errors observed adding to the emerging body of evidence that prescribing and administration stages are principally very susceptible to medication errors (Krahenbulh-Melcher *et al.*, 2007).

A survey by Labuschagne *et al.*, (2011) reported the occurrence of medication errors related to drug administration by anaesthetists in public hospitals in the Free State Province, South Africa. The study suggested that drug administration errors were a problem in anaesthesia as 40% of respondents admitted having made a drug administration error at some stage in their career.

Labuschagne *et al.*, (2011) did not use the observation method which is regarded as a gold standard method of detecting administrating errors. The observation method has the advantage of detecting more active errors than other methods and is considered to be accurate (Allan., 1990; Tissot., *et al* 2003). The drawbacks of observation method are those relate to its cost and potential concerns about confidentiality (Tissot *et al.*, 2003).

Since there are variations in the incidences and types of prescribing and administration errors across the continuum of care as shown in the studies included in this review of literature, it was prudent that a study be done at the UTH to ascertain the incidence and types of prescribing and administration errors in clinical practice.

CHAPTER 2

2.0 GENERAL OBJECTIVE

To assess prescribing and administration errors in the medication use process at University Teaching Hospital in Lusaka, Zambia.

2.1 SPECIFIC OBJECTIVES

- 2.1.1** To determine the incidence of prescribing and administration errors.
- 2.1.2** To determine the types of prescribing and administration errors.
- 2.1.3** To compare the incidence of prescribing and administration errors among Internal Medicine, Obstetrics/Gynaecology and Surgery Departments at UTH

CHAPTER THREE

3.0 METHODOLOGY

3.1 STUDY DESIGN

The study was a descriptive cross-sectional study of prescribing and administration errors.

3.2 STUDY SETTING

The study was conducted in the Department of Internal Medicine, of Obstetrics/Gynaecology and of Surgery at UTH, Lusaka, Zambia, from December 2013 to March 2014.

3.3 DATA SOURCE

Patient files and drug charts for in-patients admitted to UTH were used as source of data

3.4 STUDY POPULATION

Hospital inpatients, aged 18 years or over

Nurses who administer medications in Internal Medicine, Obstetrics/Gynaecology and Surgery Departments

Medical Doctors prescribing drugs in Internal Medicine, Obstetrics/Gynaecology and Surgery Departments.

3.5 INCLUSION CRITERIA

Nurses administering medications to inpatients in Internal Medicine, Obstetrics /Gynaecology and Surgery Departments .Patients over 18 years old for easy comparison of the results with those of adult as incidence of medication errors varies between adults and children in hospital settings (Choonara and Conroy, 2002; Ghaleb , 2009).

Medical Doctors prescribing drugs in Internal Medicine, Obstetrics/Gynaecology and Surgery Departments

3.6 EXCLUSION CRITERIA

All out-patients, Student Nurses and all nurses except those in departments under study.

3.7 SAMPLE SIZE

$$N = \frac{Z^2 P (100-P)}{e^2}$$

N=sample size

P= prevalence (In this case going by global prevalence on the subject, P=50%)

Z= standard value corresponding to a particular confidence level (in this case CL is 95% and therefore Z is 1.96)

e=marginal error = 5 %

$$N=1.96^2 \times 50 (100-50)/5^2$$

$$N= 385$$

The sample size was divided among the three departments by the use of probability-proportion to size. The average number of admission per month in

Obstetrics/Gynaecology, Surgery Departments and Internal Medicine were about 3570, 1,751 and 904 respectively.

Hence, 200 in Obstetrics/Gynaecology, 100 in Surgery and 85 treatment charts in Internal Medicine were screened for prescribing and administration errors. The in-patients were selected using systematic sampling method .The sampling Interval was: sample size divided by study population. For Internal Medicine = $385/85=5$. This meant that every fifth treatment chart was evaluated. Obstetrics/Gynaecology= $385/200=2$. This meant that every second treatment chart was evaluated. Surgery: $385/100 = 4$. This meant that every fourth treatment chart was evaluated.

3.8 VARIABLES

The criteria for classifying medication errors were based on the American Society of Health System Pharmacists (ASHP) definitions (ASHP 1982). However, this study did not include treatment time of antibiotic in the definition of prescribing errors because the formatted inpatient drug chart used at UTH does not include the column for duration of treatment

VARIABLES

VARIABLE	DEFINITION	SCALE
Administration errors	Administration errors were defined as follows: Omission of drug, wrong dose , unordered drug , wrong form , wrong time , wrong route, deteriorated drug, wrong rate of administration , wrong administration technique , wrong dose preparation	Categorical

Prescribing errors	Drug/Allergy Interaction, Improper Dose, Omitted Dose, wrong Formulation, Improper or Omitted Route of Administration, Improper or Omitted Frequency, Medication Omission, Medication Duplication, Drug/Drug Interaction, Drug/Food Interaction, Incorrect Treatment Duration, Incorrect Medication or Unspecified Medication, Improper/Omitted Medication Rate	Categorical
---------------------------	---	-------------

3.9 Data Collection Techniques

Medication errors were detected by the use of two methods namely;

Direct Observation Method

Data collection comprised five successive days of direct observation in each ward: four days were in the daytime and one during evening shift. According to (Donchin (1995) and Van den Bemt (2002), medication errors are common during the day than at night. The observed nurses were selected by convenience sampling as most drugs are administered by a single nurse (Carabrase et al., 2001). This method was selected to aid the reliability of data collection as it has been shown to be valid and accurate (Berdot *et al.*, 2012; Allan and Barker,1990). At the start of the observation period, each nurse gave written consent and had the option of refusing to take part.

Treatment Chart Review

Treatment charts and files of all inpatients in the study were prospectively screened for medication errors. The screening verified that all eligible prescriptions in the medication chart were identical to the prescriptions in the medical notes, and examine whether the prescriptions charts were unambiguous. The patients who were involved in more than one sample during the observational study, only new and changed prescriptions were screened. Each treatment chart was counted only once, regardless of how many times it was seen; each medication could be linked with more than one error. For each prescribed and administration stage in the medication process a structured register data collection tool was developed and pre-tested. The basic data in study was the number of actual errors divided by the total number of opportunities for errors. For omission errors, if the patient refuses the medication, the opportunity for errors was counted provided the nurse

responsible for administering the medication tried to give it. Doses that were withheld according to policies calling for withholding of medication doses such as nothing by mouth before surgery or hold until liver function or renal function improve were not counted as errors or opportunity for errors. Omission of duration of treatment for antibiotics was not counted as errors. Omission of duration of treatment was only counted as errors if it was not indicated for diclofenac injection 75mg twice daily IM and dexamethasone 6mg IM twice daily (used in Obstetrics/Gynaecology for fetal lung maturation) without the two days limit specified.

3.10 DATA COLLECTION TOOLS

Researcher's data collection forms for both prescribing and administration errors which were pre-tested. (Appendix III and IV)

3.11 VALIDITY

This study employed two types of data collection tools to collect prescribing and administration errors. To ensure validity of data collection tools, pre-testing of the instruments was done in the medical admission ward at UTH to ensure precision. Where necessary, adjustments were made on the data collection tools.

3.12 RELIABILITY

Reliability of data collection forms for medication errors was achieved by conducting a pre-test. After the evaluation of the pre-test, the data collection forms were perfected and the deficiencies in the tools were completed by making necessary adjustments. The pre-testing also assisted in determining how much time was needed to identify and record the prescribing and administration errors. The observation method which was used to observe nurses preparing and administering medication was also selected in order to aid the reliability of data collection as it has been shown to be valid , efficient and accurate (Berdot *et al.*, 2012; Allan and Barker,1990)

3.13 PRE-TESTING

Pre-testing was done at Adult Medical Admission Ward at UTH which had similar characteristics with wards of the main study sites. Pre-testing assisted to ascertain whether the variables were realistic, attainable and measurable. It equally helped to strengthen methodology, detect errors in the data collection forms and assessed the duration of observing nurses preparing and administer medication. After the pre-testing, some information was removed and other information was included in order to ensure quality data collection.

3.14 DATA ANALYSIS

To reduce on errors double entry was done, range and consistent checks were conducted. The data was analysed using Statistical Package for Social Science (SPSS) version 16.0. (SPSS Inc., Chicago, IL, USA) For categorical variables, data was expressed as number and percentage. Histograms and Tables were used to present the data. A Pearson-Chi-square test was used to compare the error rates among the departments. All statistical tests was two sided with a p value < 0.05 considered statistically significant.

3.15 ETHICAL CONSIDERATIONS AND APPROVAL

Permission to conduct this study at UTH was obtained from UTH Management. An application for formal ethical approval was sent to the UNZA biomedical Research Ethics Committee. Nurses in Internal Medicine, Obstetrics/Gynaecology and Surgery Departments were informed verbally and in writing about the purpose of the observational study, but not about chart reviews. Because of the professional obligation, the researcher ethically intervened after consultation if the medication error was observed and considered to be potentially harmful and the intervention was made before the medicine was administered to the patient. All medication errors prevented were entered for data analysis. The medical records were not taken away from the hospital and the results of this study would only be disseminated to the designated authorities. The informed consent was obtained from the nurse for the observation of administration of medicine.

3.16 PLANS FOR DISSEMINATION AND UTILIZATION OF THE STUDY FINDINGS

The finding from the research study would be disseminated to UTH management, Ministry of Health, Department of Pharmacy , Directorate of Research and Post Graduate studies at University of Zambia and Medical Library would each receive a copy. A symposium would be held at UTH at which the findings of the research study would be presented and discussed to come up with better ways of reducing medication errors.

CHAPTER FOUR

4.1 RESULTS

4.11 INCIDENCE AND TYPES OF PRESCRIBING ERRORS

A total of 385 patients were reviewed over 16 weeks. For these Patients, a total of 438 medication orders were written. Table 1 shows the 159 prescribing errors identified out of 438 written medication orders resulting in an overall prescribing error rate of 36.3%. The most common type of prescribing errors across all the departments were improper frequency (7.3%), medication omission (5.0%), improper dose (4.8%) and omitted duration (4.6%) as presented in Table 1.

Table 1 Number and percentages of various types of prescribing errors across all the three departments

Type of prescribing error	No of errors (% of all errors)	Examples
Improper frequency	32 (7.3)	Diclofenac IM 75mg three times instead of the correct frequency of twice daily
Medication omission	22 (5.0)	Multi-Drug Resistant TB patient receiving the first 6 months phase of treatment without addition of an injection (kanamycin or amikacin or capreomycin)
Improper dose	21 (4.8)	Cotrimoxazole 480mg once daily for PJP prophylaxis instead of correct dose of 960mg once daily (Full blood count and renal function tests normal)
Omitted duration	20 (4.6)	Diclofenac IM 75mg BID without specifying the maximum two days limit as recommended in the British National Formulary
Omitted route of administration	15 (3.4)	Metronidazole 500mg three times daily without route of administration indicated
Medication duplication	12(2.7)	Patient on Dexamethasone 8mg three times and Hydrocortisone 50mg four times. Both are corticosteroid.
Incorrect medication	12(2.7)	Ferrous Sulphate 200mg three times daily prescribed for the patient with megaloblastic anaemia (MCV 105FL, MCH 34.4 pg) instead of usual folic acid and Vitamin B ₁₂
Omitted frequency	8(1.8)	Furosemide 20mg IV prescribe without the frequency
Omitted dose	7(1.6)	Patient on Fixed dose combination antituberculoid drugs (4FDC p.o once daily without stating the dose
Improper route	5(1.1)	Gentamycin p.o 80mg three times instead of intravenously
Wrong formulation	3 (0.7)	Ciprofloxacin IV 500mg twice daily. Formulation available as an injection is 200mg
Drug/Drug interaction	2 (0.5)	Asthmatic patient on Aminophylline and Erythromycin 500mg four times daily. Erythromycin may increase plasma levels of aminophylline
Total Errors	159(36.3%)	

Incorrect medication means Medication ordered was not appropriate for patient based on indication, patient-specific variables, or clinical status. For error definition, check page X

Prescribing error rates varied across Internal Medicine (8.9%) Obstetrics/Gynaecology (16.0%) and in Surgery Departments (11.4%) as illustrated in Figure 1.

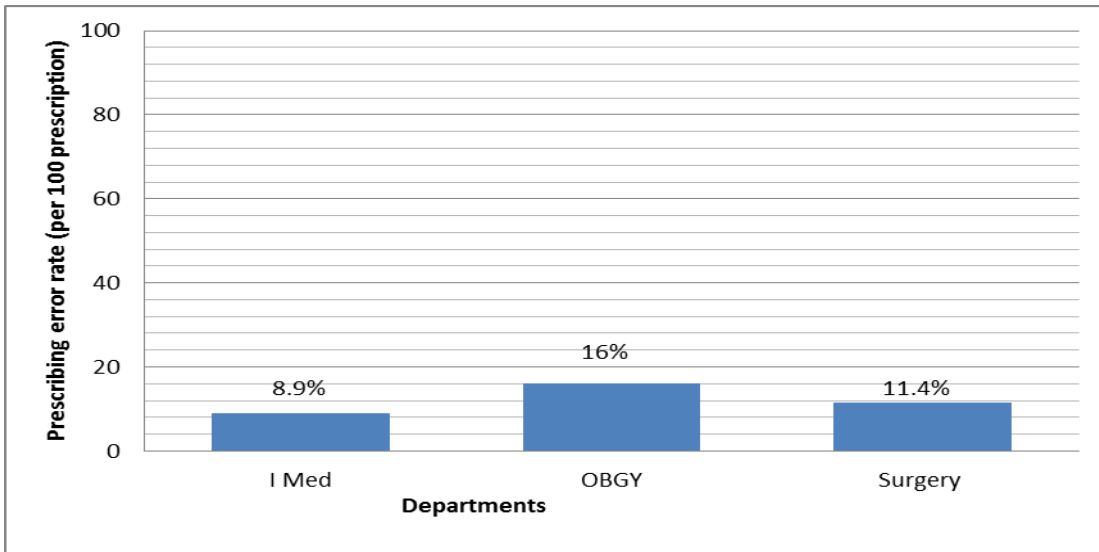


Figure 1 Comparison of prescribing errors rates across all the three departments I MED (Internal Medicine) OBGY (Obstetrics/Gynaecology) and Surgery

There was wide variation in the type of prescribing error rate across the three departments. The most common type of prescribing errors in Internal Medicine was medication omission, Surgery was improper frequency and in Obstetrics/Gynaecology, improper dose and improper frequency as shown in Table 2

Table 2 Prescribing error rate by category across all departments

Type of prescribing error	Internal Medicine	Obstetrics/Gynaecology	Surgery
Improper Dose	3 (0.7)	13(3)	5(1.1)
Drug/drug interaction	2 (0.5)	0(0)	0(0.0)
omitted route of administration	5 (1.1)	9(2.1)	1(0.2)
Omitted Dose	2 (0.5)	3(0.7)	2(0.5)
Improper Frequency	5 (1.1)	13(3)	14(3.2)
Omitted frequency	3 (0.7)	0(0)	5(1.1)
Omitted Duration	1 (0.2)	12(2.7)	7(1.6)
Medication Omission	11(2.5)	8(1.8)	3(0.7)
Medication Duplication	5 (1.1)	1(0.2)	6(1.4)
Incorrect Medication	2 (0.5)	8(1.8)	2(0.5)
Improper route	0 (0)	2(0.5)	3(0.7)
Wrong formulation	0(0)	1(0.2)	2(0.5)
Total errors	39(8.9)	70(16)	50(11.4)

The data is given as number (percentage) of the errors of each department.

4.12 INCIDENCE AND TYPES OF ADMINISTRATION ERRORS

A total of 30 nurses were observed preparing and administering 438 doses to 385 patients during 16 weeks of observation across the Internal medicine, Obstetrics/Gynaecology and Surgery departments at UTH. The same written medication orders (438) were used by nursing staff to determine the doses due at each medication round and to record their administration. There were 197 administration errors, giving in an overall administration error rate of 45 %. The most common type of administration errors were medication omission (23.1%), wrong time (18.9%) and wrong dose (1.6%) as shown in Table 3.

Table 3 Number and percentages of various types of administration errors across all the three departments

Type of administration error	No of errors (% of all errors)	Examples
Medication omission	101(23.1)	Patient on Ceftriaxone 2g twice a day missed the 06:00 and 18:00 doses
Wrong time	83 (18.9)	Patient on Metronidazole iv 500mg three times. First dose given at 06:00hrs second dose at 11:00 instead of correct time at 14:00
Wrong dose	7 (1.6)	The nurse give 0.25mg Digoxin instead of 0.125 prescribed
Wrong administration technique	2 (0.5)	The nurse administered 40mg iv of furosemide within 30 seconds instead of slowly (3-5min) as recommended by the manufacturers.
Wrong route	1 (0.2)	Metronidazole 500mg TDS intravenously given orally by the nurse
Unordered drug	3(0.7)	Tramadol was prescribed for the patient but the patient received ibuprofen which was not prescribed
Total Errors	197(45%)	

Wrong Time Error means administration of a dose more than 60 minutes before or after it is due. For error definition, check page x

Administration error rates varied across Internal Medicine (11.4%), Obstetrics/ Gynaecology (19.9%) and Surgery Departments (13.7%) as illustrated in Figure 2.

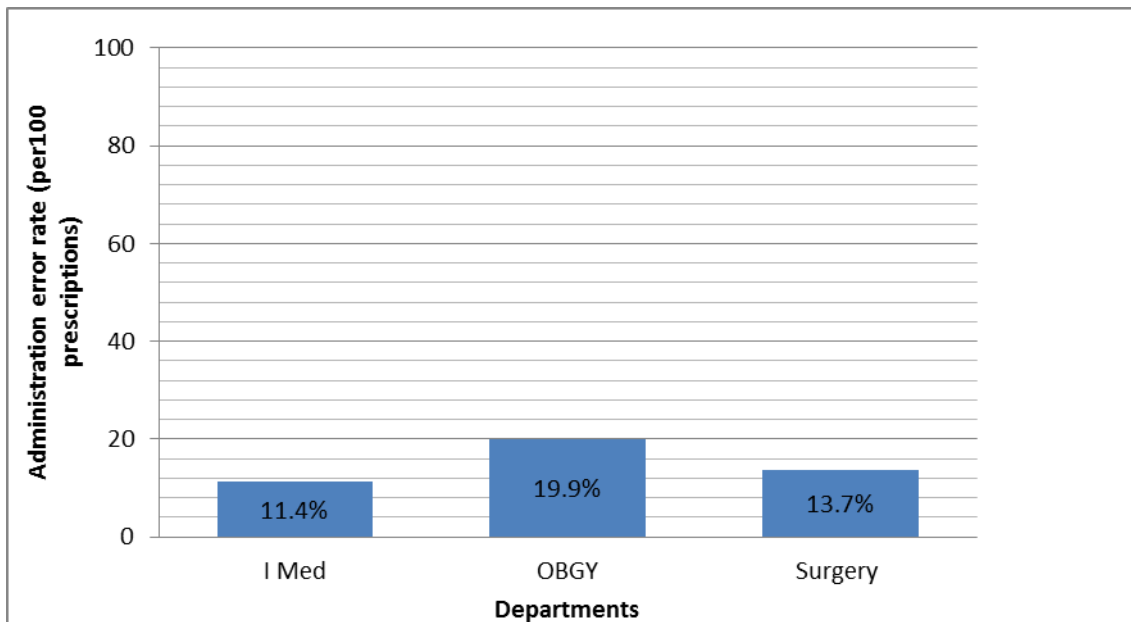


Figure 2. Comparison of administration error rates across all the three departments I MED (Internal Medicine) OBGY (Obstetrics/Gynaecology) and Surgery

There was no variation in the most common type of administration errors across the departments. Drug omission and wrong time errors were the most common types of administration errors in all the three departments as depicted in Table 4.

Table 4. Administration error rate by category across the departments

Type of administration error	Internal Medicine	Obstetrics/Gynaecology	Surgery
drug omission	25 (5.7)	45(10.3)	31 (7.1)
wrong dose	1(0.2)	3(0.7)	3 (0.7)
wrong time	21(4.8)	38(8.7)	24 (5.5)
wrong route	0 (0)	0(0)	1(0.2)
wrong administration technique	2 (0.5)	0(0)	0(0)
Unordered drug	1 (0.2)	1(0.2)	1(0.2)
Total error	50(11.4)	87(19.9)	60(13.7)

The data is given as number (percentage) of the errors of each department.

CHAPTER FIVE

5.0 DISCUSSION

The incidence and types of prescribing and administration errors were studied in Internal Medicine, Obstetrics/Gynaecology and Surgery Departments at UTH. In this study it was found that prescribing error rate in adult at UTH was 36.3 % as shown in Table 1. The most common type of prescribing errors were improper frequency (7.3%) followed by medication omission (5.0%) and the third most common errors were improper dose (4.6%) as illustrated in Table 1. This study also found that administration errors occurred in 45 % opportunities for errors (Table 3). The most common type of administration errors were medication omission (23.1%) and wrong time (18.9%) as presented in Table 3.

This study identified a lower prescribing error rate (36.3%) than that of 39% reported in Denmark (Lisby *et al*,2005). The prescribing error rate could have been much higher than that reported in Denmark if the definition of prescribing errors in this study included treatment time of the antibiotics and therefore, the comparison of the results may not be meaningful. Additionally, the prescribing error rate identified in this study is higher than the 1.5% reported in the UK and 6.2% in the USA (Williams, 2007; Bobb *et al*, 2004). The incidence of prescribing errors (14.7%) reported by Bryony *et al.*, (2011) in the UK was again lower than the 36.3% reported in this study. The high prescribing error rates reported in this study could be due to lack of robust drug distribution systems and non-availability of computerised prescribers order entry which have been used in both the UK and the USA healthcare system to reduce on medication errors(Leape and Berwick, 2005).

In the study reported by Bryony *et al.*, (2011) in the UK, the frequency of prescribing errors identified from the medical admissions wards was considerably higher than the frequency of errors on the surgical admission wards. However this study identified the frequency of prescribing errors from Internal Medicine wards (8.9%) to be lower than the frequency of errors on the surgical admission wards (11.4%) as presented in Figure 1.

To our knowledge, this is the first study to compare prescribing and administration errors in Internal Medicine, Surgery and Obstetrics/Gynaecology wards. This study found that frequency of prescribing errors in Obstetrics/Gynaecology wards was higher than that observed in medical and surgical wards (Figure 1). Internal Medicine department had lower prescribing error rate than Obstetrics/Gynaecology and surgery probably due to the fact that Obstetrics/Gynaecology and surgery at the time of the study had more admission

per month according to the figures obtained from UTH Health Information System. According to Kilbridge and Classen (2001), overload of work is one of the factors identified as the major causes of medication errors. However, the differences in the frequency of errors between Internal Medicine wards and Surgical admission wards (with $p = 1.00$) and between medical admission wards and Obstetrics/Gynaecology admission wards (with $p = 0.188$) were not statistically significant. But difference in the frequency of errors between Obstetrics/Gynaecology admission wards and surgical admission wards was statistically significant ($p = 0.030$). There was difference in the frequencies of prescribing errors across the departments. It could be because of difference in settings.

According to the study by Bryony *et al.*, (2011), the three most common types of prescribing errors were medication omission, improper dose and incomplete prescriptions. This study identified improper frequency, medication omission and improper dose as the three most common types of prescribing errors as shown in Table 1. Therefore, medication omission and improper dose were common types of prescribing errors identified in both studies. The most common type of prescribing errors in Internal Medicine Department was medication omission (2.5%), Obstetrics/Gynaecology was improper frequency (3.2%) and Surgery department was improper frequency (3%) as illustrated in Table 2. The variation in the most common type of errors across the departments could be explained by the difference in study settings.

This study also detected administration errors in 45% opportunities for errors as presented in Table 3. This is higher than the 14.9% and 32.4% observed in two observation studies in the acute-care setting (Tissot *et al* 2003; Schneider *et al* 1998). Even though the methodology used to detect administration error rate was similar to our study, the study setting was different making it difficult to accurately make comparison as medication administration error rates vary widely according to study settings (Williams, 2007). Furthermore, the administration error (45%) rate detected in our study was higher than that of 27.6% reported in similar work using similar error definitions in adults at a Teaching Hospital in Paris, France (Bardot *et al*; 2012). This could be attributable to human resource crisis facing the Zambian health sector (Makasa, 2009).The overload of work has been linked to factors that contributes to medication errors (Kilbridge and Classen, 2001). This study identified medication omission (23.1%) as the most common type of administration errors observed followed by wrong time (18.9%) and wrong dose (1.6%) as the most common type of administration errors as shown in Table 3. The study done by Berdot *at al.*,(2012) reported wrong time errors were the principal type of errors observed

(72.6%), followed by errors of omission (14.0%), and unauthorized drug errors (3.7%). The reason as to why this study identified medication omission as the principle type of administration errors could be because of non-availability of a lot of medication at UTH at the time of study. A survey by Labuschagne *et al*, (2011) in South Africa reported that drug administration errors were a problem in anaesthesia as 40% of respondents admitted having made a drug administration error at some stage in their career. This study could not be compared to a survey by Labuschagne *et al*, (2011) because of lack of similarity such as methodology used and the aims of the study.

The differences in the frequency of administration errors between Internal Medicine and surgical admission wards (with $p = 0.158$) was not statistically significant. However, the differences in error rates between Internal Medicine and Obstetrics/Gynaecology admission wards (with $p = 0.001$) and between Obstetrics/Gynaecology admission wards and surgical admission wards ($p = 0.001$) were statistically significant. The significance in the difference of administration error rate between Internal Medicine and Obstetrics/Gynaecology and Obstetrics/Gynaecology admission wards and surgical admission wards could be also because of difference in overload of work as Obstetrics/Gynaecology department at the time of study seem to have a lot of admissions than Internal Medicine and Surgery departments according to the figures obtained from UTH Health Information System.

There was the difference in the incidence of prescribing and administration errors across the three departments and it is not clear from the data as to why. It could be because of the differences in settings and overload of work. The study was undertaken at three types of adult departments at UTH, and the results were therefore unlikely to be extrapolated to Pediatric department as the incidence of medication errors in children could be higher than in adults (Kaushal *et al.*, 2001; Ghaleb *et al*, 2010). According to Williams (2007), the incidence of medication errors differ very widely depending on the definition used, hospital setting and methodology used. Therefore our research is not necessarily generalizable to other hospitals within and outside country; however, previous studies published at Aarhus University Hospital in Denmark also showed high rates of prescribing and administration errors (Lisby *et al*, 2005)

5.1 STUDY LIMITATIONS

Some permanent nurses refused to be observed for fear of victimization even after several assurances that the study was not going to affect their work. This could have affected the outcome of the study.

We did not observe nurses during evening shift except on Fridays. Therefore, the applicability of the results for work at these times is unknown. Nevertheless medication errors are common during the day than at night (Donchin, 1995; Van den Bemt, 2002). This study did not evaluate the severity of both prescribing and administration errors as some errors may be potentially nonfatal or fatal.

The definition of prescribing errors did not include duration treatment of antibiotics. Hence, this could have impacted on the outcome of the results. It only included treatment time of diclofenac injection IM 75mg twice daily and Dexamethason 6mg IM twice daily (used in gynaecology) which are supposed to be given for the maximum of 2 days limit only.

This study did not evaluate the causes of both prescribing and administration errors at UTH.

5.2 CONCLUSION

Prescribing and medication administration errors are common in adult at UTH and there was variation in the error rates across the departments studied. The overall incidence of prescribing errors was 36.3% of medication orders. The most common type of prescribing errors were improper frequency (7.3%), medication omission (5.0%), improper dose (4.8%) and omitted duration (4.6%) This error rate is higher than that reported in the USA and the UK (Williams, 2007; Bobb et al, 2004). Overall incidence of medication administration errors was 45 % which is higher than that reported in previous studies on administration errors (Tissot *et al* 2003; Schneider *et al* 1998; Berdot *et al*; 2012). The most common type of administration errors were medication omission (23.1%), wrong time (18.9%) and wrong dose (1.6%)

5.3 RECOMENDATIONS

Incidence of medication errors in paediatric may differ from those in adults (Ghaleb *et al*, 2010). Therefore, encouraged that similar study be done in paediatrics at UTH so as to ascertain the incidence and types of prescribing and administration errors in children.

The results of the study cannot be generalized to other hospitals in Zambia as incidence of prescribing errors varies widely according to methodology used and the hospital setting Hence, similar study like ours needs to be conducted in other hospitals in Zambia.

Policymakers and Healthcare providers are urged to consider redesigning the treatment chart at UTH so that it includes the column for duration of treatment especially for antibiotics and other high risk drugs

Currently, there is no system in Zambia that is designed to report medication errors. Therefore, policymakers and healthcare providers are encouraged to develop medication error report forms and be implemented in all hospitals.

This study recommends that future research must explore the severity and causes of prescribing and administration errors so that improvements strategies can be employed.

6.0 REFERENCES

Allan EL, Barker KN. (1990), 'Fundamentals of Medication Error Research', *Am J Hosp Pharm*; **47:555**.

ASHP (1982), 'ASHP Standard Definition of a Medication error' *Am J Hosp Pharm*, **39** (2): 321.

Barker, K.N., Flynn, E.A., Pepper, G.A., Bates DW., and Mikeal, R.L. (2002), 'Medication Errors Observed in 36 Health Care Facilities' *Arch Intern Med*, **162** (16):1897-1904

Bates, D.W., Cullen, D.J., Laird, N., Petersen, L.A., Small, S.D., Servi, D., Laffel, G., Sweitzer, B.J., Shea, B.F., Hallisey, R., Vliet, M.V., Nemeskal, R. and Leap, L.L et al (1995) 'Incidence of Adverse Drug Events and Potential Adverse Drug Events: Implications for Prevention' *JAMA*.;**274**:29-34

Beaufils F, Gottot., S. and Brion F. (2005), 'Drug Administration Errors and their Determinants in Pediatric In-patients.; *Int J Qual Health Care*; **17(5)**:381–389.

Berdot,S. Sabatier, B. Gillaizeau, F. Caruba,T. Prognon,P and Durieux,P(2012) 'BMC Health Services Research' 12:60 <http://www.biomedcentral. Com /1472 -6963 /12/60>

Bobb, A., Gleason, K., Husch, M., Feinglass, J., Yarnold, P.R. and Noskin, G.A. (2004), 'The Epidemiology of Prescribing Errors' *Arch Intern Med*,**164** (12):785 792.

Brennan, T.A., Leap, L.L., Laird, N.M., Hebert, L., localio, A.R., Lawthers, A.G.,Newhouse, J.P., Weiler, P.C. and Hiatt, H.H .(2004), 'Incidence of Adverse Events and Negligence in Hospitalized Patients' *Qual Saf Health Care* ;**13**:145–152

Bryony, D.F., Reynolds, M., Shebl, N.A., Burnett, S. and Jacklin, A. (2011), Prescribing Errors in Hospital Inpatients: A Three-centre Study of their Prevalence, Types and Causes' *Postgrad Med J*;**87**:739-745.

Calabrese, A.D., Erstad, B.L., Brandl, K., Barletta, J.F., Kane, S.L. and Sherman, D.S. (2001), 'Medication Administration Errors in Adult Patients in the ICU' *Intensive Care Med* ; **27** (10): 1592–1598.

Choonara I, Conroy S(2002), 'Unlicensed and Off-label Drug Use in Children: Implications for Safety. *Drug Saf* ; **25**:1–5.

Dean, B., Schachter, M., Vincent, C. and Barber, N. (2002), 'Causes of Prescribing Errors in Hospital Inpatients: A Prospective Study' *Lancet*; **359**(9315):1373–8.

Donchin, Y., Gopher, D., Olin M., Badihi, Y., Biesky, M., Sprung, C.L, Pizov, R. and Cotev, S. (1995), ' A Look into the Nature and Causes of Human Errors in the Intensive Care Unit' *Crit Care Med*; **23** (2): 294–300.

Dean, F.B., Schachter, M., Vincent, C. and Barber, N. (2005), 'The Incidence of Prescribing Errors in Hospital Inpatients: *An Overview of the Research Methods*' *Drug Saf*; **28**:891-900.

Ghaleb, M.A., Barber, N., Franklin, B.D, Yeung, V.W., Khaki, Z.F. and Wong, I.C. (2006), 'Systematic Review of Medication Errors in Pediatric Patients' *Ann Pharmacother* ; **40**:1766–76.

Ghaleb, M.A., Barber, N., Franklin, B.D, Yeung, V.W., Khaki, Z.F. and Wong, I.C (2010), '*The Incidence and Nature of Prescribing and Medication Administration Errors in Paediatric Inpatients*' *Arch Dis Child*; **95**:113–118.

Kaushal, R., Bates, D.W., Landrigan, C. McKenna, K.J., Clapp, M.D., Federico, F. and Goldmann DA (2001), 'Medication Errors and Adverse Drug Events in Pediatric Inpatients' *JAMA*; **285**:2114–20.

Kilbridge, P and Classen, D.C (2001), 'A process model of inpatient medication: Management and information technology to improve patient safety' *VHA Research Series*; **1**:1–96.

Kohn, L.T., Corrigan, JM and Donaldson, M.S. (1999), eds 'To Err is Human. Washington DC: National Academy Press.

Krahenbuhl-Melcher, A., Schlienger, R., Lampert, M., Haschke, M., Drewe, J. and Krähenbühl, S. (2007), 'Drug-related Problems in Hospitals: A Review of the Recent Literature' *Drug Safety*; 30:379-407.

Labuschagne, M., Robbette, W., Rozmiarek, J., Strydom, M., Wentzel, M., Diedericks, B. J S. and Joubert ,G (2011), 'Errors in Drug Administration by Anaesthetists in public Hospitals in the Free State' *S Afr Med J*; 101:324-327.

Leape, L.L. and Berwick, D.M. (2005), 'Five Years After To Err Is Human: What Have We Learned?' *JAMA*; **293**:2384-2390.

Lewis, P.J., Dornan, T., Taylor, D., Tully, M.P., Wass , V. and Ashcroft, D.M (2009). 'Prevalence, Incidence and Nature of Prescribing Errors in Hospital Inpatients: A Systematic Review'. *Drug Saf*; **32:379**–89.

Lisby, M., Nielsen, P.L and Mainz, J. (2005), 'Errors in the medication process: frequency, type, and potential clinical consequences' *Int J Qual Health Care*; 17 (1):15–22.

Makasa, E. (2009), 'The Human Resource Crisis in the Zambian Health Sector', *Medical Journal of Zambia*, **35** (3); 81-87

McBride-Henry K and Foureur M (2006), 'Medication Administration Errors: Understanding the Issues' *Aust J Adv Nurs*; **23**(3):33-41.

Moyen, E., Camiré, E. and Stelfox, H.T. (2008), 'Clinical Review: Medication Errors in Critical Care'; **12** (2):208.

Mukesh, C.J., and Vijay, R. (2005), 'Medication Errors, 'identification, prevention and implementation of safe medication practice' *IJHP* : 62.

Norton, L.L. (2001), 'Quality improvement, risk management, and patient education: Tools to reduce medication errors' (*JMCP*); **7**(2) 15.

Parthasarathi G (2004), ‘ A Text Book of Clinical Pharmacy Practice. Essential Elements and Skills’ :426.

Phillips, D.P., Breder, C.C. (2002), ‘Morbidity and Mortality form Medical Errors: An Increasingly Serious Public Health Problem’ *Annu.Rev.Public Health*; **23**: 135-50.

Prot, S., Fontan, J.E., Alberti, C ., Bourdon,O., Farnoux,C., Macher MA, Foureau A, Faye A, Beaufils F,Gottet S, and Brion F(2005) ‘Drug administration errors and their determinants in pediatric in-patients’ *International Journal for Quality in Health Care*’ **5**(17) : 381–389

Schneider, M., Cotting, J. and Pannatier, A. (1998) ‘ Evaluation of nurses’ errors associated with the preparation and administration of medication in a pediatric intensive care unit’ *Pharmacy World Science*, 20(4):178-182

Tissot, E., Cornette, C., Limat, S., Mourand, J.L, Becker, M, Etievent, J.P., Dupond, J.L, Jacquet, M. and Woronoff-Lemsi MC (2003), ‘ Observational Study of Potential Risk Factors of Medication Administration Errors’ *Pharmacy World Science*; **25**(6):264-268.

Thomas, E.J., Studdert, D.M., Burstin, H.R, Orav, E.J., Zeena, T., Williams, E.J., Howard KM, Weiler, P.C. and Brennan, T.A (2000), ‘ Incidence and Types of Adverse Events and Negligent Care in Utah and Colorado’ *Med Care* ;**38**:261–71.

Thomas, E.J., Studdert, D.M., Burstin, H.R, Orav, E.J., Zeena, T., Williams, E.J., Howard KM, Weiler, P.C. and Brennan, T.A (1999); ‘Costs of Medical Injuries in Utah and Colorado’ *Inquiry*;**36**:255-264.

Van den Bemt PM., Roel, F., Peter, H. J., van der Voort,. Gossen, A, A., Egberts T, C. G., and Brouwers, J. R. B. J., (2002), ‘Frequency and Determinants of Drug Administration Errors in the Intensive Care Unit’ *Crit Care Med*; **30** (4): 846–850.

Vincent, C. Barber, N., Franklin, B.D. and Burnett, S (2009), ‘The Contribution of Pharmacy to Making Britain a Safer Place to Take Medicines’ *London: Royal Pharmaceutical Society of Great Britain*.

Williams DJP (2007), ' Medication Errors' *R Coll Physicians Edinb*; **37**:343–346.

Wirtz, V., Taxis, K., and Barber, N.D. (2003), 'An Observational Study of Intravenous Medication Errors in the United Kingdom and in Germany' *Pharmacy World Science*. **25**.

7.0 APPENDICES

APPENDIX I : Budget

Item	Quantity Required	Unit Price (ZMK)	Total Cost (ZMK)
Computer	1	5500	5500
Printer	1	1000	1000
Cartridges toner	2	300	600
Reams of paper	4	22	88
Pens	4	1	4
Note Book	1	10	10
USB storage Disk	1	200	200
Binding	4	10	40
Binding of Final proposal	1	70	70
Transport			3000
UNZA Biomedical Ethics			250
Contingency			2800
Total			15062

APPENDIX II: Work plan Schedule

ACTIVITY	FEB	MAR	APRI	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DE C
Idea Submission											
Proposal writing											
Proposal presentation to the department											
Proposal presentation to the graduation forum											
Proposal submission to the UNZA biomedical ethics committee											
Data collection											
Data analysis and report writing											
Defending the thesis											

APPENDIX III: DATA COLLECTION FORM FOR ADMINISTRATION ERRORS

KEY: **A**= Appropriate

NA= Not appropriate

Name of the Drug	Route		Dosage		Administration Technique		Date	Ward	File No
	A	NA	A	NA	A	NA			
<u>NARRATIVE DESCRIPTION OF AN ERROR</u>									
Time of administration			Time administered					EXPIRY DATE	
Name of Data Collector:									

APPENDIX IV: DATA COLLECTION FORM FOR PRESCRIBING ERRORS

Name of the Drug	Route of Admin	Dosage	DATE	WARD	File No

NARRATIVE DESCRIPTION OF AN ERROR

Name of Data Collector:

**APPENDIX V : CRITERIA FOR PRESCRIBING AND ADMINISTRATION
ERROR (ASHP 1982)**

STAGE	DEFINITION	ERROR TYPE
Prescribing	Unambiguous Prescription chart	<p>Omission of: drug name; drug formulation; route; dose; dosing regimen; date; signature; treatment time for antibiotics.</p> <p>Incorrect: formulation; frequency ; dose, No indication Allergic to drug prescribed Omission</p>
Administration	The right medication to the right patient in the right way and at the right time	Wrong: administration technique (inj.); route; time (\pm 60 min); delivery (dose not delivered directly to the patient); unordered drug; unordered dose; omission of dose; Wrong rate, wrong concentration, wrong drug preparation, deteriorated drug, drug past expiration date

APPENDIX VI : INFORMATION SHEET

Research Title: **Assessment of prescribing and administration errors in medication use**

process at University Teaching Hospital, Lusaka, Zambia

Introduction

I am Martin Kampamba, working for University Teaching Hospital(UTH) and a student in Masters of Clinical Pharmacy at University of Zambia(UNZA), School of Medicine. We are doing the research on administration and prescribing errors at UTH which is a dissertation to be submitted as partial fulfilment for the award of masters in clinical pharmacy of the UNZA. I am going to give you information and invite you to be part of this research. You do not have to decide today whether or not you will participate in the research. Before you decide, you can talk to anyone you feel comfortable with about the research

There may be some words that you do not understand. Please ask me to stop as we go through the information and I will take time to explain. If you have questions later, you can ask them of me or the following supervisors Dr. L. T. Muungo and Dr. Vwalika

Purpose of the research

Medication errors are a well-recognized problem in hospitals and are major causes for adverse events in hospitals resulting in disability and death in up to 6.5% of admitted patients. The research will focus on quantifying the types and incidence of prescribing and administration errors. The patient treatment sheet will be screened for prescribing and administration errors. Therefore we have invited you to participate in a study which is designed to see if we can improve the quality on medication use process.

The results of this study will be used by policy makers, Nurses, Doctors and pharmacist to:

- improving patient safety,
- establish interdisciplinary consensus on medication-use processes
- modernize the drug distribution system in hospitals
- stimulate standardization in medication-use process

Participant selection

We are inviting all nurses in Obstetrics/Gynaecology, Internal Medicine and Surgery Departments to participate in the research on prescribing and administration errors. We have selected you to participate in this research because certain administration errors can only be detected by observing you administering medications.

Confidentiality

Any information obtained will remain absolutely confidential. Your details will be entered on a paper form but only in coded form and your name will not be included. Only your enrolment number will be recorded.

The Study is voluntary

You do not have to participate in the study if you do not want to, and if you refuse to participate in the study, your work will not be affected in any way. If you agree, you are also free to change your mind at a later date. This study has been approved by the Biomedical Research Ethics Committee of the University of Zambia and their contact details are given below:

Contact details of Principle Investigator:

Martin Kampamba

(Master of Clinical Pharmacy Student)

Pharmacy Department, University Teaching Hospital,

P/Bag RW 1X, Ridgeway, Lusaka.

Ethical Review Board: Chairperson, The University of Zambia Biomedical Research

Ethics Committee

Address: Ridgeway Campus, P.O. Box 50110, Lusaka, Zambia

Telephone: + 260-1-256067

Fax: +260-1-250753

Email: unzarec@unza.zm

APPENDIX VII: INFORMED CONSENT FORM

I confirm that I have understood the information I have been given about the study. I agree to participate in the study. I confirm that I am joining the study out of my free will and that I can withdraw at any time without affecting the quality of my work available to me.

I understand what will be required of me.

Name:

Signed :

Date:

I confirm that I have explained the information fully and answered questions.

Name of Principal investigator:

Signed:

Date:

PLEASE NOTE A COPY OF THE INFORMED CONSENT FORM WILL BE PROVIDED TO YOU TO KEEP FOR PERSONAL RECORD

Contact Information

Martin Kampamba

(Master of Clinical Pharmacy Student)

Pharmacy Department, University Teaching Hospital,

P/Bag RW 1X, Ridgeway, Lusaka.

Ethical Review Board: Chairperson, The University of Zambia Biomedical Research Ethics Committee

Address: Ridgeway Campus, P.O. Box 50110, Lusaka, Zambia

Telephone: + 260-1-256067

Fax: +260-1-250753

Email: unzarec@unza.zm