ANTIBIOTIC PRESCRIBING PATTERNS AMONG PHYSICIANS AT THE UNIVERSITY TEACHING HOSPITAL IN LUSAKA, ZAMBIA.

By

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

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DECLARATION

I, **Jimmy M. Hangoma** hereby declare that the work on which this discussion is based is original, except where acknowledgements indicate otherwise.

This dissertation is submitted for the degree of Master of Clinical Pharmacy at the University of Zambia. Neither the whole work nor any part of it has been submitted before for any degree or examination at this or any other university.

Signed……..……..…on the …….…….. day of …….

Computer Number: 531004733

Supervisor I……

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Date…….

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CERTIFICATE OF APPROVAL

This dissertation of **Jimmy M. Hangoma**, has been approved as fulfilling the requirements or partial fulfilment of the requirements for the award of Master's Degree in Clinical Pharmacy by the University of Zambia;

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DEDICATION

I dedicate this dissertation to my wife, Mrs Josephine K. Hangoma, my beautiful daughters Twalumba & Twalelekwa, my parents Mr and Mrs Hangoma for their love, support and patience during my studies.

ABSTRACT

Background

Prescribing patterns can greatly have a negative impact on patient care outcomes if not underpinned by use of ideal standards and evidence-based medicine.
The overall aim of this clinical research was to determine the antibiotic prescribing patterns among physicians and compare compliance of antibiotic prescribing with adopted National treatment guidelines.

Methods

A cross-sectional study was undertaken which involved reviewing of patients' records in wards, administration of a questionnaire to physicians and clinical heads as well as the head of pharmacy department. Systematic sampling was used for selection of patient files. The study was conducted over four months.

The study was conducted in the medical wards in the departments of Obstetrics and Gynaecology (OBGY), Internal Medicine (IM) and Surgery at University Teaching Hospital.
A sample of 385 patients were selected whose records and charts were reviewed. Of these, 165 were from the department of OBGY, 120 were from IM and 100 were from Surgery. Physicians were sampled using convenience sampling method.

Outcome measures were compliance with Gyssens *et al.* recommendations, Zambian Standard Treatment Guidelines (STG) and Traffic-light system. Documentation of clinical indication, dose, frequency, route and duration and collection of culture samples before initiation of treatment were used to measure appropriateness of a prescription.

Results

Of the 385 study patients evaluated, 270(70.1%) were prescribed with antibiotic(s). Out of 165 study patients from OBGY, 121(73.3%) were prescribed with antibiotic(s); out 120 from IM, 72(60%) were prescribed with antibiotics and those from Surgery, 77(77.0%) out of 100 study patients were prescribed with antibiotics. The average number of antibiotics per prescription was 1.8. The individual departments had prescriptions complying with Gyssens *et al.* recommendations of 59(24.3%), 18(12.4%) and 20(22.2%) for OBGY, IM and Surgery respectively. Out of 270 study patients who were prescribed with antibiotics, only 86(31.9%) had bacteriological tests ordered and only 27/86(31.4%) had the culture results ready at the time of review. The study has found that the association between position of physician and factors influencing prescribing tendencies was not statistically significant (p=0.084).The association between position held by study physicians and the ordering of bacteriological tests was found to be statistically significant (p=0.001). The study also found that there was only the Drug and Therapeutics Committee (DTC) and no other systems, structures or processes regulating the use of antibiotics at UTH.

Conclusion

It can be concluded from the findings of this study that prescribing patterns do not comply with recommended standards of care. Antibiotics were prescribed without bacteriological tests. It can also be concluded that no structures and systems are available to control use of antibiotics at the hospital.

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LIST OF ABBREVIATIONS AND ACRONYMS

AIDS	Acquired immunodeficiency syndrome
BVHF	Biventricular Heart Failure
CNS OI	Central Nervous System Opportunistic Infections
EDL	Essential Drug List
HIV	Human Immuno deficiency virus
HTN	Hypertension
IMed	Internal Medicine
MDR	Mult-Drug Resistance
NDP	National Drug Policy
OBGY	Obstetrics and Gynaecology
PHC	Primary Healthcare
PID	Pelvic Inflammatory Disease
PPROM	Pre-term Premature Rupture of Membranes
Pre/Post OP	Pre/Post-operative
PROM	Premature Rupture of Membranes
STG	Standard Treatment Guidelines
STI	Sexually Transmitted Infections
TB	Tuberculosis
UNZA-BREC	University of Zambia Biomedical Research Ethics
URTI	Upper Respiratory Tract Infection
UTH	University Teaching Hospital
UTI	Urinary Tract Infection

WHO	World Health Organisation

LIST OF DEFINITIONS

Antibacterial drugs: A group of drugs used to treat infections caused by bacteria.

Antibiotic: A group of drugs used to treat infections caused by *bacteria* and to prevent bacterial infection in cases of *immune system* impairment (Medical Dictionary, 2008).

Antimicrobial: A drug used to treat a microbial infection. “Antimicrobial" is a general term that refers to a group of drugs that includes antibiotics, antifungals, anti-protozoals, and antivirals (Medical Dictionary, 2008).

Antibiotic resistance: The ability of bacteria and other microorganisms to withstand an antibiotic to which they were once sensitive (and were once stalled or killed outright). Also called drug resistance (Medical Dictionary, 2008).

Irrational use of medicines is a major problem worldwide. It is estimated that half of all medicines are inappropriately prescribed, dispensed or sold and that half of all patients fail to take their medicine properly. The overuse, underuse or misuse of medicines results in wastage of scarce resources and widespread health hazards (WHO, 2004).

Physician: A medical doctor at any level.

Rational drug therapy: The use of the least number of drugs to obtain the best possible effect in the shortest period and at a reasonable cost (Gross, 1981).

CHAPTER ONE

1.0 BACKGROUND AND INTRODUCTION

Antibiotics account for the most commonly prescribed drugs in the hospital setting. Inappropriate antibiotic prescribing and the increasing levels of resistance are now issues of global concern (Charani *et al.,* 2010). According to Davy *et al*., (2005), a significant proportion of antibiotic prescriptions within hospitals have been described as inappropriate. Up to 50% of antibiotic use is inappropriate (Ashiru-Oredope *et al*., 2012).

Information about antimicrobial prescribing patterns is necessary for a constructive approach to challenges that arise from the multiple antibiotics that are available (Srishyla, *et al. 1994).* Excessive and inappropriate use of antibiotics in hospitals, health care facilities and the community contributes to the development of bacterial resistance (Shankar *et al., 2003*).

Irrational prescribing habits for antibiotics lead to ineffective and unsafe treatment of medical conditions. Moreover, irrational prescribing may worsen or prolong the illness thereby leading to distress and harm to the patient. As Sharma and Kapoor (2003) argued, not only does irrational prescribing lead to exorbitant costs of medicines, its occurrence is common in clinical practice.

The decision model of prescribing antibiotics is rather complex and multiple factors other than clinical considerations can influence the decision to prescribe. These factors include patient characteristics, physician characteristics, and medical environments such as competition for clients. Patient characteristics such as age, lower socio-economic status, and higher co-morbidity have significant effects on the antibiotic prescription rate. Physician characteristics, including gender, age, time since graduation, and volume of practice, also significantly influence antibiotic prescription (Choi *et al*., 2008). They also pointed out that an urban location of a medical practice and patient income level also influence antibiotic prescription rates. Other significant predictors are the physician expertise (that is specialist or generalist). *Choi et al*., (2008) further argued that medical environment variables such as the number of primary care clinics and number of hospital beds affect the rate of antibiotic prescription**.**

Sharma and Kapoor, (2003) attributed irrational prescribing to lack of knowledge about drugs, unethical drug promotions, high patient load, ineffective laboratory facilities, availability of drugs, and ineffective law enforcement by governments with subsequent failure to ensure compliance to guidelines. The irrational prescribing of antibiotics (particularly broad-spectrum antibiotics), in primary care is a major contributing factor to reduced drug efficacy, increased prevalence of resistant pathogens in the community, and the appearance of new co-infections (Sharma and Kapoor, 2003).

Antimicrobial resistance is currently the greatest challenge to the effective treatment of infections globally. Resistance adversely affects both financial and therapeutic outcomes with effects ranging from the failure of an individual patient to respond to therapy and the need for expensive and/or toxic alternative drugs to the social costs of higher morbidity and mortality rates, required and/or longer durations of hospitalisation, increased health care costs and the need for changes in empirical therapy (Essack, 2006).

Previous studies on prescribing patterns have looked at the evaluation of rational therapy, the appropriateness of prescribing antibiotics and antibiotic use, resistance development and environmental factors. These factors addressed the characteristics of individual patients and doctors, related with prescription episodes. Most studies have shown that there is inappropriate prescribing. The use of antibiotics and a large number of prescriptions did not conform to the ideal pattern (Baktygul *et al.*, 2011).

Medicines consume a significant portion of the total health care budget. Equitable access to affordable medicines remains a challenge. The STG and Essential Medical List ensure the cost-effective treatment options are available to citizens of the country, and seek to build capacity in health care workers at the Primary Health Care (PHC) level (MoH, 2011-unpublished data).

Antibiotics are among the most frequently used drugs worldwide. They are particularly utilized in developing countries, where an average of 35% of the total health budget is spent on antibiotics (Isturiz & Carbon, 2000, cited in Makhado, 2009).In Zambia for instance, the University Teaching Hospital alone spends well over 15.28 % of its medicines budget on antibiotics per quarter of the financial year (UTH Pharmacy records, 2013-unpublished data).

Monitoring of prescriptions and drug utilisation studies can identify the problems and provide feedback to prescribers and other stake holders so as to create awareness about irrational use of antibiotics. This study was undertaken to investigate the prescribing and use of antibiotics at the University Teaching Hospital, Lusaka, Zambia.

This study aimed at describing the patterns of antibiotic prescribing and to suggest modifications in practitioners' prescribing habits so as to make medical care rational and cost-effective. It was designed to provide evidence-based antibiotic prescribing patterns at UTH which would be helpful in developing antibiotic treatment guidelines. By improving antibiotic prescribing, Zambia can move towards controlling the antimicrobial resistance problem.

1.1 RATIONALE OF THE STUDY

The indiscriminate use of antibiotics has led to the antimicrobial resistance problem (WHO, 2009). According to Lukwesa, (2012- unpublished data), selected data showed that the percentage of resistance for organisms isolated from blood specimens where n=2175, ampicillin was 97.1% resistant, co-trimoxazole 86.2%, penicillin G 83.6%, erythromycin 53.5%, chloramphenicol 43.5%, gentamycin 40.5%, ciprofloxacin 38% tetracycline 35.5% and cefotaxime 31.5%. It could be clearly seen that even cefotaxime which was second line drug at UTH showed significant resistance hence the need to use the available antibiotics appropriately.

According to WHO, (2009) inappropriate antibiotic prescribing was as high as 67.6%. High patient load, prior prescription by unqualified prescribers, high prices of antibiotics, misdiagnosis, availability of antibiotics, ineffective law enforcement to ensure treatment guideline are followed and prescribers being influenced by a particular company to prescribe its medical products are some of the major reasons for inappropriate prescribing of antibiotics. Lack of systems, structures and processes or antibiotic control measures such as Antibiotic Policy Committee or their ineffectiveness could greatly contribute to inappropriate prescribing.

The improper prescribing of antibiotics poses an economical implication to the government as well as to the public. For instance UTH, according to the data gathered from the department of Pharmacy, spent about K942, 000 (15.28% of drug budget) on antibiotics per quarter of the year 2013. World over there are laws and regulations that aim at rationalising antibiotic prescriptions. Antibiotics by law and code of ethics are not supposed to be prescribed without a proper diagnosis and a sample for microscopic, culture and sensitivity should be collected prior to administration of antibiotics. However, this may not be followed at times due to lack of manpower and poor laboratory support forcing prescriptions without confirmation.

Zambia like any other developing country especially in the Sub-Saharan Africa has a high prevalence of infectious diseases which require antimicrobial chemotherapy. The seemingly increasing levels of antibiotic use has contributed to the increase of resistant bacteria and straining of government budgets on the expense of other needs.

At UTH, there seems to be no systems, structures and processes that regulate the prescribing and use of antibiotics.

This study endeavored to investigate prescribing patterns of antibiotics among physicians at UTH in the departments of Internal Medicine, Surgery and Obstetrics and Gynaecology as well as assessing the availability of systems, structures and processes or control measures that regulated use of antibiotics such as the examples for Australia shown in ***appendix G.***

1.2 RESEARCH QUESTION

1. Do antibiotic prescribing patterns at UTH conform to Gyssens *et al.* recommendations and Zambian Standard Treatment Guidelines?

1.3 STUDY JUSTIFICATION

Inappropriate prescribing of antibiotics is a global concern.The research of antimicrobial prescribing patterns was of greater importance as the antibiotic usage at UTH was amongst the top most drug groups by value (UTH Pharmacy Department, 2013).

The Zambian Government outlined the commitment to ensure continuous availability and accessibility of medicines to all the people. The health objectives according to the government were:

- Ensuring accessibility and availability of medicines to all citizens
- Ensuring that medicines that were dispensed to people were safe, effective and of good quality
- Ensuring that rational drug prescribing and good dispensing practices were observed at all times
- Promoting rational use of medicines by prescribers, dispensers and patients
- To promote the concept of patients being responsible for their health (MoH, 2011-unpublished data).

It was of paramount importance that such a study was carried out in order to establish the current antibiotic prescribing patterns. There was need for up to date data on antibiotic prescribing patterns at UTH in consonance with increased antibiotic consumption and introduction of new antibiotics (UTH Pharmacy Records, 2013-unpublished data). The study findings would benefit physicians/prescribers, pharmacists/dispensers and microbiologists in their practice. An audit of this nature would assist proper generation of new antibiotic policy, medication management policy and would further be useful for health administrators and other officials responsible for the formulation of health policies governing the use of antimicrobials in order to strike a balance between health benefits and economical benefits.

1.4 AIM

To study the prescribing patterns of antibiotics among physicians at the University Teaching Hospital in Lusaka, Zambia.

1.5 SPECIFIC OBJECTIVES

1. To determine the most prescribed antibiotics and the conditions for which they are prescribed.
2. To investigate the appropriateness of antibiotics in terms of dose, duration, dosage interval and routes of administration.
3. To determine the association of microscopic, culture and sensitivity findings with antibiotic prescribing patterns.
4. To determine the prescribing patterns of antibiotics by level of qualification of the physicians.
5. To identify the systems, structures and processes or control measures available at UTH that aimed at regulating the prescribing of antibiotics.

CHAPTER TWO

2.0 LITERATURE REVIEW

This review of literature explored the main concerns centred on antibiotic prescribing patterns among physicians in the hospital setting. The review of literature focussed mainly on objectives 1, 2, and 5 as set out in chapter one subsection 1.5. (These objectives were met through data collection and analysis, while objectives 3 and 4 were achieved as a result of findings from objectives 1 and 2). The objectives were;

1. Determine the most prescribed antibiotics and the conditions for which they are prescribed.
2. Investigate the appropriateness of antibiotics in terms of dose, duration, dosage interval and routes of administration.
3. Determine the association of microscopic, culture and sensitivity findings with antibiotic prescribing patterns.
4. Determine the prescribing patterns of antibiotics by level of qualification of the physicians.
5. Identify the systems, structures and processes or control measures available at UTH that aimed at regulating the prescribing of antibiotics.

A study which was done in Jammu city, India, by Sharma and Kapoor, (2003), aimed at assessing the prescribing pattern for evaluation of rational drug therapy. The study involved reviewing 200 prescriptions that were written by qualified medical graduate and post graduate doctors. The study showed that there was inappropriate prescribing in 33 per cent of the drugs and that a large number of prescriptions did not conform to the ideal pattern (Sharma *and Kapoor,* 2003).Their study was retrospective and did not only include physicians but interviewed patients as well. However, this study did not involve interviewing of patients as they would have not known why certain antibiotics were prescribed for them but merely reviewed their records.

Gyssens *et al.,* (2011) looked at antibiotic stewardship programmes and evidence-based principles of prudent antibiotic prescribing. They concluded that by applying strategies for appropriate prescribing that optimise indication, selection, dosing, route of administration, duration, and timing of antibiotic therapy, selection of resistant microorganisms could be

reduced to the minimum. The definition of appropriateness of antibiotic prescribing as stated by Gyssens and colleagues (i.e correct drug choice, duration of therapy indicated, dose and route of administration indicated), was in line with the definition used in this study hence was adopted. Bijnen *et al*., (2011), defined appropriateness as the congruency between resistance patterns and prescription patterns. This study did not look at the resistance patterns. Therefore, Bijnen and colleagues' definition was not applicable to this study.

Acimis *et al*., (2009) undertook a cross sectional survey titled 'The Prevalence of Prescribing Antibiotics by Primary Health Care Physicians in Turkey: A multi-centered Survey' in which 267 physicians participated. The study reported that 22.6% of the reviewed prescriptions had antibiotics. The most prescribed antibiotics were amoxicillin+ clavulanic acid (15.6%) and amoxicillin + sulbactam (15.1%). Of the conditions recorded, acute upper respiratory infections accounted for 53.3% and UTIs accounted for 16.4% (Acimis *et al*., 2009). Their methodology also included factors that affected prescribing patterns of physicians which were also included in the questionnaire for physicians in this study.

A similar study on prescribing patterns conducted at the Hospital of Kathmandu Valley in East Africa, evaluated the prescribing practice of antibiotics in hospital in-patients. The study showed that more than 98% of patients were exposed to at least 2 antibiotics and of those only 24 cases had specimens taken for culture (Palikhe, 2004).

In South Africa, a study conducted in Vhembe district, Limpopo province by Makhado (2009), compared antimicrobial prescribing patterns with STG and EDL in primary Healthcare facilities. It was noted that the highest rate (28%) of antibiotics prescribed was in children of the age group from birth to 10 years followed by 11 to 20 years (24.2%). The number of items per prescription was found to be 2.6 and the average number of antibiotic per prescription out of the 500 prescriptions that had antibiotics was 1.17. Only 26.77% of the prescribed antibiotics were by generic names. The duration of treatment was indicated in 12.67% of prescriptions and 71.27% of the prescriptions had the frequency recorded. The study further found that indications were either recorded as symptoms or diagnosis. However, the majority of indications which were recorded did not appear in the STG/EDL as diagnosis (Makhado, 2009).

Similarly, a survey of antibiotic prescribing patterns and in-vitro antibiotic susceptibility patterns at the University Teaching Hospital by Lukwesa, (1998) showed that out of the 191 patients included in the study, 73% received antibiotics. Paediatrics department had more antibiotic prescriptions (90%) of which 82% had multiple antibiotics. The prescriptions were mainly for lower respiratory tract infections and gastrointestinal infections. In the department of internal medicine prescriptions with antibiotics accounted for 67% and mainly were due to tuberculosis. Obstetrics and gynaecology, and surgery departments had antibiotic prescription frequency of 74% and 64% respectively. In the study, bacteriological tests were requested only in 29% of cases and apart from bacteria, other organisms were isolated such as fungi. 70% of the antibiotics prescribed were parenteral and the duration of treatment ranged from 2 to 14 days. Unlike their study which looked at site of infection in terms of body systems, this study looked at prescriptions in the context of the actual disease being treated. This study also included the administration of questionnaires to physicians and heads of departments as well as the head of pharmacy department in order to assess the availability of structures, systems and processes that regulated antibiotic use at UTH.

Sahoo and colleagues conducted a qualitative study involving healthcare professionals in Orissa, in India. The study evaluated the interrelationship between antibiotics use, resistance development and environmental factors. The conclusion was that there was lack of information about what constitutes prudent use of antibiotics. It further found that there was poor awareness of prudent antibiotic use (Sahoo *et al.*, 2010). This study excluded resistance development and environmental factors but instead included a review of antibiotic control measures that were available at UTH.

A study undertaken by Baktygul *et al.*, (2011) evaluated the pattern of antibiotic prescriptions in a secondary health care setting in Kyrgyzstan Republic. A retrospective analysis was performed on antibiotic prescriptions in 251 inpatient records of patients admitted to the Sokuluk Territorial Hospital. A total of 19 different antibiotics were prescribed. Antibiotic therapy proved inappropriate for 184 patients (73.3%). The most common reason given for inappropriateness was the unjustified (not indicated) use of antibiotics in 143 (48.6%) cases. It concluded that antibiotic prescriptions were seriously inappropriate in the Kyrgyz Republic with prescribing patterns failing to strictly adhere to the national guidelines. As opposed to their methods, this study took a prospective

approach in order to review records as soon as possible to avoid losses of patient records/files and also to have the component involving interview physicians on current prescribing habits.

Carlos *et al.,* (2012), carried out a prospective audit of antimicrobial stewardship in intensive care unit of a public hospital in Atlanta, GA, and assessed its impact on clinical outcomes. The conclusion was that Audit and feedback had an influence on antimicrobial prescription patterns in the ICU with a favourable impact on the emergence of resistance. However, this study did not give feedback as it was non-interventional and had only one phase.

According to Niederman, (2005), many antibiotics, including macrolides and quinolones, are used incorrectly in the treatment of presumed respiratory tract infections. The use of broad spectrum antibiotics has been noted to be on the rise considerably since the 1990s, however, this use is often inappropriate. There are strong links between appropriate use, compliance and resistance as well as between regimen complexity and compliance. These issues provide a platform for thinking about a short duration, high compliance drug therapy with good clinical efficacy. Such therapies need to be combined with programmes that promote rational antibiotic use. The study by Niederman did not clearly state the variables and how the statistical analysis was done. However, this study concurred with Niederman's study on the aspect of combining therapies and programmes that promote rational antibiotic use as stated by the Australian Pharmaceutical Advisory Council, 2002.

The gap was that the above reviewed studies did not include the structures, systems and processes regulating antibiotic use. Thus, in addition to reviewing patient records and administering questionnaires to physicians, clinical heads and Head of Pharmacy Department were given questionnaires to assess the availability of relevant antibiotic control measures as also stated by Bijnen, *et al*., (2011).

Owens (2008) looked at Antimicrobial Stewardship: concepts and strategies in the 21 st century. He concluded that the majority of bacterial infections could be cured simply, effectively and cheaply. The problem of increasing resistance is greatly due to suboptimal antimicrobial use. A variety of studies he reviewed concluded that programmatic means to steward the use of antimicrobials optimises patient safety, addresses some of the

contributing factors to escalating antimicrobial resistance, and as a side effect, minimises cost to the healthcare system.

In 2009, a cross-sectional study conducted at the University of Ilorin Teaching Hospital in Nigeria, evaluated the prescription patterns and cost. The findings were that out of the 630 prescriptions that were reviewed, 83.5% of them had at least one antibiotic and only 45.6% of the prescriptions were presented in generic names. The conclusion was that prescribing habits in developing countries were bad as prescribers were not complying with standard treatment guidelines and that a lot of costs were incurred as a result of irrational prescribing (Akande *et al*., 2009).

Another study was conducted in Korea to examine the area characteristics affecting the prescription of antibiotics and injections in primary care practices in the treatment of respiratory tract infections (RTIs). A nationwide cross-sectional study was performed in all 250 administrative districts of Korea. This study was confined to one institution due to feasibility purposes as opposed to their study. The outcome was modeled as a binary variable: over-prescription or not compared with the nation-wide average. Over-prescription of antibiotics was associated with the ratio of specialists to general physicians and over-prescription in previous years in the area (adjusted odds ratio [aOR], 4.8; 95% confidence interval [CI] 1.5-14.8; and aOR, 12.0; 95% CI 5.5-25.9, respectively). Over-use of injections was associated with younger population, urban living and the number of hospital beds in the area (aOR, 0.2; 95% CI 0.1-0.4; aOR, 0.3; 95% CI 0.1-0.8; and aOR, 0.4, 95% CI 0.2-0.9; respectively). There were differences in the prescribing patterns in different districts; prescription patterns were affected more by supply factors than by demand factors. Highly competitive medical environment associated with supply factors was a significant determinant of prescription patterns in Korea (Choi *et al.*, 2008).

A cross-sectional survey done by Ndhlovu, (2009) in four districts of Zambia, evaluated the prescription patterns at primary Healthcare facilities. Out of a total number of 2206 prescriptions that were evaluated, about 40% of them were prescriptions for antibiotics. Of all encounters in which a systemic antibiotic was prescribed, just above a quarter were of appropriate indication and dosage (Ndhlovu, 2009).

As medicines funding was one of the challenges that were experienced on yearly basis at UTH (Pharmacy records, 2013) and the fact that antimicrobials represented the most expensive therapeutic group among medications used in hospitals, and their use comes at a cost, not only of the medicine itself, but of side-effects and promoting ever-growing bacterial resistance to antibiotics (Kali & Swingler, 2003), it was envisaged that the study findings would have a significant impact on the field. This study was aimed at filling the gap of lack of current data on antibiotic prescribing patterns and lead to a greater understanding of the extent of challenges on the prescribing patterns of antimicrobials at UTH. From the reviewed literature, it was noted that prescribing patterns were inappropriate globally. This study in addition to describing the antibiotic prescribing patterns at UTH would assess availability of systems, structures and processes at UTH such as Drug and Therapeutic Committee, Antibiotic Policy Committee, Pharmaceutical Advisory Committee, Medication Advisory Committee, and Medication Management/Administration Policy. Tseng *et al*., (2012), suggests that hospitals need to have antibiotic control measures and conduct courses on the appropriate use of antibiotics at least once every 6 months, and clinicians need to attend the course at least once per year.

CHAPTER THREE

3.0 METHODOLOGY

This chapter includes the following: study design, study setting, data source, study population, inclusion/exclusion criteria, sample size/sampling method, variables, data collection/data collection tools, data consolidation/analysis/interpretation, gold standards for treatment and ethical considerations.

The general objective of this research was to describe the prescribing pattern of antibiotics among physicians at University Teaching Hospital in Lusaka, Zambia, and it specifically related to the appropriateness of antibiotics in terms of dose, duration, dosage interval and routes of administration.

The researcher intended to collect empiric data due to lack of up to date data describing the antibiotic prescribing patterns at UTH despite the skyrocketing consumption of antibiotics (UTH Pharmacy records 2013) and increased resistance(Lukwesa, 2012-unpublished data).

3.1 Study design

The study was designed as a prospective cross-sectional study which was appropriate to collect over a short period of time and find the prevalence of the outcome of interest which was the prescribing patterns of antibiotics among physicians. The study endeavoured to review files as soon as it was feasible to avoid loss of patient records/files.

3.2 Study Setting

The University Teaching Hospital being a public tertiary-care institution offering all medical specialties and had an official bed capacity of 1 863. In 2010 there were 79 029 admissions, in 2011 there were 81 227 admissions and in 2012 there was a total of 80 993 admissions. On average from the three years cited, the hospital had 80 416 admissions per year.

The study was conducted in the departments of Internal Medicine (IM), Surgery and Obstetrics/Gynaecology (OBGY). IM has six wards (E01, E02, E11, E12, E21 and E22), Surgery department had five wards (G01, G02, G11, G12, G21, and G22) and OBGY had twelve wards (B01, B03, B11, B13, B21, C01, C02, C03, and C13).

3.3 Data source and study population

The study used triangulation method by reviewing patient files and drug charts for in-patients admitted to UTH, administering questionnaires to Physicians in IM, OBGY and Surgery and administering questionnaires to clinical heads in the three departments and the head of pharmacy department at UTH in order to capture as much information as possible.

3.4 Inclusion criteria

- Files of patients admitted to hospital units of internal medicine, surgery, and obstetrics/gynaecology were eligible for inclusion in the study.
- Physicians (graduate, post-graduate and consultant doctors) practicing in the named departments at the time of data collection.
- Clinical heads of the named departments and head of pharmacy department.

3.5 Exclusion criteria

- Patients admitted to neurology, ICU.
- Patients admitted to B12 (Labour ward) and B21 (Cancer diseases ward).
- Physicians and clinical heads in other departments.
- Patients below 18years of age.

3.6 Sample size determination

At 95% confidence level, expected frequency of 50% as revealed by several studies (Davey *et al*., 2005) and a precision of ± 5%, with a worst acceptable frequency of 55%, a sample size was calculated as follows:

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

Where n is the sample size

P is the prevalence 50%, and

Z (1.96) is area under curve for confidence level of 95%

e is the marginal error which is 5 in this case.

Therefore $n = 1.96^2 \times 50 (100-50)/5^2 =$ **385**

The sample size was divided among the three departments using probability-proportional to size based on the average number of admissions per month. IM had about 953 admissions per month; OBGY had about 2, 904 and Surgery had about 1,751 admissions per month respectively. However, surgery had also patients below 18 years who were excluded.

Therefore, 165 patient records were from OBGY, 100 from surgery and 120 from IM. Systematic sampling was used with sampling intervals (SI) as follows:

- IM: SI = 385/120 =3.2 = 4
- OBGY: SI = 385/165 =2.3 =3
- Surgery: SI = 385/100 =3.9 = 4

There were 12, 11 and 10 consultants; 5, 5, and 2 senior registrars; 25, 30 and 17 registrars; 6, 22 and 10 junior doctors in IM, OBGY and Surgery respectively bringing the total number of clinicians in the three departments to 155.

All the 155 physicians were eligible for the study.
The clinical heads for the three departments and the head of pharmacy department were included as well to collect information about structures, systems and processes available at UTH that regulated antibiotic use.

The study sample was from three sample frames: Patient records, physicians, and clinical heads and head of pharmacy department. For the patient files they were systematically sampled where as for other two sample frames, it was purposive sampling of the heads of departments and convenience sampling for the physicians (whoever was willing to participate was recruited).

3.7 Variables

Table 1: Variables with their associated definitions and scales of measurements

Variable	Definition	Scale of Measurement
Age	Age was grouped as 18-20 years, 20-30years and 31 years and above,	Categorical 1=18-20yrs; 2=21-30 yrs 3=31-40 yrs; 4=above 40 yr
Gender	Sex was defined as male and female	Nominal 1=male, 2=female
Antibiotics prescribed	Antibiotics were according to alphabetical order as Amoxicillin, Ampicillin, Azithromycin and so on.	Categorical 1=Amoxicillin; 2=Ampicillin etc
Conditions	Conditions for which antibiotics were prescribed were grouped according to systems as outlined in Zambian STG index such as CNS, GIT etc.	Categorical 1=abortion 2=anaemia, etc
Appropriateness of antibiotic	Appropriateness of antibiotic was defined as dose, route of administration, dosage interval and duration of treatment being indicated or not in the patient records and being correct or wrong	Categorical 1=indicated 2=not indicated
Microscopic, Culture & Sensitivity (MCS)	MCS was defined as type of sample taken and readiness of results.	Categorical 1=urine ; 2=stool 3=pus swab; 4=vaginal swab; 5=others; 6=results not ready; 7=results ready; 8=not requested
Availability of systems, structures and processes regulating antibiotics	Availability was defined as presence or absence of structures, systems and processes such as DTC, antibiotic Policy Committee, Medication Advisory Committee, Medication and Administration Policy	Categorical 1=available; 2=not available

3.8 Data collection

Data was collected from patients' records. These records were given codes. The ages and gender were noted. The diagnosis was noted and the antibiotics prescribed. Records were reviewed to determine whether the dose, route of administration, dosage interval and duration were recorded either in the patient file or drug chart.

The other data was collected from the prescribers. A self-administered questionnaire with open-ended questions on the use of antibiotics mainly prescribed at UTH was used ***(Appendix D).*** Data on whether there were systems, structures and processes available at UTH aiming at regulating antibiotic use was collected from the clinical heads of the three departments included in the study and the head of pharmacy department at UTH. A self-administered questionnaire with closed –ended questions was used ***(Appendix F).***

Data collection was over a period of four months. The data collected was then analysed.

3.9 Data Collection Tools

A structured self-administered questionnaire with open-ended questions for prescribers, self-administered questionnaire with closed-ended questions for clinical heads and head of pharmacy department and researcher's data collection form which were pre-tested (***Appendices D, E and F*****).**

3.10 Data consolidation, analysis and interpretation

Quality evaluation

The appropriateness of antibiotic prescribing was assessed according to the method of Gyssens *et al*. ***(Appendix B)*** and the traffic light system. The following classification was used: appropriateness of the prescription, inappropriateness due to improper dose, dosing intervals, route of administration, duration, antibiotic not indicated, and records insufficient for categorization. To minimize errors, double entry, range and consistent checks were done.

Prescriptions were considered therapeutic if:

(a). the medical records contained information that the antibiotic was presented for therapy.

(b). an infectious disease was diagnosed.

(c). clinical signs of infection such as fever were present on the day that antibiotic therapy was initiated.

Antibiotics were classified as prophylactic if:

(a). the medical record stated that the antibiotic was prescribed for prophylaxis.

(b). it was given for only one day relative to the timing of a surgical intervention.

The antibiotic therapy was reviewed to assume compliance with recommendations of the national guidelines (STG).

Statistical analysis

The Statistical Package for Social Sciences (SPSS) version 16.0 was used for all statistical calculations. For categorical variables, data was expressed as number and percentage and pie charts and bar charts were used. The association between bacteriological findings and antibiotic prescribing patterns was done using chi-square. The recorded diagnosis and symptoms were grouped according to Zambian STG index. The total number of prescriptions containing antibiotics for each indication were counted and expressed as percentages of the total number of prescriptions.

3.11 Gold standards for treatment

The prescriptions were analysed for compliance with the Zambian STG and Gyssen *et al*. form (**Appendix B**).

3.12 Ethics Considerations

The purpose of the study was to determine the current prescribing patterns of antibiotics at UTH in view of the increased use of antibiotics and increasing resistance patterns.

Permission was sought from the UTH Management to carry out the study at the institution and permission was granted. Clearance by The University of Zambia Biomedical Research Ethics committee was sought .All procedures regarding the confidentiality of patient documents and clinician details were followed in full. The research results would only be released to designated authorities. The patients' records and any other relevant documents were handled as regulated by the hospital authorities as necessary. The patient records were reviewed from the sister in charge's office hence there was no need for patients to sign a consent form. Confidentiality was assured as no names were captured on the data collection tool, the medical prescriptions were not taken away from the hospital premises to avoid data mix up**.** Physicians willing to participate in the study were requested to sign the consent form ***(Appendix C).***

The clinical heads and head of pharmacy department were not required to disclose their particulars and were also requested to sign on the consent form.

CHAPTER FOUR

4.0 RESULTS

This chapter gives a brief description of the sample characteristics: demographics of the study patients, the antibiotics prescribed and the conditions for which they were prescribed, whether the dose, route of administration, frequency and duration of treatment were indicated, and whether prescriptions met the Gyssens *et al*. criterion. The chapter provides details on statistical association of level of qualification of physicians and prescription patterns as well as level of compliance to the Zambian STG. This is followed by an analysis of systems, structures and processes or control measures that were available at UTH monitoring and regulating antibiotic use.

In this report, the term 'Physician' refers to a medical doctor.

4.1 Sample Description

4.1.1 Demographics of study patients

A total of 385 patients had their medical records reviewed.

Out of these patients, 165(42.9%) were from the department of Obstetrics and Gynaecology (OBGY), 120(31.1%) were from the department of Internal Medicine (IM) and 100(26.0%) were from the department of Surgery. Of those from IM, 50(41.7%) were males while 70(58.3%) were females whereas those from the department of Surgery, 49(49.0%) were males and 51(51.0%) were females.

The age of the study patients was in categories; From the department of OBGY, study patients within 18-20 years were 20(12.1%), 21-30 years were 89(53.9%), 31-40 years were 41(24.8%) and those above 40 years were 15(9.1%); from the department of IM,

study patients in the age group of 18-20 years were 10(8.3%), 21-30 years were 36(30.0%), 31-40 years 23(19.2%) and those above 40 years were 51(42.5%); those from the department of Surgery, 18-20 years were 15(15.0%), 21-30 years were 31(31.0%), 31-40 years were 32(32.0%), those above 40 years were 22(22.0%) as shown in table 2 below.

Table 2: Age groups of study patients whose records were reviewed

Department	**Age groups (years)**			
	18-20	21-30	31-40	Above 40
Obstetrics and Gynaecology(OBGY)	20	89	41	15
Internal medicine(IM)	10	36	23	51
Surgery	15	31	32	22
Total	45	156	96	88

From the table above, the study patients were mainly from the age group 21-30 years with a frequency of 156 out of 385 study patients and the least study patients being from the age group 18-20 years with a frequency of 45.

4.2 Study patients who were prescribed antibiotics

Of the 385 patients evaluated, 270(70.1%) had antibiotic(s) prescribed for them and only 115(29.9%) had no antibiotics. Out of 165 study patients from OBGY, 121(73.3%) had an antibiotic(s) prescribed for them and 44(26.7%) had no antibiotics; out 120 from IM, 72(60%) were on antibiotics while 48(40%) were not on antibiotics whereas those from

Surgery, 77(77.0%) out of 100 study patients were on antibiotics while 23(23.0%) were not on antibiotics. Out of those with antibiotics, the average number of antibiotics per prescription was 1.8. This meant that up to 486 antibiotic prescriptions were noted. The number of antibiotics per prescription breakdown in the three departments was; OBGY 2.0, IM 2.0, and Surgery 1.3.

4.2.1 Most prescribed antibiotics

The most commonly prescribed antibiotic in OBGY was metronidazole with a frequency of 68(28.0%). Benzyl penicillin and gentamycin accounted for 40(16.5%) and 37(15.2%) respectively. The least prescribed antibiotics were nitrofurantoin and 4FDCs both with a frequency of 1(0.4%).

In the department of IM, the most commonly prescribed antibiotic was benzyl penicillin with a frequency of 39(26.9%). Ceftriaxone accounted for 28(19.3%). Chloramphenicol, metronidazole and 4FDCs all had a frequency of 16(11.0%) each. Amoxicillin, cephalexin, ciprofloxacin and co-trimoxazole were the least prescribed antibiotics, with each antibiotic accounting for 1(0.7%). Table 3 below shows the types of antibiotics prescribed by physicians in the three departments (OBGY, IM and Surgery) and whether they were given for treatment (T), prophylaxis (P) or there was no indication at all (NI).

Table 3: Antibiotics prescribed by physicians in the different departments and reasons for prescribing them.

Antibiotic/Depart **No of patients**	**OBGY**			**IM**			**SURGERY**			**TOTAL**
	T	**P**	**NI**	**T**	**P**	**NI**	**T**	**P**	**NI**	
Amoxicillin	4	5	4	1	0	0	0	0	0	14
Ampicillin	0	0	0	0	0	0	0	0	0	0
Azithromycin	0	0	0	0	0	0	0	0	0	0
Benzathine penicillin	0	0	0	0	0	0	0	0	0	0
Benzyl penicillin	12	26	2	29	2	8	3	1	1	84
Cefotaxime	3	8	2	6	0	1	3	8	1	32
Cefuroxime	13	0	0	0	0	0	0	0	0	13
Ceftriaxone	3	0	6	12	2	14	1	3	1	42
Cefixime	0	0	0	0	0	0	0	0	0	0
Chloramphenicol	0	0	0	13	0	3	1	1	0	18
Cephalexin	19	1	1	1	0	0	0	0	0	22
Ciprofloxacin	3	1	0	1	0	0	2	4	0	11

Clarithromycin	0	0	0	0	0	0	0	0	0	0
Clindamycin	0	0	0	0	0	0	0	0	0	0
Cloxacillin	5	1	0	0	0	0	10	23	1	40
Co-trimoxazole	0	0	0	1	0	0	0	1	0	2
Doxycycline	1	1	0	0	0	0	0	0	0	2
Erythromycin	1	10	1	8	2	3	0	0	0	25
Gentamycin	10	26	1	2	0	2	3	1	1	46
Imipenem	0	0	0	0	0	0	0	0	0	0
Metronidazole	16	39	13	11	0	5	6	10	2	92
Nalidixic acid	3	0	0	0	0	0	0	0	0	3
Nitrofurantoin	1	0	0	0	0	0	0	0	0	1
Phenoxymethylpenicillin	0	0	0	0	0	0	0	0	0	0
Procaine penicillin	0	0	0	0	0	0	0	0	0	0
Tetracycline	0	0	0	0	0	0	0	0	0	0
Vancomycin	0	0	0	0	0	0	0	0	0	0
4FDCs	0	1	0	16	0	0	2	0	0	19

Streptomycin	0	0	0	2	0	0	0	0	0	2
Total	**94**	**119**	**30**	**103**	**06**	**36**	**31**	**52**	**07**	

Key: T=Treatment, P=Prophylaxis, NI=No Indication

From the table above, antibiotics were mostly prescribed for prophylaxis in OBGY(119) followed by treatment(94) and no indication(30) whereas in Internal Medicine, antibiotics were mostly prescribed for treatment(103), followed by no indication(36) and prophylaxis(06) while in surgery, antibiotics were mostly for prophylaxis(52) followed by treatment(31) and no indication(07).

4.2.2 Documentation of dose of treatment

Of the 270 prescriptions that had antibiotics, a total of 478 antibiotics were prescribed and of the total prescriptions with antibiotics, 453(94.8%) prescriptions had the dose of treatment indicated while 25(5.2%) prescriptions had no dose indicated on them. Dose of treatment was indicated in 233(95.9%) prescriptions out of 243 prescriptions in Obstetrics and Gynaecology, 131(90.3%) out of 145 in Internal Medicine whereas 89(98.9%) out of 90 prescriptions in Surgery had the dose indicated.

4.2.3 Documentation of duration of treatment

Out of the 270 study patients with antibiotics evaluated, 113(41.8%) had duration of treatment specified or at least review date indicated while 157(58.2%) had no duration or review date.

Physicians in OBGY specified the duration of treatment on 67(27.6%) out of 243 prescriptions while physicians in Internal Medicine and Surgery specified duration of treatment on 22(15.2%) out of 145 and 24(26.7%) out of 100 respectively.

4.2.4 Frequency of dosing (frequency of administration)

Frequency of dosing was documented in 451(94.4%) of the total prescriptions with antibiotics evaluated. OBGY had 231(95.1%), IM 132(91.0%) and Surgery had 88(97.8%) of prescriptions that had frequency of dosing indicated.

4.2.5 Route of administration

Route of administration was indicated in 440(92.1%) of the total prescriptions with antibiotics that were reviewed. OBGY had 222(91.4%), IM 130(89.7%) and Surgery had 88(97.8%) of prescriptions that had frequency of dosage indicated.

4.3 Compliance of physicians to Gyssens *et al*. recommendations and Zambian Standard Treatment Guidelines (STG).

4.3a. Compliance of physicians to Gyssens *et al.* recommendations

In this study, evidence is provided that physicians did not comply with recommendations made by Gyssens and colleagues regarding appropriateness of a prescription. It was found that 78.13 percent of prescriptions were not complying with Gyssens *et al*. recommendations and only 21.87 percent conformed to recommendations as shown in figure 1 below.

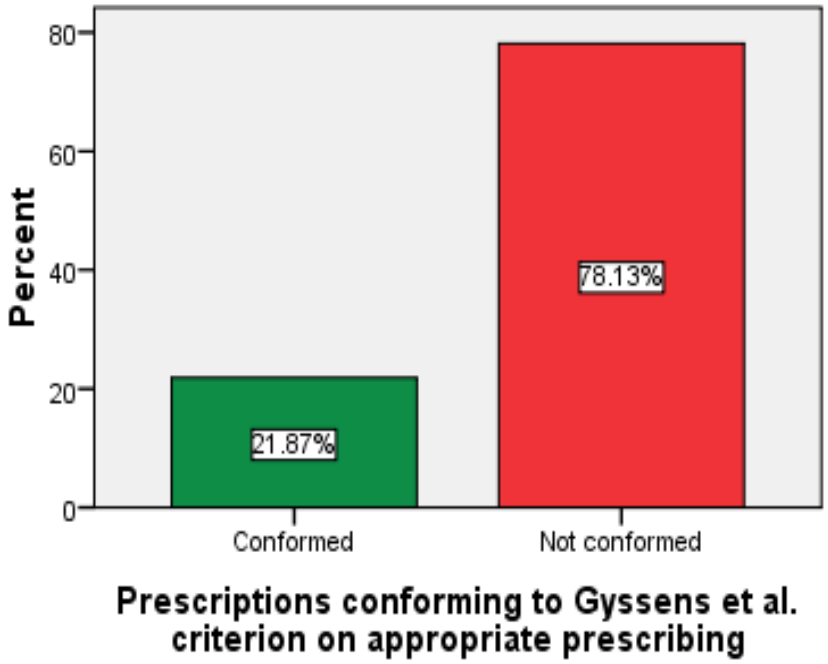


Figure 1: A bar chart showing the overall percentage of compliance to Gyssens et al. recommendations

Out of the 270 prescriptions with antibiotics, only 21.87 percent of them conformed to Gyssens *et al*. criterion meaning they had the right choice of drug and dose, duration, frequency and route of administration were all documented whereas 78.13 percent either had the wrong antibiotic or dose, duration, dosing frequency and route of administration were not documented as illustrated in table 4 below.

Table 4: Levels of compliance of physicians from individual departments to Gyssens *et al.* recommendations

	OBSTETRICS & GYNAECOLOGY				**INTERNAL MEDICINE**				**SURGERY**			
	A	B	C	D	A	B	C	D	A	B	C	D
TOTAL	59	176	1	7	18	116	2	12	20	68	0	1
PERCENT	24.3	72.4	0.4	2.9	12.4	80.0	1.4	8.2	22.2	68.7	0.0	0.01

Note: A=Dose, Frequency, Route & Duration all indicated

B=Three out of (Dose, Frequency, Route & Duration all indicated) indicated

C=Two out of (Dose, Frequency, Route & Duration all indicated) indicated

D= only one out of (Dose, Frequency, Route & Duration all indicated) indicated

The individual departments had prescriptions conforming to Gyssens *et al*. criterion as follows; 59/243(24.3%) for Obstetrics and Gynaecology, 18/145(12.4%) for Internal Medicine and 20/90(22.2%) for Surgery.

4.3b. Compliance of physicians to the Zambian Standard Treatment Guidelines

This study shows that compliance to the national Standard Treatment Guidelines (STG) by physicians is very poor. This was evidenced by the number of prescriptions that were conformed to STG as shown in the pie chart (figure 2) below.

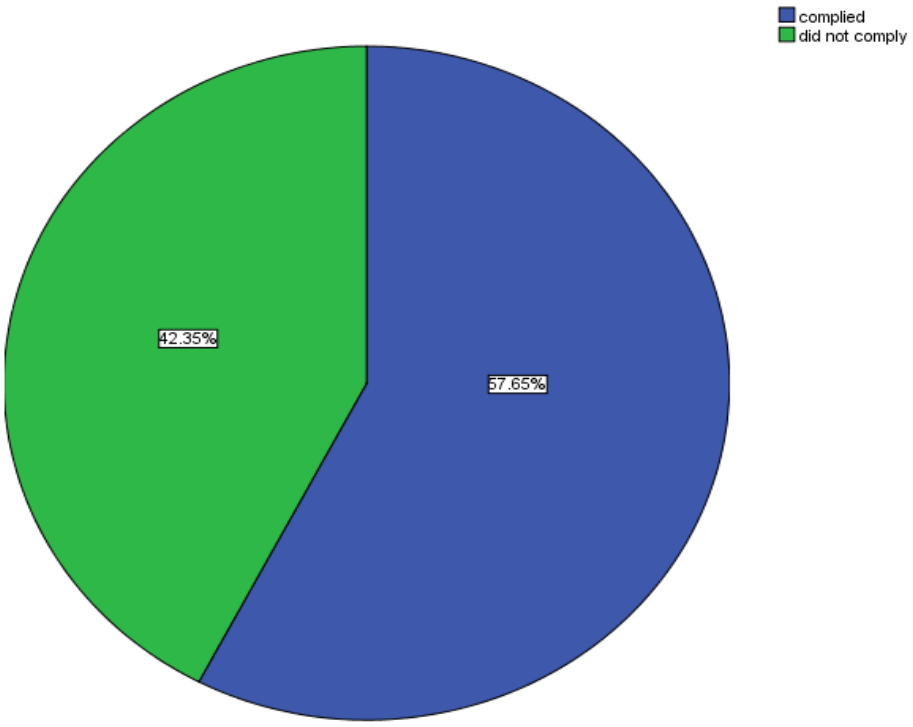


Figure 2: Compliance of physicians to Zambian Standard Treatment Guidelines

Of the prescriptions that had antibiotics, 167/290 (57.65%) prescriptions complied to the Zambian STG in terms of right choice of drug for the right condition at the right dose while 123/290(42.35%) prescriptions did not comply.

4.4 Reasons for prescribing antibiotics

Out of the prescriptions that had antibiotics, 228(47.7%) were prescribed for treatment, 177(37.1%) were prescribed for prophylaxis and 73(15.2%) were prescribed without any indication. OBGY had 94(38.7%) out 243 antibiotics prescribed for treatment, 119(49.0%) antibiotics were prescribed for prophylaxis and 30(12.3%) antibiotics were prescribed without justification; whereas IM had 103(71.0%) antibiotics prescribed for treatment, 6(4.1%) antibiotics prescribed for prophylaxis and 36(24.8%) prescriptions had no indication. Surgery had 31(34.4%) antibiotics prescribed for treatment, 52(57.8%)

antibiotics were prescribed for prophylaxis and 7(7.8%) antibiotics had no justified indication.

4.5 Conditions recorded on prescriptions and antibiotics prescribed.

The tables 5, 6 and 7 below show the conditions that were recorded in patients' files and the antibiotics that were ordered in three departments, OBGY, IM and Surgery respectively.

Table 5: Conditions most prevalent and antibiotics prescribed in Obstetrics and Gynaecology department

Condition	**No of patients**	**Antibiotics prescribed**
Abortion	2	Gentamycin, metronidazole, benzyl penicillin
Anaemia	6	Cefotaxime
Cancer	10	Amoxicillin, metronidazole, ceftriaxone
PID	5	Gentamycin, metronidazole
UTI	36	Amoxicillin, cephalexin, cefuroxime, metronidazole, cefotaxime, nalidixic acid
PROM/PPROM	11	Amoxicillin, erythromycin, metronidazole
Pneumonia	1	Benzyl penicillin, erythromycin, metronidazole
Pre/Post operation	32	Ciprofloxacin, cloxacillin, metronidazole, benzyl penicillin, Nalidixic acid, gentamycin

Sepsis	6	Benzyl penicillin, ciprofloxacin, cloxacillin, gentamycin, metronidazole, cefotaxime
Viscero-vaginal fistula(VVF)	2	Gentamycin, metronidazole
HTN/VVF	1	Metronidazole
Post-partum haemorrhage	2	Amoxicillin, gentamycin, metronidazole, benzyl penicillin, cefotaxime
Vaginosis	1	Cefuroxime
Pyrexia of unknown origin	2	Gentamycin, metronidazole, benzyl penicillin
Spontaneous vaginal delivery	8	Amoxicillin, nalidixic acid
Sickle cell disease/UTI	1	Cephalexin

The most prevalent condition in OBGY was UTI with frequency of 36 and was managed using amoxicillin, cefuroxime, cephalexin, metronidazole and cefotaxime. Others were pre/post operation (32) treated with ciprofloxacin, benzyl penicillin, gentamycin, nalidixic acid and metronidazole; PROM/PPROM (11) treated with amoxicillin, erythromycin and metronidazole; cancer (10) where amoxicillin, metronidazole and ceftriaxone were given; and sepsis (6) treated with benzyl penicillin, ciprofloxacin, cloxacillin, gentamycin, metronidazole and cefotaxime.

Table 6: Conditions most prevalent and antibiotics prescribed in Internal Medicine

Condition	**No of patients**	**Antibiotic(s) prescribed**
Anaemia	4	Cefotaxime
Ascites	3	Ceftriaxone
Cancer/sepsis	1	Cefotaxime
Allergy	1	Benzyl penicillin, ceftriaxone, gentamycin
Diabetes/diabetic foot	7	Ceftriaxone, benzyl penicillin, erythromycin, metronidazole,
Peptic ulcer disease	2	Amoxicillin
Biventricular heart failure	7	Benzyl penicillin
Meningoencephalitis	7	Benzyl penicillin, cefotaxime, ceftriaxone, chloramphenicol
Psychosis	4	Benzyl penicillin, chloramphenicol
CVA/stroke	2	Ceftriaxone
Organophospate poisoning	3	Benzyl penicillin, metronidazole
Sepsis/septicaemia	10	Benzyl penicillin, ceftriaxone, chloramphenicol,

		gentamycin, metronidazole
Meningitis	2	Benzyl penicillin, chloramphenicol,
PID	2	Cefotaxime, gentamycin
BVHF/TB	1	Benzyl penicillin, erythromycin, 4FDCs
Pneumonia/TB	13	Benzyl penicillin, erythromycin, ceftriaxone, chloramphenicol, cefotaxime, metronidazole
HIV/AIDS	1	Ceftriaxone
DIH/TB	1	4FDCs, streptomycin
Left ventricular heart failure	1	Cefotaxime
TB	3	Ceftriaxone, metronidazole, 4FDCs, streptomycin
Malnutrition	1	Benzyl penicillin, metronidazole
Anaemia/TB	2	4FDCs
CNS OI	2	Ceftriaxone
Sepsis/TB	1	Benzyl penicillin, ceftriaxone, erythromycin, metronidazole, 4FDCs
Meningitis/TB	1	Benzyl penicillin, ceftriaxone, chloramphenicol, erythromycin, 4FDCs
Hepatitis/jaundice	2	Ceftriaxone

Severe headache	1	Benzyl penicillin, chloramphenicol
Bed sores	1	Ceftriaxone
Pleural effusion	1	Benzyl penicillin
Pyrexia of unknown origin	1	Cefotaxime
Gastroenteritis	2	Metronidazole
UTI	1	Ciprofloxacin
Septic shock	1	Benzyl penicillin, cefotaxime, erythromycin
Renal failure	3	Benzyl penicillin, ceftriaxone, gentamycin

The most prevalent condition in Internal Medicine was pneumonia with frequency of 13 and was managed using benzyl penicillin, erythromycin, ceftriaxone, chloramphenicol, metronidazole and cefotaxime. Others were sepsis (10) treated with benzyl penicillin, gentamycin, ceftriaxone, chloramphenicol and metronidazole; meningoencephalitis (7) treated with benzyl penicillin, ceftriaxone, chloramphenicol and cefotaxime; diabetes/diabetic foot (7) where ceftriaxone, erythromycin and metronidazole were given; and biventricular heart failure (7) where benzyl penicillin was given.

Table 7: Conditions most prevalent and antibiotics prescribed in the department of Surgery

Condition	**No of patients**	**Antibiotic(s) prescribed**
Abscess	10	Cloxacillin, co-trimoxazole, metronidazole
Burns	4	Ciprofloxacin
Cellulitis	3	Benzyl penicillin, cefotaxime, cloaxicillin, gentamycin, metronidazole
Cancer	7	Benzyl penicillin, ceftriaxone,gentamycin, metronidazole
Diabetic foot	3	Chloramphenicol, cloxacillin, metronidazole
Fracture	29	Cefotaxime, ciprofloxacin, cloxacillin, metronidazole
Injuries	25	Cefotaxime, cloxacillin, ceftriaxone, metronidazole
Sepsis	5	Benzyl penicillin, cefotaxime, ceftriaxone, gentamycin, metronidazole
Abscess/TB	2	Cloxacillin, 4FDCs
Fever/TB	2	Cefotaxime, ciprofloxacin, cloxacillin, 4FDCs
Diarrhoea	1	Metronidazole
Others	4	Cefotaxime, metronidazole
Pre/Post OP	4	Cefotaxime, ceftriaxone, cloxacillin

Fractures were the most prevalent condition in surgery department with frequency of 29 and antibiotics that were mostly prescribed included cefotaxime, ciprofloxacin, cloxacillin and metronidazole. Other top prevalent conditions were injuries such as head injury (25) and antibiotics including cefotaxime, cloxacillin, ceftriaxone and metronidazole were prescribed; abscesses (10) treated with cloxacillin, co-trimoxazole and metronidazole; sepsis (5) where ceftriaxone, cefotaxime, benzyl penicillin, gentamycin and metronidazole were prescribed; and burns (4) for which ciprofloxacin was the main antibiotic that was prescribed.

4.6 Demographical characteristics of physicians

Of the 34 physicians that took part in the study, 5 were consultants, 5 were senior registrars, 8 were registrars, 4 were senior house officers/senior residence medical officers and 12 were junior resident medical officers.

4.1.9 Frequencies of drugs and conditions

Of the antibiotics that were prescribed, the ten most prescribed antibiotics were; cefotaxime (8.0%), ceftriaxone (6.7%), benzyl penicillin (5.9%), metronidazole (5.9%), amoxicillin (5.7%), cefuroxime (5.7%), gentamycin (4.8%), erythromycin (4.6%), ciprofloxacin (4.3%) and cephalexin (4.3%).

The conditions for which these antibiotics were prescribed included; Urinary tract infection, upper respiratory infections, pneumonia, sepsis, meningitis, premature rupture of membranes and pre/post operation.

4.7 Conditions for which physicians prescribed the selected antibiotics

In this study, it was found that the newer and more expensive antibiotics such as cefixime, ceftriaxone, cefotaxime and cefuroxime were becoming more prescribed by the physicians as shown in the table 8 below.

Table 8: Selected antibiotics from the EDL and conditions for which they were prescribed.

Drug	**Condition and frequency of physicians**
Amoxicillin	UTI (6), URTI(7), post OP(2), pneumonia(8), PID(2), PPROM/PROM(5), tonsillitis(1), abscess(1)
Ampicillin	UTI(1), URTI(3), post OP(1), pneumonia(6), sepsis(2), PID(1), abscess(1)
Azithromycin	UTI(1), URTI(4), pneumonia(2), sepsis(2), MAC(1)
Benzathine penicillin	Post OP(1), syphilis (15), pneumonia(1), RHD(3)
Benzyl penicillin	UTI(2), URTI(1), Post OP(10), Pneumonia(6), pyelonephritis(5), meningitis(1), sepsis(3), PID(2), burns(1), GI infections(1), tonsillitis(1)
Cefotaxime	UTI (2), URTI(2), post OP(7), pneumonia(6), pyelonephritis(5), meningitis(8), sepsis(8), head injury(1), PID(2)
Cefuroxime	UTI(6), URTI(5), Post OP(4), pneumonia(4), pyelonephritis(2), meningitis(3), sepsis(6) PID(1), abscess(1)
Ceftriaxone	UTI(4), URTI(1), post OP(4), pneumonia(7), pyelonephritis(4), meningitis(6), sepsis(9), Head injury(1), abscess(1), chronic liver disease(1)
Cefixime	UTI(2), URTI(2), Post OP(1), pneumonia(5), meningitis(1),

	sepsis(2), abscess(1)
Chloramphenicol	URTI(1), Post OP(1), pneumonia(1), meningitis(10), sepsis (2), head injury(1), GI infections(1), abscess(1), SCD(1)
Cephalexin	UTI(8), URTI(8), pneumonia(6), sepsis(1), PID(1)
Ciprofloxacin	UTI(8), sepsis(2), PID(14), burns(2), enteric fever(1)
Clarithromycin	UTI(1), URTI(1), pneumonia(1), PID(2), Peptic ulcer disease(14)
Clindamycin	Pneumonia(1), PID(2), PUD(1), abscess(2)
Cloxacillin	Pneumonia(1), abscess(7), cellulitis(2)
Co-trimoxazole	URTI(1), PCP(16), GI infections(2), toxoplasmosis(1)
Doxycycline	UTI(1), pneumonia(1), PID(17)
Erythromycin	UTI(3), URTI(2), pneumonia(9), PID(2), PPROM/PROM(10)
Gentamycin	UTI(3), URTI(1), Pre/post OP(9), pneumonia(5), pyelonephritis(1), sepsis(4), head injury(1), PID(2)
Imipenem	Pneumonia(2), meningitis(2), sepsis(7), burns(2)
Metronidazole	pre/post OP(2), pneumonia(4), sepsis(2), PID(10), PUD(3), PCP(1), PPROM/PROM(2), GI infections(4)Chronic liver disease(1), dysentery(1)

Nalidixic acid	UTI(13), PID(1), GI infections(2), dysentery(6)
Nitrofurantoin	UTI(20), PID(1)
Phenoxymethyl penicillin	URTI(3), pre/post OP(1), tonsillitis(8), mumps(1)
Procaine penicillin	Syphilis(3), pyelonephritis(1)
Tetracycline	URTI(1), pleural effusion(1)
Vancomycin	Sepsis(1), PID(1)

From the table above it is clear that the newer and more expensive antibiotics such as cefotaxime, ceftriaxone, cefuroxime, cefixime and imipenem were the mainstay in managing conditions such as UTI, pneumonia, sepsis and meningitis.

4.8 Microscopic, Culture and Sensitivity (MCS)

Of the study patients on antibiotics, 86(31.9%) had bacteriological tests ordered while 184(68.1%) had no bacteriological tests ordered.

Of the bacteriological tests ordered from OBGY, 25 were samples of urine and four (4) of them had results available at the time of review. In the department of IM, four (4) samples were of urine, five (5) of stool, two (2) of pus swab eight (8) were of other samples such as vaginal swab and blood. 19 patients had results available at the time of review.

In surgery, only two (2) patients had culture results at the time of review out of the 12 patients that had bacteriological tests ordered.

4.9 Factors influencing prescribing patterns

This study found that there were a number of factors that physicians reported to influence their prescribing habits as illustrated in the figure 3 below.

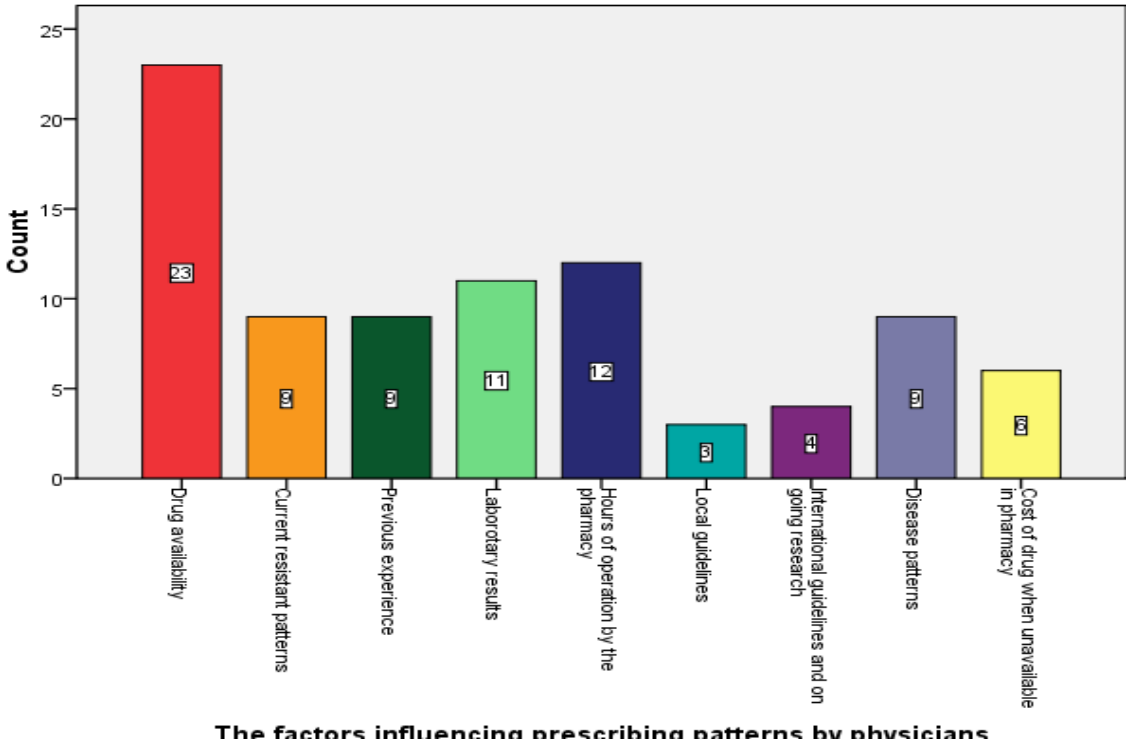


Figure 3: A bar chart showing factors that physicians reported to influence their prescribing patterns

Among the many factors that influence prescribing patterns, drug availability(23), hours of operation by the pharmacy(12), laboratory facilities(11), disease patterns, resistant patterns and previous experience(9) each, cost of drugs(8), were said to be factors that influenced prescribing patterns at UTH.

4.10 Structures, systems and processes regulating the prescribing of antibiotics

There was only a Drug and Therapeutics Committee (DTC) at UTH at the time of review. The composition of the DTC was Medical Doctors, Pharmacists, Microbiologists, nurses, Environmental officer, accountant and procurement officer.

The committee met once per quarter. However, sometimes they did not meet every quarter due to lack of time and busy schedules. According to Tseng *et al*., (2012), hospitals should have antibiotic control measures and should conduct a course on the appropriate use of antibiotics at least once every 6 months, and clinicians should attend the course at least once per year

CHAPTER FIVE

5.0 DISCUSSION

5.1 key findings

In this study, it was found that antibiotic prescribing patterns at University Teaching Hospital were inappropriate. It was found that up to 270/385 (70.1%) study patients received antibiotics at the time of review with an average number of 1.8 antibiotics per prescription and up to 73/270(15.2%) had no justified indication. Only 86(31.9%) prescriptions had bacteriological tests ordered. The study also found that prescriptions were not conforming to ideal standards. The evidence is that only 97/270(35.9%) of prescriptions conformed to Gyssens and colleagues' recommendations and only 57.65 percent of prescriptions with antibiotics complied with the national Standard Treatment Guidelines. The study also found that there were no antibiotic control measures at the hospital.

5.2 Demographic characteristics of study patients

The highest number of prescriptions with antibiotics(50) in Internal Medicine, were from the age group 21 to 30 years followed by (45) in the age group 31-40 years while age groups above 40 years and 18 to 20 years had 44 and 5 prescriptions with antibiotics respectively.

In the department of Obstetrics and Gynaecology, the highest antibiotic prescribing (125) like in Internal Medicine was in the age group 21 to 30 years followed by 68, 30 and 20 prescriptions for age groups 31 to 40 years, 18 to 20 years and above 40 years respectively.

In the department of surgery, 21 to 30 years age group had 32 study patients followed by 24, 22 and 12 study patients for age groups 31 to 40 years, 18 to 20 years and above 40 years respectively.

Out of the physicians that participated in the study, 5 were consultants, 5 were senior registrars, 8 were registrars, and senior house officers/senior residence medical officer and junior residence medical officers were 4 and 12 respectively

5.3 Study patients prescribed with antibiotics

In this study, it was found that a significant number of patients were prescribed with antibiotics. The evidence is that out of the 385 patients whose records were reviewed, 270 (70.1%) were prescribed with antibiotics. The breakdown per department was 121/165(73.3%), 72/120(60%) and 77/100(77.0%) from OBGY, IM and Surgery respectively. These findings are comparable to the findings of Lukwesa (1998). However, in this study unlike their study, Surgery had the highest percentage (77.0%) followed by OBGY (73.3%) and then 60% for IM. Unlike our findings, Akande *et al*., (2009) in Nigeria found that up to 83.5 percent prescriptions reviewed had antibiotics.

5.4 Average number of antibiotics per prescription

In this study, the average number of antibiotics was found to low though higher than other findings of other studies. It was found that the average number of antibiotics per prescription was 1.8. The average number of antibiotics on a prescription per department was found to be 2.0, 2.0 and 1.3 for OBGY, IM and surgery respectively. This was similar to findings of a study undertaken by Palikhe in East Africa. The average number of antibiotics per prescription was found to be 2.0 (Palikhe, 2004). A study conducted by

Makhado (2009), found a lower average number of antibiotics per prescription. The average number of antibiotics per prescription was of 1.17.

The mean number of drugs per prescription should be as low as possible because the higher the number of drugs, the greater the risk of drug resistance, non-compliance as well as cost (Kutty *et al*., 2003).

The average number of antibiotics per prescription is an important index of the scope for review and educational intervention in prescribing habits.

5.5 Most prescribed antibiotics

The study found that the most prescribed antibiotics in the department of OBGY were metronidazole, benzyl penicillin and gentamycin. It was found that metronidazole had a frequency of 68(28.0%), benzyl penicillin 40(16.5%) and gentamycin 37(15.2%). The study also found that the least prescribed antibiotics were nitrofurantoin and 4FDCs 1(0.4%). The trio (metronidazole, benzyl penicillin and gentamycin) had the highest frequency as they were most used antibiotics for pre-and post-operation. Metronidazole was also prescribed in PPROM and PROM to prevent vaginosis. Nitrofurantoin despite being the drug of choice in the treatment of UTI was the least prescribed antibiotic in OBGY due to its unavailability. 4FDCs were one of the least prescribed antibiotics due to low prevalence of tuberculosis among the pregnant women.

In this study, it has been shown that in the department of IM, the most prescribed antibiotics included benzyl penicillin 39(26.9%), ceftriaxone 28(19.3), chloramphenicol, metronidazole, 4FDCs, all with a frequency of 16(11.0%) and the least prescribed were amoxicillin, cephalexin, ciprofloxacin and streptomycin 1(0.7%). The high cases of sepsis, pneumonia, meningitis and tuberculosis accounted for high rate of prescription of top five

drugs listed above. It was noted in the study that sepsis, pneumonia, meningitis and tuberculosis accounted for about 51.0% of the admissions. Amoxicillin was less prescribed perhaps owing to reported resistance of more than 90% at UTH (Lukwesa, 2012). In Lukwesa's findings in 1998, cephalosporins were rarely used as they were still new on the market and more expensive than at the time of the study. Anti-TB drugs accounted for about 45% of antibiotics that were prescribed.

5.6 Documentation of dose of treatment

The study results indicate that dose indication is a not a serious problem. We found that the dose was indicated in 451/487(92.6%), of the total prescriptions that had antibiotics. The department breakdown was: 231/243(95.1%) for Obstetrics and Gynaecology, 131/145(90.3%) for Internal Medicine and 89/90(98.9%). This is worrying because dose is vital as it indicates how much drug should be given at each time.

5.7 Documentation of duration of treatment

In this study evidence is provided that indication of the duration of treatment is a serious problem. The evidence is that duration of treatment was only indicated in 113/270(41.9%) of the prescription with antibiotics. This was slightly better than what was found in Limpopo, South Africa by Makhado (2009) who found that only 12.6% of the reviewed prescriptions had the duration of treatment indicated.

Indication of duration of treatment is essential as patients need to comply with the prescribed treatment. In general, there are still difficulties in documenting duration of treatment or review date and thus there is need to develop policies on prescription requirements. Makhado (2009) also stated that duration of treatment is very important even if the patient felt better. There is need for the patient to take antibiotics for a specified

period of time otherwise micro-organisms would develop resistance and this would have cost implications on this resource limited economy since newer antibiotics to which resistance was not developed are costly.

5.8 Frequency of dosing (Dosing Interval)

In this study, it has been shown that indication of frequency of dosing was not a major problem. It was found that for all the prescriptions that had antibiotics (270), 94.4% of them had the frequency of dosing indicated. Although this does not reflect good or bad administration of prescribed drugs, it may be interesting to determine for example if antibiotics are administered at correct intervals as stated on the prescriptions. Documentation of dosing frequency is a necessity in all spheres of prescribing drugs. Not indicating the dosing interval is one of the reasons why micro-organisms develop resistance as drugs tend to be administered wrongly especially with concentration dependent antibiotics. And as Charani *et al*., (2010), agues, inappropriate antibiotic prescribing and increasing levels of resistance have become global concerns.

5.9 Route of administration

Indication of route of administration is very cardinal as certain drugs may have less effects when or may produce lethal toxicities when given via other routes.

In this study, it was found that the route of administration was indicated in 92.1% of the total prescriptions with antibiotics. Gyssens *et al*., (2011), recommended that indication of route of administration and other parameters optimises therapy.

Route of administration is essential as certain drugs may not be as effective if given via other routes.

5.10 Compliance of prescriptions to Gyssens *et al*. recommendations and Zambian Standard Treatment Guidelines (STG).

This study shows that compliance of prescriptions with ideal standards such as Gyssens' recommendations and the national Standard Treatment Guidelines is a major concern. The target compliance to Gyssens *et al*. recommendations or national STG was attainment of a percentage compliance of 100%. However, this may not be practical and thus the Royal College of Pathologists (RCPath) suggested the use of a traffic-light system approach for making comparisons of percent compliance of antibiotic prescribing with standards. This approach is more useful in practice. Therefore, in addition to Gyssens *et al.* recommendations, the findings of this study under the sections of compliance to STG are discussed with reference to the traffic-light system illustrated in table 16.

Table 16: Traffic-light system with associated criteria range

% compliance	Colour of traffic light
Less than 85	Red
85-95	Amber
Greater than 95	Green

In this study only 97/270(35.9%) of the prescriptions with antibiotics complied with Gyssens *et al*. recommendations and which was less than 85% (Red) according to the traffic-light system indicating serious need to improve prescribing habits at UTH.

The individual departments had prescriptions meeting Gyssens' recommendations of 59(24.3%), 18(12.4%) and 20(22.2%) for OBGY, IM and Surgery respectively.

Failure to comply with Gyssens *et al*. recommendations, may lead to drug resistance, poor patient care outcomes and unnecessary expenditure in an already resource stretched environment.

According to the traffic-light system, all departments had compliance less than 85% on three aspects recommended by Gyssens and only two aspects, in all departments compliance of 85 to 95% was attained.

The study also found that only 57.65 percent (figure 2) of prescriptions with antibiotics complied with the national STG compared with 29.20 percent compliance reported in a study conducted in South Africa by Makhado, (2009). According to the traffic-light system, prescription compliance to the national STG was in the red band indicating urgent need to correct the situation. This clearly shows that prescribing practices were not up to ideal standards. This was consistent with views held by Ashiru-Oredope *et al*., (2012), who contends that up to 50% of antibiotic prescribing is inappropriate.

5.11 Reasons for prescribing antibiotics

In this study, it was found that quiet a significant portion of antibiotics were prescribed without any justification. The evidence is that out of the 270 prescriptions of antibiotics, up to 73(15.2%) were prescribed for unjustified indication. For instance, in the department of OBGY, up to 10 prescriptions had antibiotics (either amoxicillin or metronidazole or benzyl penicillin or two of them) for patients with cervical cancer and up to 7 prescriptions had antibiotics (cloxacillin or metronidazole or benzyl penicillin) in surgery for patients with tumours whereas in the department of IM, 4 patients with anaemia without any signs and symptoms of an infection were prescribed with cefotaxime. The findings of this study are similar to the findings of Baktygul *et al*., (2011) in Japan who found that the most common reason for inappropriateness of prescriptions was the unjustified (not indicated)

use of antibiotics. Inappropriate prescribing of antibiotics could lead to ineffective and unsafe treatment of medical conditions. Moreover, inappropriate prescribing may worsen or prolong the illness thereby leading to distress and harm to the patient (Sharma and Kapoor, 2003). Prescriptions without indication added pressure to the meagre resources to procure antibiotics which are very costly.

5.12 Conditions for which physicians prescribed the selected antibiotics found in the Essential Drug List (EDL).

The study found that most physicians reported prescribing amoxicillin for UTI (6), URTI (7), pneumonia (8) and PPROM/PROM (5). Ampicillin was said to be prescribed mainly for pneumonia (6) which according to the Zambian STG fell out of favour due to high levels of resistance (97.1%) according to Lukwesa (2012).

The study also found physicians prescribed azithromycin mainly for URTI (4) and benzathine penicillin for syphilis (15) which was found to be in line with Zambian STG recommendations.

Benzyl penicillin was prescribed mostly for post OP (10), pneumonia (6) and pyelonephritis (5) while cefotaxime for post OP (7), pneumonia (6), pyelonephritis (5), meningitis (8) and sepsis (8).

Physicians indicated that they prescribed cefuroxime mainly for UTI(6),URTI(5), pneumonia(4) and sepsis(6); ceftriaxone for pneumonia(7), pyelonephritis(4), meningitis(6) and sepsis(9); cefixime for pneumonia(5), meningitis(1) and sepsis(2); chloramphenicol for meningitis(10); cephalexin for UTI(8), URTI(8) and pneumonia(6); ciprofloxacin for UTI(8) and PID(14); clarithromycin for Peptic ulcer disease(14); clindamycin for PID(2) and abscess(2); cloxacillin for abscess(7); co-trimoxazole for

PCP(16); doxycycline for PID(17); erythromycin for pneumonia(9) and PPROM/PROM(10); gentamycin for pre/post OP(9), pneumonia(5) and sepsis(4); imipenem for sepsis(7); metronidazole for pneumonia(4), PID(10) and GI infections(4); nalidixic acid for UTI (13), PID (1) and dysentery (6); nitrofurantoin for UTI (20); phenoxymethyl penicillin for tonsillitis (8); and procaine penicillin for Syphilis (3).

Acimis *et al*., (2009) also found that amoxicillin, though in combination with other drugs, was the commonly prescribed among physicians in Turkey. The commonest conditions in their findings were URTI (53.3%) and UTIs (16.4%) and in this study, the two conditions accounted for 7.6% and 14.4% respectively.

5.13 Microscopic, culture and sensitivity (MCS)

In this study, it was found that ordering of bacteriological tests and processing of samples were very poor. It was found that out of 270 study patients who were prescribed with antibiotics, only 86(31.9%) had bacteriological tests ordered before initiating treatment and only 27/86(31.4%) had the bacteriological results ready at the time of review.

The department of OBGY had 25(10.3%) patients with urine sample submitted and 4(1.6%) had the results available at time of review while 114(88.1%) did not have any laboratory orders at the time of review.

The department of IM had 4(2.8%) urine MCS samples taken, 5(3.4%) stool MCS, 2(1.4%) pus swab, other samples 8(5.5%) and results were ready at the time of review for only 19(13.1%) while 7(4.8%) had results not ready and 100 (69.0%) did not have a laboratory order.

In the department of Surgery, results were ready at the time of review for 2(2.2%) study patients while 10(11.1%) had their results not ready at time of review and 78(86.7%) did

not have orders for MCS. The findings of this study were comparable to Lukwesa's findings where only 29 percent of cases had bacteriological tests (Lukwesa, 1998). In a study done by Palikhe in East Africa, only 24 percent of cases had bacteriological tests (Palikhe, 2004).

The association of MCS and prescriptions on whether they met Gyssens *et al.* recommendations for the various departments was performed using Pearson Chi-Square. In the department of OBGY, the association was found to be statistically significant (x^2=13.960, p=0.001), in the department of IM, the association was not statistically significant (x^2=3.887, p=0.692) and in the department of Surgery, the association was statistically significant (x^2=1.152, p=0.001). However, the overall association for the three departments was not statistically significant (x^2=3.887, p=0.692). This means that ordering of bacteriological tests was dependent on the department, some departments ordered tests more than others. The probable reasons for levels of ordering tests were that results took more than five days in which case some patients would even be discharged from hospital before culture results were ready. The other reason can be attributed to ineffective microbiology laboratory.

5.14 Factors physicians reported to influence their prescribing habits.

In this study, it has been shown that drug availability, current resistant patterns, previous experience, laboratory facilities, hours of operation by the pharmacy among others, were found to be the factors that influenced prescribing patterns among physicians. It was found that drug availability had a frequency of 23(26.7%), current resistant patterns 9(10.5%), previous experience 9(10.5%), laboratory findings 11(12.8%), hours of operation by the pharmacy 12(14.0%), local guidelines 3(3.5%), international guidelines and on-going

research 4(4.7%), disease patterns 9(10.5%) and cost of drugs when unavailable in the pharmacy 6(7.0%).

Sharma and Kapoor, (2003), attributed irrational prescribing to lack of knowledge about drugs, unethical drug promotions, high patient load, ineffective laboratory facilities, availability of drugs and ineffective law enforcement by governments with subsequent failure to ensure compliance to guidelines. The factors mentioned by Sharma and Kapoor were consistent with the findings of this study. However, in addition to given factors, hours of operation by the pharmacy 12(14.0%) came out to be the second most influencing factor to the prescribing habits. Physicians tended to prescribe what was available in the ward when the pharmacy was closed after 5pm and on weekends and public holidays.

5.15 Association of the position/qualification of the physicians and the factors influencing prescribing habits.

The study shows that the position or qualification of the physicians has no association with factors that influence prescribing habits. The Pearson Chi-Square was performed to determine the association between position held by study physicians and the factors that were found to influence prescribing habits. The study demonstrated that the association between position of physician and factors influencing prescribing tendencies was not statistically significant (p=0.084). This meant that factors influencing prescribing habits were independent of the qualification or position of the physician.

5.16 Association of position of physicians and ordering of bacteriological tests

The study shows that ordering of bacteriological tests is influenced by the level of qualification or position held by the physician. The Pearson Chi-Square was performed to

find out if there was any association between position held by study physicians and the ordering of bacteriological tests. The study found that the association was statistically significant (p=0.001). This means that the position held by the physician had an influence on whether one ordered a test or not. This meant that as one became more senior, the more likely for them to order bacteriological tests.

5.17 Systems, Structures and Processes available to regulate antibiotic prescribing at University Teaching Hospital (UTH).

The study found that there were no structures or systems in place apart from the Drug and Therapeutics Committee (DTC) to regulate antibiotic use at UTH. It was found that there was only one system (Drug and Therapeutics Committee) that regulated use of all drugs and not specific to antibiotics. World over, for instance Australia, USA and United Kingdom, they have committees such as the Medication Advisory committee which aim to give advice on the implementation of national standards, guidelines and policies and to develop policies and performance indicators on medication use. They also have Antibiotic policies which monitor and regulate antibiotic use. Lack of such systems, structures and processes or control measures poses a serious challenge to the use drugs. In institutions without these important systems, inappropriate prescribing and use of antibiotics is likely to be higher as demonstrated in this study.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter includes a summary where the objectives are weighed against the key findings, limitations of the study and the study is evaluated in terms of the appropriateness of antibiotic prescribing at the University Teaching Hospital

6.2 Limitations

The following limitations to the study were identified

- Low number of physicians who managed to fill in the questionnaires, 34/ 67 (50.7%) physicians that were given questionnaires.
- The study only covered three departments of the institution and only in patients had their records reviewed.

6.3 Conclusion

The study investigated the prescribing patterns of antibiotics by physicians at UTH, Lusaka in Zambia.

The study findings raise a lot of concerns due high levels of antibiotic use 270/385(70.1%).

Availability of drugs, hours of operation by the pharmacy and cost of drugs were among the many factors that influenced prescribing patterns of antibiotics by physicians at UTH.

It was noted that the laboratory facilities were ineffective as can be seen from the number of samples that had results available at the time of review 25/86(29.1%) and can therefore be concluded that antibiotics were prescribed without bacteriological tests.

It can also be concluded that the institution had no systems, structures and processes except for the DTC that monitored and regulated the use of antibiotics hence antibiotics could have been prescribed without any controls to promote rational use of antibiotics.

From the study findings, it could be concluded that compliance to adopted treatment guidelines is still a major challenge hence there was need for an urgent antibiotic policy.

6.4 Recommendations

1. There is need to develop an antibiotic policy as soon as possible to combat the inappropriate use of antibiotics.
2. It may be extrapolated that country over there is irrational use of antibiotics the study centre being the highest level, however, before we can make such conclusions, there is need to carry out a similar survey at all provincial centres to determine the prescribing patterns.
3. There is need to strengthen the microbiology laboratory facilities which actually may turn to be cheaper than prescribing antibiotics on a trial and error basis.
4. Clinical meetings including pharmacists, physicians, nurses and microbiologist need to be held on a regular basis to continuously evaluate the use of antibiotics and indeed other drugs as well.
5. There is need for the hospitals to enforce adherence to treatment protocols by health practitioners.
6. The hospital should have antibiotic control measures and should conduct training on the appropriate use of antibiotics at least once every 6 months, and clinicians should attend the course at least once per year.

REFERENCES

Acimis, N.M., Yazici, A.C., Gocmen, L. and Mas, R. (2009). The prevalence of prescribing antibiotics by primary health care physicians in Turkey: A multi-centered survey. *Pak J Med Sci*., **25**(5):706-711.

Akande, T.M., Olege, M. and Medubi, G.F. (2009). Prescribing Patterns and Cost**.** *Int J Trop Med.*, **4** (2): 50-54.

Ashiru – Oredope, D., Sharland, M., Charani, E., McNulty, C. and Cooke, J. (2012). Improving the quality of antibiotic prescribing in the NHS by developing a new Antimicrobial Stewardship Programme: Start Smart - Then Focus. *J. Antimicrob. Chemother.*, **67**(1): i51–i63.

Bijnen, E.M., Heijer, C. D., Paget, W. J., Stobberingh, E. E., Verheij, R. A., Bruggeman, C. A., Pringle, M., Goossens, H. and Schellevis, F. (2011). The Appropriateness of Prescribing Antibiotics in the community in Europe: Study Design. *BMC InfDis*., **11**: 1-5.

Carlos, A. and Diaz, G. (2012). Prospective Audit for Antimicrobial Stewardship in Intensive Care: Impact on Resistance and Clinical Outcome. *j. ijic*., **40**: 526-529.

Charani, E., Cooke, J. and Holmes, A. (2010). Antibiotic Stewardship Programmes – What's missing?. *J Antimicrob Chemother.*, **65**: 2275 – 2277.

Choi, K.H., Park, S.M., Lee, J.H. and Kwon, S. (2012). Factors Affecting the Prescribing Patterns of Antibiotics and Infections. *J korean Med Sci*., **27**(2):120-127.

Davey, P., Brown, E., Fenelon, L., Finch, R., Gould, I., Hartman, G., Holmes, A., Ramsay, C., Taylor, E., Wilcox, M. and Wiffen, P. (2005). Interventions to improve antibiotic prescribing practices for hospital inpatients. *Cochrane Database Syst. Rev*., **19**:CD003543

Erbay, A., Colpan, A., Bodur, H., Cevik, M.A., Samore, M.H. and Ergonul, O**.** (2003). Evaluation of antibiotic use in a hospital with an antibiotic restriction policy. *Int J Antimicrob Agents*. **21**: 308–312.

Essack, S.Y. (2006). Strategies for the Prevention and Containment of Antibiotic Resistance. *SA Fam Pract.,* **48**(1):51 Available from www.safpj.co.za. Accessed on 12 April 2013.

Gyssens, I.C., van den Broek, P.J., Kullberg, B.J., Hekster, Y. and van der Meer, J.W. (1992). Optimizing antimicrobial therapy: a method for antimicrobial drug use evaluation. *J Antimicrob Chemother.*, **30**: 724–727.

Gyssens, I.C. (2011). Antibiotic Policy. *j. ijantimicag,* **38:** S 11-20.

Hecker, M.T., Aron, D.C., Patel, N.P., Lehmann, M.K. and Donskey, C.J. (2003). Unnecessary use of antimicrobials in hospitalized patients: current patterns of misuse with an emphasis on the anti-anaerobic spectrum of activity. *Arch Intern Med.*, **163**: 972–978.

Hogerzeil, H.V. (1995). Promoting rational prescribing: an international perspective. *Br J Clin Pharmacol.*, **39**:50-79

Kali, G.T.J. and Swingler, G. (2003). Evidence for antibiotic use for sore throat and URTI in general practice. *Community Medical Education.* **21**(9):508-510. Available from http://www.cmej.org.za/index.php/cmej/article/view/1318/1048. Accessed on 22 May 2013.

Kutty, K.V.G., Sambasivam, N. and Nagarajan, M. (2002). A study on drug prescribing pattern in Madurai City. *Indian J Pharmacol.,* **34**: 361-362. Available from: http://medind.nic.in/ibi/t02/i5/ibit02i5p361.pdf. Accessed on 12 April, 2013.

Kuyvenhoven, M., de Melker, R. and van der Velden, K. (1993). Prescription of antibiotics and prescribers' characteristics. A study into prescription of antibiotics in upper respiratory tract infections in general practice. *Fam Pract*., **10**:366–370.[PubMed]

Lukwesa, C. (1998). A Survey of Antibiotic Prescribing Patterns and In-vitro Antibiotic Susceptibility Patterns at The University Teaching Hospital, Lusaka, Zambia. MPH thesis, University of Zambia: Zambia.

Michael, S. and Niederman (2005). Principles of appropriate Antibiotic use. *International Journal of Antimicrobial Agents* **26** (3); S170-S175.

Makhado, M. (2009). Comparison of Antimicrobial Prescribing Patterns with Stanard Treatment Guidelines and Essential Drug List in Primary Healthcare Facilities in Vhembe District, Limpopo Province, Master of Science in Medicine-Pharmacy thesis, Department of Pharmacy, Faculty of Healthcare Sciences, Medunsa Campus: South Africa.

Ndhlovu, M. (2009). Prescription Patterns for patients at Primary Healthcare Facilities in Zambia. MPH thesis, University of Zambia; Zambia, P 1-5.

Palikhe, H. (2004). Prescribing Practice of Antibiotics in Hospital in-patients. *Kathamandu University Med J.*, **4** (1): 6-12

Raveh, D., Levy, Y., Schlesinger, Y., Greenberg, A., Rudensky, B. and Yinnon, A.M. (2001). Longitudinal surveillance of antibiotic use in the hospital. *QJM.*, **94**: 141–152.

Robert, C. and Owens, Jr. (2008). Antimicrobial Stewardship: Concepts and Strategies in the 21st Century. *j.diagmicrobio.*, **61**: 110-128

Sahoo, K.C., Lundborg, C.S., Tamhankar, A.J. and Johansson E. (2010). Antibiotic use, Resistance Development and Environmental factors: A Qualitative Study among Health Professionals in Orissa, India. *BioMed Central*, **10**, 629.

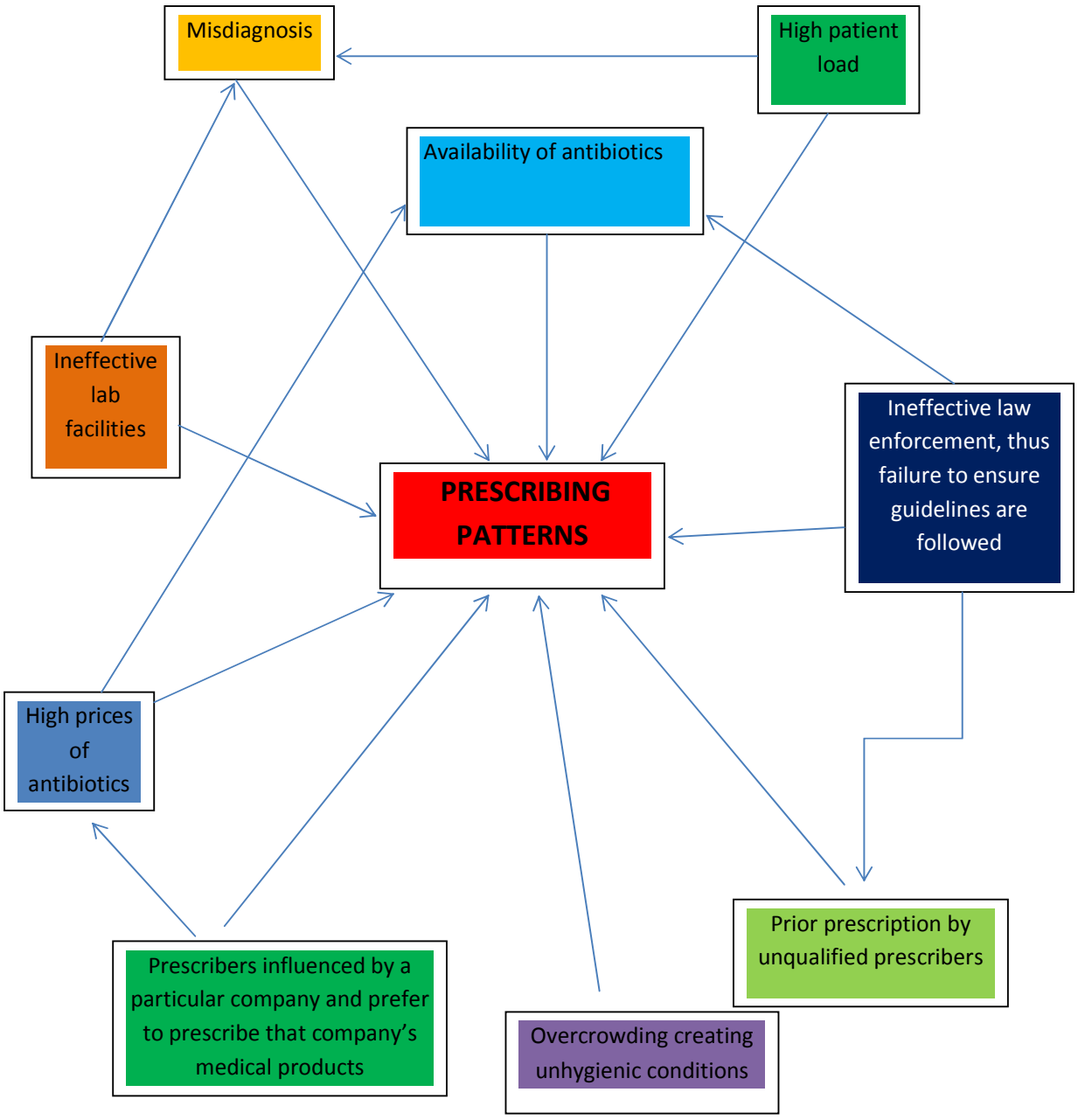
Shankar, R.P., Partha, P. Shenoy, N.K., Easow, J.M. and Brahmadathan, K.N. (2003). Prescribing patterns of antibiotics and sensitivity patterns of common micro-organisms in the Internal Medicine ward of a teaching hospital in Western Nepal: a prospective study. *Indian J Pharmacol., ISSN*: 1531 -2976. Available from http://www.ann-clinmicrob.com/content/2/1/7. Accessed on 14 April, 2013.

Srishyla, M.V., Naga Rani, M.A. and Venkataraman, B.V. (1994). Drug utilization of antimicrobials in the in-patient setting of a tertiary hospital. Indian *J Pharmacol.*, **26**:282-287. Available from http://www.ijponline.com/temp/IndianJPharmacol264282-4895466_133554.pdf. Accessed on 20 April, 2013.

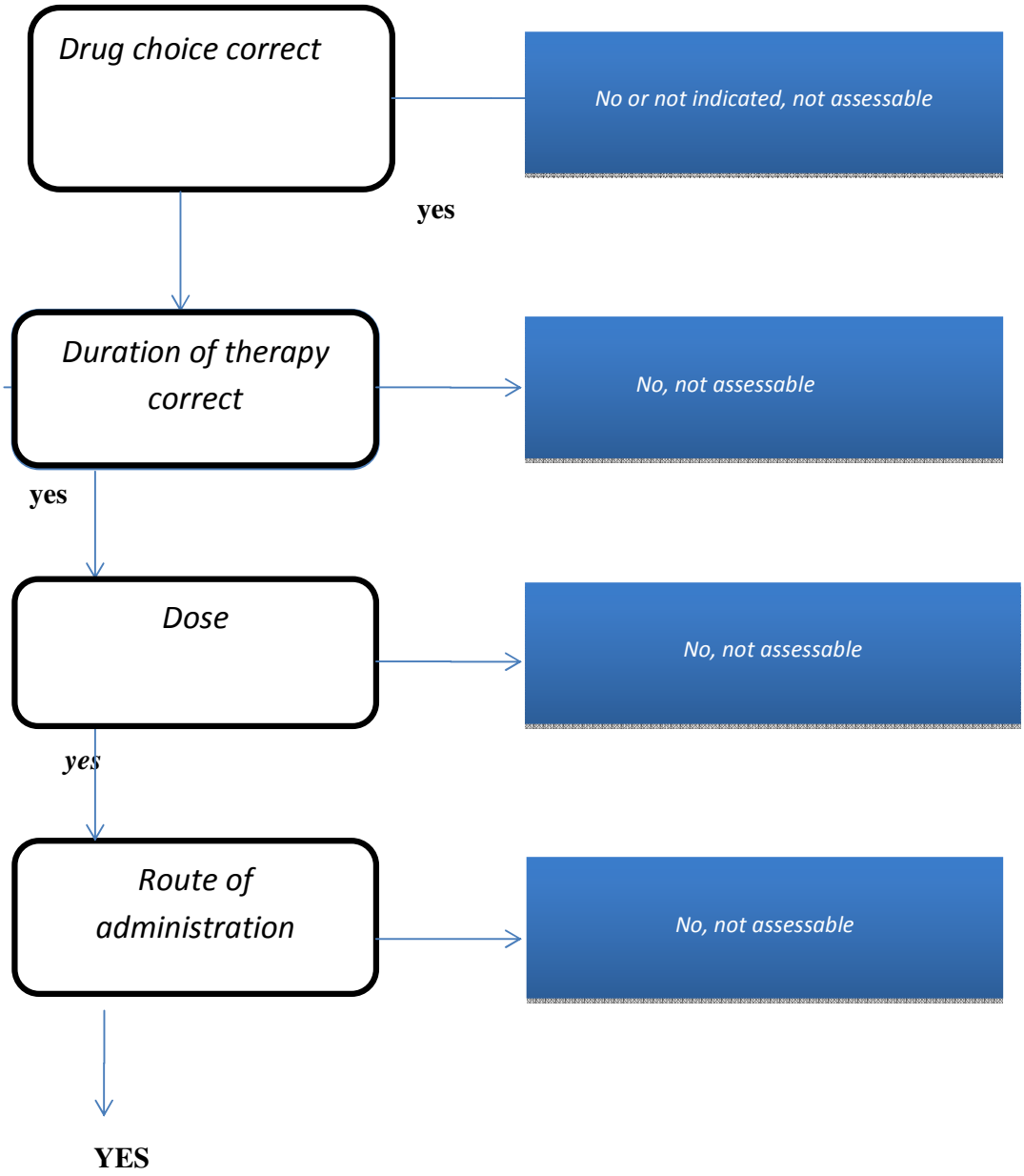
WHO, (2009). Community based surveillance of antimicrobial use and resistance in resource-constrained settings. Available from http://www.who.int/medicines/publications/who_emp_2009.2/en/index.htm. Accessed on 1 April, 2013.

APPENDICES

Appendix A: Problem analysis diagram



Appendix B: Gyssens *et al*. form



If all questionbs are answered ‘’ YES”’, a prescription is completely appropriate.

Appendix C: Participant information sheet (To be kept by the participant)

Research Title: Antibiotic Prescribing Patterns among physicians at the University Teaching Hospital (UTH).

Dear Participant,

We have invited you to participate in a study which is designed to see how antibiotics are prescribed at UTH.

Appropriate prescribing of antibiotics has been shown to delay development of antibiotic resistance, to be cost-effective and to improve clinical outcomes. Prescribers need to prescribe antibiotics in line with set standards. In this study, we want to assess and compare whether antibiotics are prescribed as per our national guidelines.

If you are willing to participate in this study, we shall go through your clinical records (medical notes, drug charts, microbiology, and culture and sensitivity results).

What are we asking you to do?

During the study we will only ask for your permission to go through your clinical records and to answer a questionnaire.

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 care 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 researcher: Jimmy M. Hangoma

(Master of Clinical Pharmacy Student)

Pharmacy Department, University Teaching Hospital,

P/Bag RW 1X, Ridgeway, Lusaka.

Contact details of Biomedical Research Ethics Committee: The Chairperson, Biomedical Research Ethics Committee, Ridgeway Campus,

P.O. Box 50110, Lusaka.

Consent Form (To be kept by the researcher)

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 care available to me.

I understand what will be required of me.

Name:

Date:

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

Name of researcher:

Signed:

Date:

Appendix D: Questionnaire for physicians

ANTIBIOTIC PRESCRIBING PATTERNS AMONG PHYSICIANS AT THE UNIVERSITY TEACHING HOSPITAL.

1. **Department**……
2. **Title**……
3. **Position/qualifications**……..
4. **For each of the following listed antibiotics, give the probable condition(s) for which you prescribe it.**

   Amoxicillin…….
   Ampicillin……..
   Azithromycin…….
   Benzathine penicillin…….
   Benzyl penicillin……
   Cefotaxime…….
   Cefuroxime……
   Ceftriaxone……
   Cefixime……
   Chloramphenicol……..
   Cephalexin……
   Ciprofloxacin……
   Clarithromycin……
   Clindamycin……
   Co-trimoxazole……..
   Doxycycline……
   Erythromycin……
   Gentamycin…….
   Imipenem……
   Metronidazole……..
   Nalidixic acid……
   Nitrofurantoin……
   Phenoxymethyl penicillin…….
   Procaine penicillin……...
   Tetracycline……

Vancomycin……

5. **Of the antibiotics listed in part 4 above, which five (5) of them do you mostly prescribe**?.....

   …….

6. **Do you order any bacteriological test before prescribing antibiotics?**

   Yes = 1 [ ]

   NO =2 [ ]

7. **If your response to part 6 above is yes, which test(s) do you order and for how long does it take for results to be ready**?.....

   ……

8. **If your response to part 6 above is no, why?.....**

   ……

9. **Which treatment guidelines do you usually refer to**?.....

   ……

10. **What factors do you encounter which influence prescribing patterns?**

    ……

    ……...

    ……

    ……...

Appendix E: Researcher's data collection form

ANTIBIOTIC PRESCRIBING PATTERNS AMONG PHYSICIANS AT THE UNIVERSITY TEACHING HOSPITAL, LUSAKA, ZAMBIA.

1. **Patient Number**……
2. **Department**…….....
3. **Sex of patient**……..
4. **Age of patient**…….
5. **Weight of patient**……....
6. **Date of admission**……...
7. **Provisional diagnosis**…….
8. **Confirmed diagnosis**……
9. **Site of infection/system affected**……
10. **Antibiotic(s) prescribed**

    Yes = 1 [ ]

    No = 2 [ ]

11. If yes in part 10, fill in the following table:

	Antibiotic 1	**Antibiotic 2**	**Antibiotic 3**	**Antibiotic 4**
Name				
Initial dose				
Maintenance dose				
Starting date				
*Route of administration**				
Frequency				
Duration of treatment				
*Reasons for giving antibiotic***				
Treatment comply with STG/EDL				

Intravenous* (IV), ***intramuscular* (IM), ***subcutaneous*** (SC), Oral (PO) etc

Therapy* (T) or ***Prophylaxis (P)

12. **Reasons for more than one antibiotic**……

13. **Any switch of antibiotic done during treatment**

Yes = 3 [ ]

No = 4 [ ]

14. **If yes in part 13, after how many days of initiating treatment**?.....

15. **Reasons for switching**…….

16. **Diagnosis confirmed by bacteriological test?**

Yes = 5 [ ] *No* =6 [ ]

17. **If yes in part 16, (a). Which test**?.....

(b). **was sample taken before initiation of treatment?**

Yes = 7[ ]

No = 8[ ]

(c). **how long did it take for results to be ready**?.....

Appendix F: Questionnaire for the clinical heads and head of UTH pharmacy department.

ANTIBIOTIC PRESCRIBING PATTERNS AMONG PHYSICIANS AT THE UNIVERSITY TEACHING HOSPITAL, LUSAKA, ZAMBIA.

1. **Which of the following structures, systems and processes are available at UTH?**

   (i*). Antibiotic Policy/Committee*

   (ii). Drug and Therapeutic Committee

   (iii). Medication Advisory Committee

   (iv). Storage and Administration Policy/Committee

   (v). Others specify……

   …….

2. **If any structure/system/process in 1 above is/are available, how often do they hold meetings and when was the last one?**

   i. *Once a month*

   ii. *Once per quarter*

   iii. *Once every 6 months*

   iv. *Once a year*

   v. *Other specify*……

Appendix G: Medication Advisory Committees for Australia

Role

Through a partnership approach, develop, promote, monitor and evaluate policies and activities to assist management, residents and staff achieve best possible health outcomes for all residents by ensuring quality use of medicines in residential aged care facilities.

Terms of Reference (example)

1. To advise on the implementation of national standards, guidelines and policies and relevant legislation on medication use in the residential aged care facility.

2. To develop policies and performance indicators on medication use, and evaluate their implementation.

3. To assist in the development and evaluation of indicators for quality use of medicines as part of a quality assurance framework of the facility.

4. To make recommendations to the board or management of the facility on any matter relating to medication use with the view of optimising health outcomes through the quality use of medicines.

Activities

(a) To develop mechanisms which allow for a review and evaluation of:

– Medication usage across the facility;

– Emergency medicine supply;

– The use of 'when required' medication;

– The outcome of medication review processes;

– Medication errors and incidents; and

– Adverse drug reaction reporting to the national reporting system via the established 'blue card' system of the Adverse Drug Reaction Advisory Committee (ADRAC)

(b) To monitor and make recommendations for the use of psychotropic agents for behavioural management.

(c) To monitor and make recommendations for the appropriate pain management of residents.

(d) To monitor and advise on the management of any other clinical problem involving medications as appropriate.

(e) To advise on appropriate medicines education programs for staff of the facility.

(f) To develop mechanisms for the provision of information about medicines to staff, residents/carers, including the availability of Consumer Medicine Information.

(g) To promote in residents/carers the awareness of their rights and responsibilities with regard to their medication management.

(h) To make recommendations on the medicine information/resources to be available at the facility.

(i) To advise on the development of an information technology strategy relevant to medication management within the facility.

(j) To review medication related incidents within the facility.

(k) To review the processes for the timely, effective communication between the prescriber and the pharmacist for any change to the medication regimen, in accordance with legislative requirements.

(l) To develop a policy for the administration of medicines for residents temporarily off site (eg, excursion, temporary home visit).

(m) To audit/review the selection and performance of Dose Administration Aids (DAAs) on a regular basis, in line with quality improvement.

(n) To prepare and maintain a list: of drug products which cannot be altered (eg, crushed or broken) prior to administration (refer Appendix F); of medications which can be initiated by nursing personnel; and, of medications which may be stored in the facility for emergency purposes.

Seen the Methodology.
Ensure Confidentiality of findings.
Would like Hospital to learn from findings
No objection
17/04/13

University Teaching Hospital,

Pharmacy Department,

P/Bag RW 1X,

Ridgeway.

Lusaka

12 th April, 2013.

REPUBLIC OF ZAMBIA
HEAD CLINICAL CARE
15 APR 2013
UNIVERSITY TEACHING HOSPITAL
P/BAG RW 1X, LUSAKA

REPUBLIC OF ZAMBIA
SENIOR MEDICAL SUPERINTENDENT
15 APR 2013
UNIVERSITY TEACHING HOSPITAL

The Senior Medical Superintendat,

P/Bag RW 1X

Ridgeway

Lusaka

Dear Sir,

RE: REQUEST FOR PERMISSION TO CONDUCT A MASTER OF CLINICAL RESEARCH PROJECT.

Iam a postgraduate student at the University of Zambia pursuing a Master of Clinical Pharmacy currently in second year.

I would like to conduct a clinical project for my dissertation entitled **"Antibiotic Frescribing Patterns among Clinicians at The University Teaching Hospital"**.

I write to request for permission to conduct this study at this hospital (sample size determination and data collection) and I will be sending a request for ethical approval from the Biomedical Research Ethics Committee.Among other things Iam requesting for is the total number of clinicians at UTH and specifically in the departments of Obstetrics/Gynaecology, Internal Medicine and surgery as well as the approximated annual budget for antibiotics for the institution.

Please find attached herewith my Clinical Project Protocol and a supporting letter from my university.

Your favourable consideration will be greatly appreciated.

Yours faithfully,

Jimmy Hangoma

B.Pharm,

Pharmacist (File PS 568)

THE UNIVERSITY OF ZAMBIA
SCHOOL OF MEDICINE

Telephone: 252641
Telegram: UNZA, Lusaka
Telex: UNZALU ZA 44370
Email: selestinenzala@yahoo.com

P.O. Box 50110
Lusaka, Zambia

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03rd July, 2013

Mr. Jimmy .M. Hangoma
Department of Pharmacy
School of Medicine
LUSAKA

Dear Mr Hangoma,

RE: GRADUATES PROPOSAL PRESENTATION FORUM (GPPF)

Having assessed your dissertation entitled **"Antibiotic Prescribing Patterns Among Physicians at the University Teaching Hospital in Lusaka, Zambia".** We are satisfied that all the corrections to your research proposal have been done. The proposal meets the standard as laid down by the Board of Graduate Studies.

You can proceed and present to the Research Ethics.

Yours faithfully,

Dr. S. H. Nzala
ASSISTANT DEAN, POSTGRADUATE

CC: HOD – Pharmacy

UNIVERSITY OF ZAMBIA
SCHOOL OF MEDICINE
03 JUL 2013
ASSISTANT DEAN (PG)
P.O. BOX 50110, LUSAKA

THE UNIVERSITY OF ZAMBIA

BIOMEDICAL RESEARCH ETHICS COMMITTEE

Telephone: 260-1-256067
Telegrams: UNZA, LUSAKA
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E-mail: unzarec@unza.zm
Assurance No. FWA00000338
IRB00001131 of IORG0000774

Ridgeway Campus
P.O. Box 50110
Lusaka, Zambia

9th December, 2013.

Your Ref: 006-07-13.

Mr. Jimmy Hangoma,
University Teaching Hospital,
Department of Pharmacy,
P/Bag RW 1X,
Lusaka.

Dear Mr. Hangoma,

RE: RE-SUBMITTED RESEARCH PROPOSAL: **"ANTIBIOTIC PRESCRIBING PATTERNS AMONG PHYSICIANS AT THE UNIVERSITY TEACHING HOSPITAL" (REF. No. 006-07-13)**

The above mentioned research proposal was re-submitted to the Biomedical Research Ethics Committee with recommended changes on 21st October, 2013. The proposal is approved.

CONDITIONS:

- This approval is based strictly on your submitted proposal. Should there be need for you to modify or change the study design or methodology, you will need to seek clearance from the Research Ethics Committee.
- If you have need for further clarification please consult this office. Please note that it is mandatory that you submit a detailed progress report of your study to this Committee every six months and a final copy of your report at the end of the study.
- Any serious adverse events must be reported at once to this Committee.
- Please note that when your approval expires you may need to request for renewal. The request should be accompanied by a Progress Report (Progress Report Forms can be obtained from the Secretariat).
- **Ensure that a final copy of the results is submitted to this Committee.**

Yours sincerely,

Dr. J.C Munthali
CHAIRPERSON

Date of approval: 9th December, 2013. **Date of expiry**: 8th December, 2014.